

Michigan Drowning Data Report

CDC Foundation



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Introduction

State background

Michigan, nestled in the heart of the Great Lakes region, is celebrated for its breathtaking water landscapes. Surrounded by four of the five Great Lakes—Michigan, Huron, Erie and Superior—the state boasts the longest freshwater coastline in the United States, stretching over 3,200 miles.[1] Beyond these iconic lakes, Michigan is also home to more than 11,000 inland lakes and over 50,000 miles of rivers and streams.[2,3] Access to water is further enhanced by the presence of more than 280,000 residential swimming pools and approximately 5,000 public pools across the state.[4,5] With a population of nearly 10 million, many Michiganders engage with these waterways not only for recreation and sport but also for work and cultural tradition.[6] Moreover, the state's lakes and rivers are vital to its economy, anchoring industries such as shipping, fishing and tourism.

Michigan faces unique water safety challenges due to its extensive connections to the Great Lakes and other bodies of water. The presence of dangerous currents at Great Lakes beaches wasn't widely recognized until the 1990s.[7] Furthermore, the lakes generate waves with shorter intervals than those found in the ocean, have hard-to-predict wind and storm patterns, and lack the buoyancy that salt water provides.[8] The state's northern location also introduces distinct cold weather drowning hazards, including widespread access to frozen water and an increased risk of hypothermia. This unique combination of drowning hazards has led to a heightened awareness of the importance of drowning prevention. State programs emphasize water safety through lifeguard training, public education about swimming hazards and promotion of personal flotation device use. Despite these initiatives, drowning remains a significant concern, particularly among children and older adults, individuals with limited swimming abilities and those living in rural areas far from trained emergency responders.[9,10] Michigan's commitment to water safety continues to evolve, adapting to new trends in water recreation and increasing awareness of drowning risk factors.

Drowning prevention landscape

Drowning prevention efforts in Michigan have advanced through the collaborative efforts of local, state and national organizations committed to enhancing water safety. The Michigan Department of Health and Human Services (MDHHS) plays a central role in these efforts, working closely with a wide range of public and private partners to provide surveillance and promote prevention strategies. Injury epidemiologists at MDHHS report annual fatal and nonfatal drowning incidents to the Centers for Disease Control and Prevention (CDC) and share this data with water safety partners upon request. Data gathered from death certificates, hospitalizations and emergency department (ED) visits, provide insights that guide water safety education and public health campaigns tailored to those at increased risk of drowning in Michigan, including children, older adults and individuals from underserved communities.[10]

The Great Lakes Water Safety Consortium (GLWSC) serves as a vital contributor to drowning prevention efforts in Michigan. This volunteer organization comprises a diverse group of stakeholders from the Great Lakes states and Canada, all of whom are focused on water safety. Members consist of representatives from MDHHS, National Oceanic and Atmospheric Association (NOAA), law enforcement agencies, fire departments, educational institutions, non-profit organizations and various interest groups. The GLWSC addresses all dimensions of water safety within the Great Lakes region.

The Michigan Department of Natural Resources (DNR) plays a significant role by overseeing regulations related to boating and water sports, as well as enforcing safety laws. The DNR offers educational programs, provides water safety courses and advocates for the use of personal flotation devices, particularly during boating activities. Additionally, the DNR partners with local municipalities to establish designated swimming areas and parks, promoting safety for recreational activities.

Regional and local organizations also play a significant role in Michigan's drowning prevention initiatives. The American Red Cross of Michigan promotes water safety through its programs, which include swim education, lifeguard training, cardiopulmonary resuscitation (CPR) classes and other water safety courses. Several communities around the state have established local programs that teach children about water safety and offer swimming lessons, particularly in communities with limited access to these resources. Furthermore, numerous school-based, private and nonprofit programs across the state actively promote water safety by providing swimming lessons to the community. Together, these coordinated efforts reflect Michigan's strong commitment to reducing drowning risks and fostering a culture of water safety for all residents across the state.

Project details

This project sought to identify and engage with MDHHS along with other water safety and drowning prevention partners across the state to strengthen data collection and prevention initiatives. A questionnaire was administered to these partners to assess current drowning surveillance and prevention activities, identify existing data sources, evaluate interest and capacity for data collection and analysis, and determine specific data needs. Additionally, current data sources were used to analyze and summarize the burden and circumstances of drowning in the state.

The specific objectives of this project included:

1. Identifying opportunities to improve state-level drowning data collection and surveillance.
2. Developing initial recommendations and resources to support the enhancement of drowning data systems.
3. Describing the burden and circumstances associated with drowning incidents in Michigan.



Wilfred Sykes on the Detroit River.



Situational assessment

Methods

The state of Michigan surveyed state and local health departments, along with drowning prevention partners, to identify the types of data collected on drowning incidents and how these data are utilized. Potential participants were drawn from internal lists of water safety partners, programs and existing state and local government agencies. A sample of local health departments was selected based on convenience and jurisdictional relevance to water exposure, such as areas near lakes and tourism regions. Respondents included staff and volunteers from key organizations, including the Michigan Department of Health and Human Services (MDHHS), local health departments, the Michigan Department of Natural Resources (DNR), the Great Lakes Water Safety Consortium (GLWSC), academic institutions, the Michigan Fatality Review and Prevention (Child Death Review) within the Michigan Public Health Institute (MPHI), National Oceanic Atmospheric Administration (NOAA) and law enforcement. This group represents a sample of the primary users of drowning data in Michigan, rather than an exhaustive list of all stakeholders involved in this area.

Michigan employed a personalized approach to distributing the questionnaire by conducting initial one-on-one interviews and guided walkthroughs of the survey tool. Potential participants were first contacted to determine whether their organizations collected or accessed drowning data or were involved in water safety programs. Organizations that did not participate in drowning data collection or prevention activities were excluded from the survey.

Results

Respondents from nine different departments and organizations completed the drowning data questionnaire: four non-profit organizations, two state government agencies, two local government agencies and one academic institution. Table 1 illustrates the number of organizations by type that reported having access to each drowning data source. The most commonly available sources of drowning data were hospitalization and emergency department records (four responses, 44%), followed by civil registration and vital statistics (death certificates), and records from law enforcement, fire departments and maritime boating incidents, all tied for the second most common (three responses, 33%).

Syndromic surveillance data—typically used by state and local health departments to monitor communicable diseases in near real-time—was accessed solely by the state health department to monitor drowning incidents. This was primarily due to a lack of epidemiological support capacity and the absence of a standardized drowning query within the syndromic surveillance software. None of the respondents reported having access to drowning data from emergency management or child welfare agencies.

Five of the nine respondents reported that their organizations collect data on both fatal and nonfatal drowning incidents. Additionally, drowning data were generally limited to the past decade, with only a few exceptions extending prior to 2000. For example, MDHHS reported having fatal drowning data dating back to 1999. Although most state and local government agencies indicated they capture "all or a substantial proportion" of drowning cases within their jurisdictions, data coverage was often more limited among agencies outside the state health department.

Table 1. Number of questionnaire respondents reporting access to various drowning data sources within their institutions or organizations.

Data source type	Type of organization				
	State government (2)	County/ local government (2)	Non-profit (4)	Academic (1)	Total (9)
Hospitalizations	2	1		1	4
Emergency department	2	1		1	4
Civil Registration and Vital Statistics	1	1	1		3
Law enforcement	1	1	1		3
Fire department	1	1	1		3
Maritime boating	1	1	1		3
Emergency Medical Services	2				2
Child Death Review data			2		2
National or state parks		1	1		2
Media	1		1		2
Syndromic surveillance	1				1
Lifesaving/drowning prevention			1		1
Occupational				1	1
Emergency management					0
Child welfare					0

The drowning-related variables collected differed across data sources. Basic information, such as age (100%), sex (94%), date of incident (84%), type of body of water (77%), time of incident (74%), location of drowning (74%) and activity at the time of drowning (74%) were most commonly available across all data sources. Variables less commonly available included supervision (23%), presence of comorbidities (16%) and presence of structural barriers (3%). Notably, data on race and ethnicity were available in only 52% of cases across all data sources.

Drowning data were used in various ways. Reported uses of drowning data included recordkeeping (42%), public-facing reports (42%), raising awareness (39%), surveillance (29%), resource allocation (6%) and program implementation (6%). Additionally, one respondent associated with NOAA reported using drowning data to forecast the impact of weather conditions on drowning risk.

Challenges

Respondents were asked to identify the most common challenges their institutions or organizations faced related to either drowning data or the implementation of prevention measures. Figure 1 summarizes the total number of responses for each listed challenge. All participants reported that their organizations faced challenges related to drowning prevention program implementation. The most frequently reported challenges were a lack of access to data sources and insufficient staff support for analysis and reporting activities (seven responses, 78% each). Other common challenges included a lack of available data, a lack of data on nonfatal drowning incidents (six responses, 67%) and a lack of funding (five responses, 56%). Notably, four of the top five challenges reported were related to a lack of data.

Open-ended responses further highlighted several challenges related to gaps in drowning data, primarily due to inconsistencies and fragmentation in data collection across various agencies. Data on drowning incidents are collected from multiple sources, including Emergency Medical Services (EMS), law enforcement, fire departments and hospitals, but each uses different systems to collect, store and process information. This makes it challenging to create a comprehensive and unified understanding of the nature and burden of drowning across the state. Key details, such as the activity and whether there was supervision prior to drowning, the type of body of water and alcohol and drug use, are often missing, underreported, or only available through time-consuming manual review of narrative descriptions. Current drowning data surveillance methods, often rely on cause of death and discharge diagnosis codes, such as the International Classification of Diseases 10th revision (ICD-10) codes for death records and the ICD-10-Clinical Modification (ICD-10-CM) codes for hospitalization and ED visit records. A limitation of these codes is that they can frequently fail to capture key circumstances surrounding these incidents. One respondent noted that there is limited understanding of the costs, effectiveness and potential liabilities associated with drowning prevention measures—such as funding lifeguards on public beaches, which has historically been a highly debated issue in the state.[11]



The top three ranked choices for <u>overall challenges</u> included:

1. Availability of staff support; access to data sources (tied for first place).
2. Procurement of resources; data on nonfatal drowning; availability of data (tied for second place).
3. Funding; completeness of records (tied for third place).

The top three ranked choices for <u>data-related challenges</u> included:

1. Availability of staff support; access to data sources (tied for first place).
2. Data on nonfatal drowning; availability of data (tied for second place).
3. Funding; completeness of records (tied for third place).

The top three ranked choices for <u>implementation-related challenges</u> included:

1. Procurement of resources.
2. Competing priorities.
3. Lack of drowning prevention programming; buy-in by leadership (tied for third place).

Opportunities

Respondents were asked to select and rank up to five potential opportunities to initiate, continue or expand their drowning prevention work from a given list, focusing on three key areas: access to data sources, availability of data variables, and support. The top-ranked opportunities identified in each area are presented below.

The top three ranked choices for data sources needed included:

1. Increased availability and access to maritime and boating safety data; police reports (tied for first place).
2. Data from lifesaving and drowning prevention organizations.
3. Vital statistics data (death certificates).

The top three ranked choices for data variables needed included:

1. Activity at the time of drowning; variables related to fatal versus nonfatal drowning incidents (tied for first place).
2. Swimming skills.
3. Race/ethnicity; weather condition variables (tied for third place).

The top three ranked choices for support needed included:

1. Enhancing coordination among multi-sector stakeholders.
2. Improving data collection and strengthening data systems.
3. Raising awareness about drowning prevention.



Partners and programs

Respondents to the questionnaire described a range of current and past partnerships and programs focused on water safety and drowning prevention across Michigan. Their responses highlighted collaborations among government agencies, nonprofits, academic institutions and local organizations that collectively form the foundation of the state's prevention efforts. At the state level, MDHHS serves as the primary collector of drowning data. This information is shared with local health departments and prevention partners upon request to inform public awareness campaigns and programming.

A key regional collaborator, the GLWSC has partnered with MDHHS for over a decade to support data collection and promote water safety education. The GLWSC also works with NOAA to enhance drowning data with weather-related information, helping to contextualize fatal and nonfatal incidents in the Great Lakes and raise public awareness.

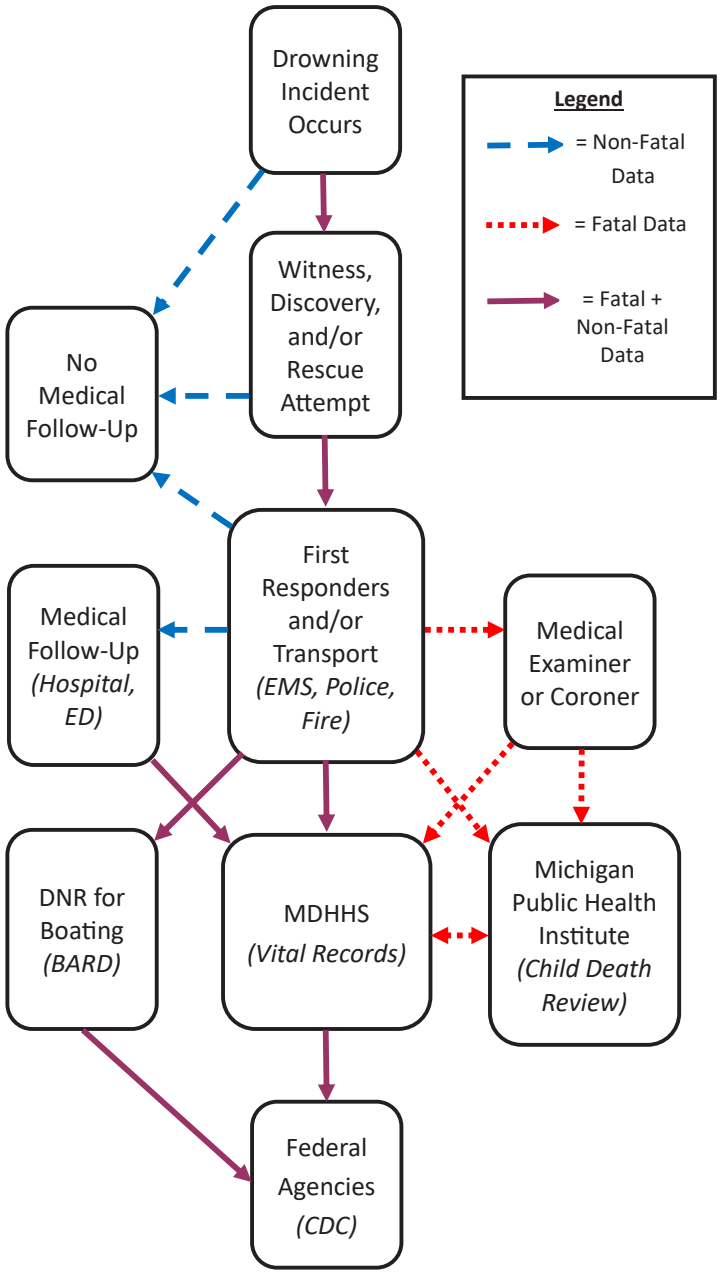
Community-level partnerships further strengthen drowning prevention efforts. Safe Kids Greater South Haven, led by Bronson Healthcare Group, operates life jacket loaner stations on local Lake Michigan beaches and provides seasonal education at community events. The group also partners with South Haven Area Emergency Services, the Van Buren County Sheriff's Department and South Haven Public Schools to increase water safety awareness—though some programs, like school swim lessons, have been discontinued due to staffing changes.

Other notable examples include the St. Clair County Health Department and the YMCA of the Blue Water Area, which continue to offer long-standing swim instruction programs, and the Muskegon County Sheriff's Office Marine Services, which educates young students on boating safety and personal flotation device (PFD) use. These varied partnerships underscore Michigan's strong commitment to water safety through education, policy and community engagement.

Data flow

Based on insights from the drowning data questionnaire and related discussions, Figure 1 illustrates the typical flow of drowning data collection in Michigan. Data gathering generally begins when a drowning incident is witnessed, discovered, or involves a rescue attempt. If medical care is sought, information is recorded by hospitals or emergency departments. First responders, including EMS, police and fire personnel, also contribute data during rescue or transport. In fatal cases, medical examiners or coroners collect information and share it with MDHHS for vital statistics; when the death involves a child, the information is also shared with MPHI for child death review. Additionally, the DNR reports incidents through its Boating Accident Report Database (BARD). MDHHS collects and reports data from recorded drowning incidents to federal agencies, such as the US Centers for Disease Control and Prevention (CDC). While this represents the primary data flow, it is not exhaustive; due to the complexity of drowning incidents, alternative reporting routes exist. For example, cases without medical follow-up may go undocumented, creating gaps in the data.

Figure 1. Typical flow of drowning data collection in Michigan.





Burden and circumstances

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 2 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 Michigan Department of Health and Human Services (MDHHS), Division of Vital Records and 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.

Nonfatal drowning data were obtained from data collected by the Michigan Health and Hospital Association, which MDHHS purchases annually. Over 95% of eligible health care facilities in Michigan participate in submitting emergency department and hospitalization data. Emergency department (ED) visit data reported through the Michigan Outpatient Database were limited to ED visits that did not result in hospitalization or death. Hospitalization data reported through the Michigan Inpatient Database 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.[12] 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 and hospital data were limited to 2018 to 2023 and 2016 to 2023, respectively, 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[13], 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 Michigan among non-residents of Michigan. Unless otherwise noted, the focus of this report is on unintentional drowning-related incidents among state residents.



Children ice fishing in Michigan's Upper Peninsula.

Table 2. 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 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.

Non-fatal (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.

Overall

From 2009 to 2023, 2,127 Michigan residents and 192 non-residents died from drowning-related incidents within the state, while an additional 152 Michigan residents drowned outside the state. From 2016 to 2023, 691 Michigan residents and 58 non-residents were hospitalized at Michigan hospitals due to non-fatal drowning-related incidents in the state. Between 2018 and 2023, there were 1,912 ED visits for non-fatal drowning incidents among residents and 196 among non-residents to Michigan EDs. The majority of deaths (over 80%), hospitalizations (91%) and ED visits (95%) were due to unintentional drowning (Table 3). The expanded criteria identified 13% more unintentional drowning deaths compared to the traditional approach from 2009 to 2023.

Among 625 unintentional nonfatal drowning-related hospitalizations for residents, 267 cases met the traditional nonfatal drowning-related hospitalization definition (included a drowning-related discharge diagnosis code in conjunction with an injury-related discharge diagnosis code in the principal diagnosis field). This indicates that the modified drowning inclusion criteria identified an additional 358 nonfatal potential drowning-related hospitalizations, reflecting a 134% increase compared to traditional identification methods limited to a primary diagnosis of injury only. This disparity between the two drowning identification methods demonstrates that further consideration and validation of the modified approach is warranted in future research.



Man waterskiing on unknown lake.

Table 3. Counts of drowning-related deaths, hospitalizations, and emergency department (ED) visits by intent and Michigan residency.*

	Deaths (2009–2023)		Hospitalizations (2016–2023)		ED visits (2018–2023)	
Intent	**State residents**	**Non-state residents**	**State residents**	**Non-state residents**	**State residents**	**Non-state residents**
All intents	2,127	192	691	58	1,912	196
Unintentional	1,768	169	625	55	1,822	*
Intentional	221	17	57	*	75	*
Undetermined	138	6	9	*	15	0

* Counts greater than zero and less than six have been suppressed. Additional suppression may be applied to prevent back calculation of a suppressed value. The drowning counts presented represent only those which occurred within the state of Michigan.

From this point forward, all analyses by sex, age, race/ethnicity and region of residence will focus exclusively on unintentional drowning incidents involving Michigan residents. Additionally, all references to drowning-related hospitalizations and ED visits pertain to non-fatal incidents only.

Sex

Drowning rates were consistently higher among males than females (Table 4). On average, males experienced 88.20 fatal drownings per year compared to 29.67 for females. Males also averaged 49.38 annual drowning-related hospitalizations versus 28.75 for females, and 180.17 annual ED visits compared to 123.50 for females. This equates to a male-to-female ratio of approximately 3:1 for deaths, 1.7:1 for hospitalizations and 1.4:1 for ED visits. This disparity has been consistently supported by national and international research.[14] Males have been shown to be more likely to engage in high-risk water activities (e.g., swimming in unguarded areas, boating without life jackets, being under the influence of alcohol/drugs), exhibit overconfidence in their swimming ability and are more frequently exposed to occupational water hazards (e.g., fishing, shipping).[14,15]

Age

Overall, children under five years of age and older adults aged 75 and older had higher rates of fatal and nonfatal drowning incidents when compared to other age groups (Table 4). Children aged one to four years had the highest rate of ED visits (20.12 ED visits per 100,000), along with the highest nonfatal hospitalization rates (3.94 hospitalizations per 100,000 population). Infants under one year of age also had notably high rates for nonfatal drowning outcomes (2.21 hospitalizations per 100,000 and 11.03 ED visits per 100,000). Adults aged 75 and older had the highest rate of fatal unintentional drowning deaths (1.91 deaths per 100,000), followed by children aged one to four (1.78 deaths per 100,000). These findings are similar to national trends and highlight the need for enhanced prevention measures targeting young children and older adults alike.[16]

Race/ethnicity

While non-Hispanic White Michigan residents represented the largest proportion of drowning cases overall, non-Hispanic American Indian or Alaska Native Michiganders had the highest fatality rate (2.30 deaths per 100,000), followed by multiracial individuals (1.68 deaths per 100,000) and non-Hispanic Black or African American Michiganders (1.45 deaths per 100,000) (Table 4).

The highest rate of non-fatal drowning-related hospitalizations was observed among non-Hispanic Black or African American residents (1.12 hospitalizations per 100,000), followed by non-Hispanic White residents (0.86 hospitalizations per 100,000) and non-Hispanic American Indian or Alaska Native residents (0.57 hospitalizations per 100,000) (Table 4).

For non-fatal drowning-related ED visits, rates were highest among non-Hispanic White residents (3.62 ED visits per 100,000), followed by non-Hispanic American Indian or Alaska Native (3.02 ED visits per 100,000) and non-Hispanic Black or African American residents (2.57 ED visits per 100,000). Hispanic residents had moderate rates across all outcomes compared to non-Hispanic groups: 0.93 deaths per 100,000, 0.44 hospitalizations per 100,000 and 1.98 ED visits per 100,000 (Table 4).

Multiple factors likely contribute to disparities in drowning rates among racial and ethnic group. For example, research has indicated that Black and Indigenous populations have often had less access to formal swim instruction, public pools and water safety resources.[14,17]

Table 4. Average annual counts and rates for unintentional drowning-related deaths, hospitalizations, and emergency department (ED) visits among Michigan residents by sex, age, race, Hispanic ethnicity, and region of residence.

Variable		Non-fatal ED visits (2018–2023)		Non-fatal Hospitalizations (2016–2023)		Fatalities (2009–2023)	
		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	180.17	3.92	49.38	1.03	88.20	1.75
	Female	123.50	2.81	28.75	0.62	29.67	0.59
Age	<1 year	11.67	11.03	2.38	2.21	1.00	0.91
	1-4 years	90.00	20.12	17.75	3.94	8.20	1.78
	5-9 years	28.83	4.90	8.38	1.42	3.80	0.63
	10-14 years	21.50	3.48	3.88	0.62	3.40	0.53
	15-19 years	21.17	3.27	4.12	0.63	8.67	1.28
	20-24 years	18.33	2.72	4.50	0.66	7.60	1.09
	25-34 years	28.17	2.15	8.75	0.67	15.07	1.21
	35-44 years	19.00	1.59	4.50	0.38	10.67	0.88
	45-54 years	21.67	1.75	6.38	0.51	15.67	1.16
	55-64 years	21.17	1.53	7.62	0.55	17.40	1.29
	65-74 years	13.50	1.24	5.62	0.53	13.33	1.42
	75+ years	8.67	1.20	4.25	0.60	13.07	1.91
Race/ ethnicity	NH White	228.17	3.62	58.12	0.86	84.80	1.06
	NH Black or African American	35.17	2.57	15.50	1.12	20.33	1.45
	NH Native American or Alaska Native	1.50	3.02	0.25	0.57	1.27	2.30
	NH Asian	3.67	1.19	0.75	0.21	1.93	0.66
	NH Native Hawaiian or other Pacific Islander	*	*	*	*	*	*
	Multiracial	*	*	*	*	3.33	1.68
	Hispanic or Latino	13.33	1.98	2.88	0.44	5.20	0.93
	Other	6.50	*	*	*	*	*
	Unknown	15.17	*	*	*	0.73	*
Residence region	Region 1	30.50	3.33	6.75	0.70	12.33	1.13
	Region 2N	59.83	3.15	17.62	0.87	17.93	0.79
	Region 2S	51.67	2.39	19.38	0.89	21.93	0.93
	Region 3	44.33	4.22	8.25	0.70	17.87	1.42
	Region 5	33.17	3.72	6.38	0.66	12.80	1.34
	Region 6	54.17	3.86	15.12	1.03	20.33	1.33
	Region 7	19.67	4.88	3.00	0.69	8.73	1.98
	Region 8	10.33	3.72	1.62	0.52	5.93	1.57

* Rates per 100,000 residents for Sex, Race / Ethnicity, and Residency Region are adjusted for age; Rates for age groups are age-specific. Hospitalizations and emergency department (ED) visits resulting in death were excluded from ED and hospital estimates. ED visits and Hospitalizations represent mutually exclusive incidents. NH refers to non-Hispanic individuals. Averages and rates based on counts less than six have been suppressed. Rates could not be calculated for "Other" or "Unknown" race categories. ED and Hospitalization data were not available for "Multiracial" category.

Region

Drowning-related incidents by county of residence demonstrated marked regional variation, likely reflecting geographic, demographic and systemic differences across the state (Table 4). Regions 2N and 2S, encompassing the densely populated metropolitan Detroit area (Figure 2), reported relatively high hospitalization rates (0.87 and 0.89 hospitalizations per 100,000 residents, respectively) but lower fatality rates (0.79 and 0.93 deaths per 100,000 residents) compared to other regions. In contrast, Regions 7 and 8, which are less densely populated and more remote areas of Michigan, exhibited respectively the highest (1.98 deaths per 100,000 residents) and second highest (1.57 deaths per 100,000 residents) fatal drowning rates, despite having relatively low hospitalization rates (0.69 and 0.52 hospitalizations per 100,000 residents, respectively). These findings are consistent with previous research indicating that the remoteness of rural areas can delay rescue efforts and access to medical care, thereby increasing the risk of fatal outcomes compared to more urbanized regions.[18]

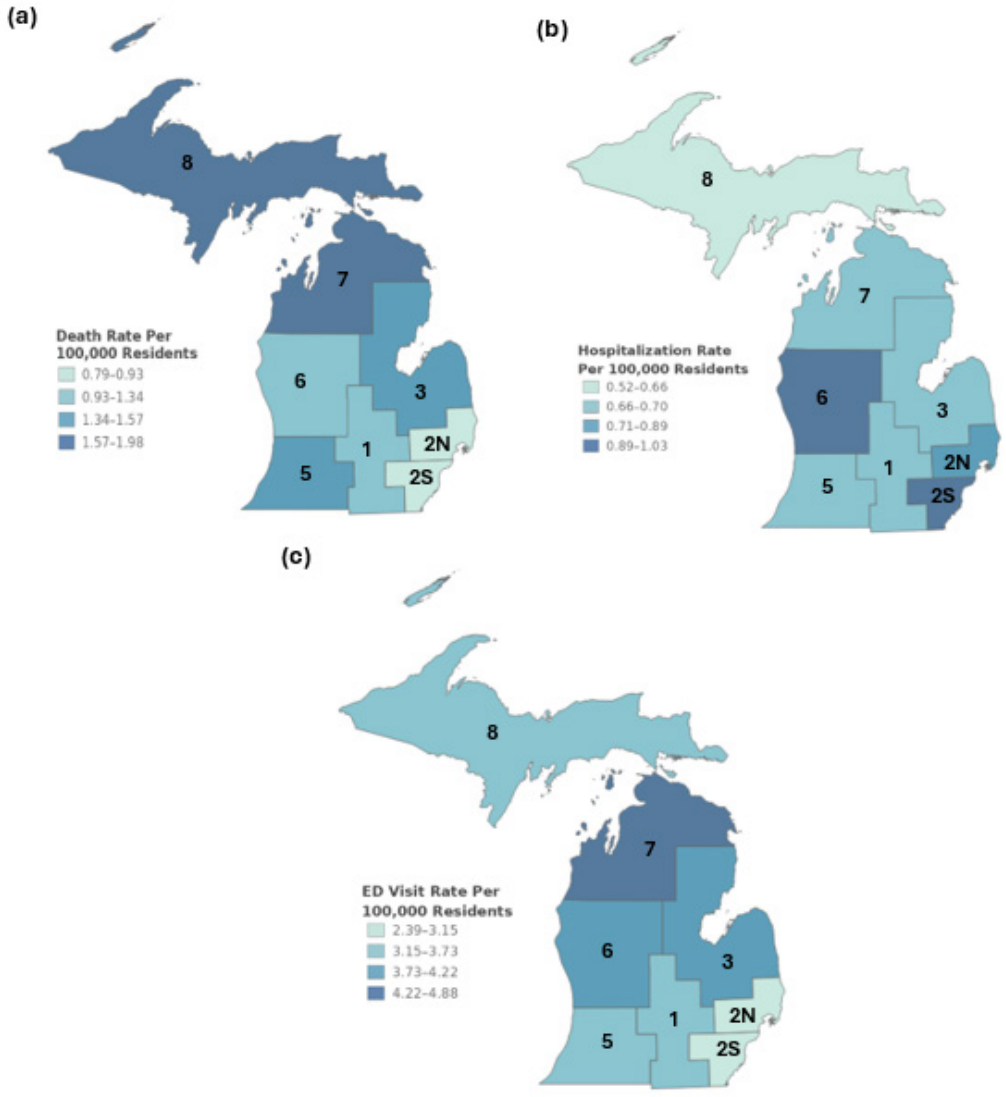
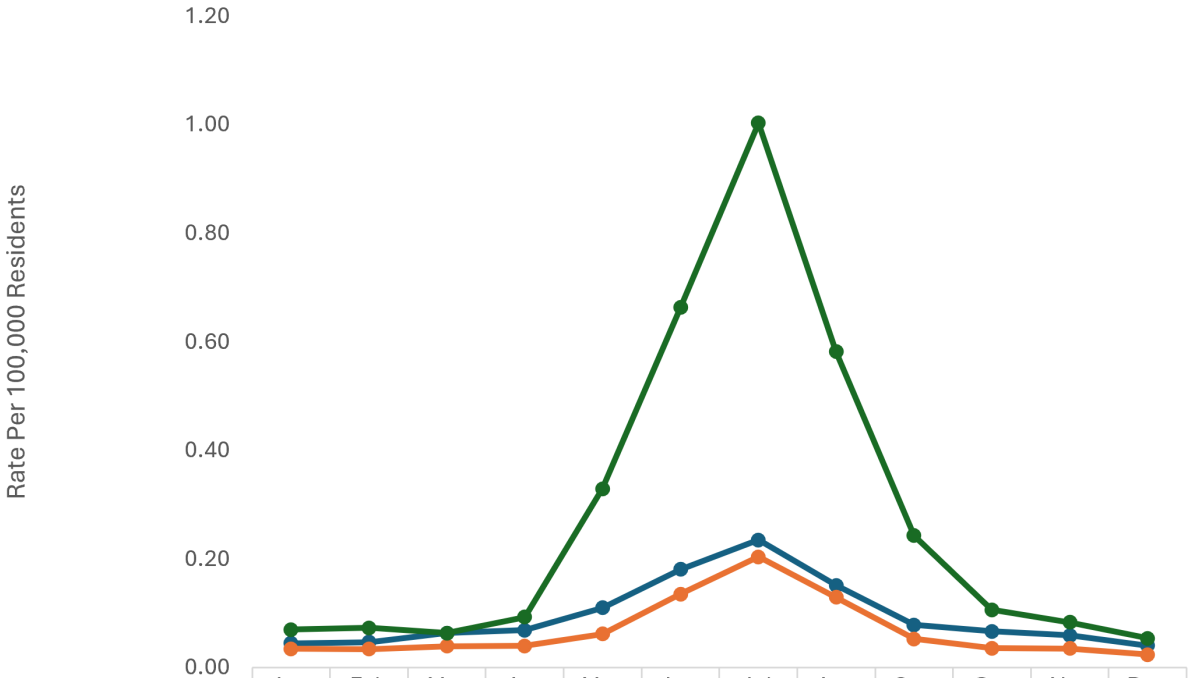


Figure 2. Rates of drowning-related deaths (a), hospitalizations (b), and emergency department (ED) visits (c) among Michigan residents by region (rates per 100,000 residents).

Seasonality

Drowning-related fatalities, hospitalizations and ED visits in Michigan demonstrated pronounced seasonal variations (Figure 3). Rates for all three outcomes were lowest during the winter months (December-February), with fatalities ranging from 0.04 to 0.05 deaths per 100,000 residents, hospitalizations from 0.02 to 0.03 per 100,000 and ED visits from 0.05 to 0.07 per 100,000. Beginning in April, rates climbed steadily and reached their highest levels in July, with 0.24 fatalities, 0.20 hospitalizations, and 1.00 ED visit per 100,000 residents. Compared to the lowest monthly rates observed in winter, this represents a 500% increase in fatalities, a 900% increase in hospitalizations and a 1900% increase in ED visits during the peak summer month of July. Elevated rates persisted through August before declining steadily in the fall and returning to low levels during the winter. This pattern highlights a distinct increase in drowning risk during the warmest months, coinciding with periods of greater recreational water activity.

Figure 3. Rates of Michigan resident drowning fatalities, hospitalizations, and emergency department (ED) visits.*



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fatalities	0.04	0.05	0.06	0.07	0.11	0.18	0.24	0.15	0.08	0.07	0.06	0.04
Hospitalizations	0.03	0.03	0.04	0.04	0.06	0.14	0.20	0.13	0.05	0.04	0.04	0.02
ED Visits	0.07	0.07	0.06	0.09	0.33	0.66	1.00	0.58	0.24	0.11	0.08	0.05

* Fatal drowning data cover the years 2009–2023; hospitalization data span 2016–2023; ED visit data cover 2018–2023. Dates for fatal drowning based on date of death while hospitalization and ED are based on admission dates.

Additional data sources available in Michigan: Dangerous currents (Great Lakes only)

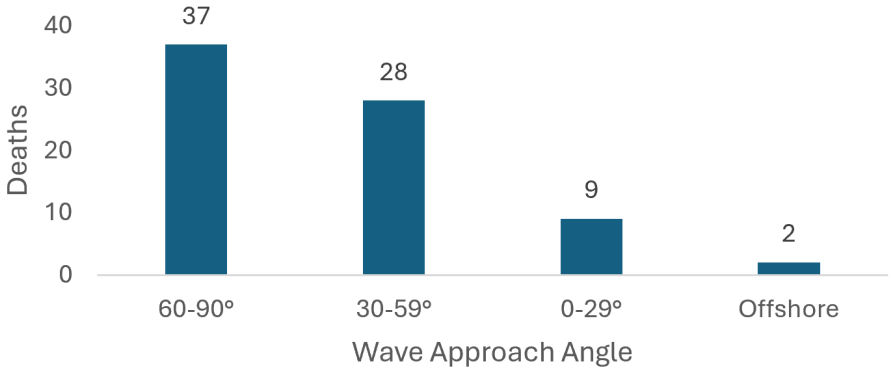
The National Weather Service (NWS), in collaboration with NOAA and the GLWSC, collect data on fatal drowning throughout the Great Lakes, including the approximate location of each incident. By analyzing historical weather and environmental conditions, they identify which incidents were likely associated with dangerous currents. This dataset, called the Great Lakes Current Incident Database (GLCIDB), represents only a subset of all drowning fatalities and may not capture every current-related incident that occurs in the Great Lakes. Approximately 16% of all fatal drownings in the Great Lakes are attributed to dangerous currents, with some years recording notably higher proportions such as in 2010 (26%) and 2020 (43%). Data regarding the intent of the incidents was not available, so all intents are included. The dataset encompasses both Michigan residents and non-residents who drowned in the Great Lakes along Michigan's coastline. Information was compiled from multiple sources, including weather records from the NWS, media reports, the DNR, the U.S. Coast Guard (USCG), local beach managers, lifeguards, water safety advocates and Freedom of Information Act (FOIA) requests submitted to law enforcement agencies.

Between 2009 and 2023, 76 drowning deaths that were determined to be caused by dangerous currents in the Great Lakes along Michigan's coastline were recorded by GLCIDB. Of these, males accounted for 67 deaths (88%). The ages of the victims ranged from six to 82 years, with an average age of 23.6 years. Most of these deaths occurred in Lake Michigan, which had 60 deaths (79%).

Wave angle

The angle at which waves approach the shore is a known factor that influences the formation of dangerous currents.[19] Waves arriving at different angles affect the speed and type of currents they can generate. Waves approaching the beach at a 60-90 degree angle are likely to create strong rip and structural currents; those coming at a 30-59 degree angle can produce rip currents, structural currents and longshore currents. Waves at a 0-29 degree angle and those from offshore are generally less likely to result in dangerous currents.[19] Between 2009 and 2023, there were 37 current-related drowning deaths (48%) in Michigan waters of the Great Lakes associated with waves approaching at a 60–90 degree angle. An additional 28 deaths (37%) occurred with waves at a 30–59 degree angle, nine deaths (12%) with waves at a 0–29 degree angle and two deaths (3%) were linked to offshore-directed waves (Figure 4).

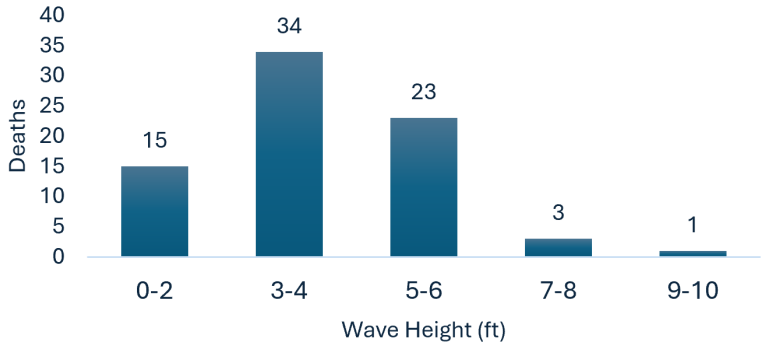
Figure 4. Michigan Great Lakes drowning death counts by wave approach angle—Great Lakes Current Incident Database, 2009–2023.



Wave height

Wave height is an important factor in drowning risk.[20] Larger waves generally pose greater risks to swimmers and boaters; however, the general public may be less likely to enter the water when waves exceed five feet. In Michigan's Great Lakes between 2009 and 2023, the majority of current-related drowning deaths occurred when wave heights were between three to four feet (34 deaths, 45%) and five to six feet (23 deaths, 30%), as outlined in Figure 5.

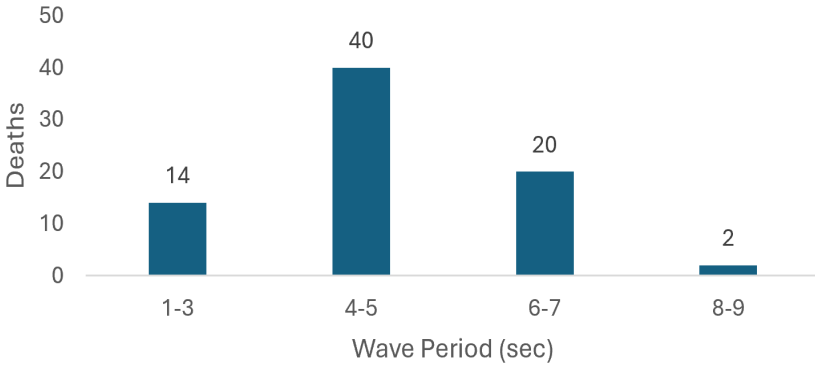
Figure 5. Michigan Great Lakes drowning deaths by wave height—Great Lakes Current Incident Database, 2009–2023.



Wave period

The wave period, which refers to the time between each wave in seconds, can also play a role in the formation of rip currents. More extended wave periods generally result in increased currents and larger volumes of water within each wave.[21] Conversely, shorter wave periods can be hazardous as swimmers are struck by waves more frequently, resulting in an abbreviated recovery period. In Michigan's Great Lakes between 2009 and 2023, the majority of current-related drowning deaths occurred when wave periods ranged from four to five seconds (40 deaths, 53%) and six to seven seconds (20 deaths, 26%), as shown in Figure 6.

Figure 6. Michigan Great Lakes drowning deaths by wave period—Great Lakes Current Incident Database, 2009–2023.



Extreme Weather – Seiches

A seiche is a standing wave oscillation that occurs in an enclosed or partially enclosed body of water, such as the Great Lakes.[22] This phenomenon is caused by strong winds and rapid changes in atmospheric pressure that push water from one end of the body of water to the other. When the wind subsides, the water sloshes back and forth for hours or even days, which can lead to rapid fluctuations in water levels and dangerous conditions along the shoreline.

For example, on July 4, 2003, early morning storms produced a seiche at Warren Dunes State Park in Berrien County, Michigan, pushing water to one side of the beach. Later that day, after the storm passed and the weather improved, many people flocked to the beach to celebrate the holiday. Unfortunately, this situation resulted in dangerous currents and swimming conditions, leading to seven drowning incidents within a five-hour period.[23]



Lessons and considerations

Lessons and considerations to strengthen drowning data systems

Lesson 1. The current system for tracking drowning incidents in Michigan is fragmented and inconsistent, with data on the circumstances often limited in coverage, completeness and availability, and significant variation in quality and standardization across sources that frequently omit key contributing factors.

In Michigan, while the Michigan Department of Health and Human Services (MDHHS) effectively tracks drowning deaths, hospitalizations and emergency department (ED) visits using the International Classification of Disease 10th revision (ICD-10) and ICD-10 Clinical Modification (ICD-10-CM) codes, key contextual data, such as environmental conditions, supervision, the type of body of water, the presence of alcohol or other substances and law enforcement or boating details, are inconsistently captured across agencies. Obtaining data can also be challenging without direct access to local records. Without uniform reporting and integration of diverse data sources (e.g., emergency medical services (EMS), law enforcement, Michigan Department of Natural Resources (DNR), coroners, hospitals), critical gaps persist that limit the usefulness of drowning data for prevention efforts.

Consideration 1. A comprehensive and coordinated drowning data registry housed within MDHHS can significantly enhance the understanding and prevention of drowning incidents.

Establishing a statewide, multi-agency drowning surveillance system—managed by MDHHS but populated by local agencies such as EMS, sheriffs' departments, DNR, hospitals and coroners—could ensure the consistent, standardized collection of both fatal and nonfatal drowning incidents. Using a comprehensive reporting tool (e.g., a modified Submersion Incident Reporting Form), triggered by drowning-related codes or incident reports, would improve data quality and completeness. Mandatory data-reporting and sharing protocols, along with real-time access across jurisdictions, would support more accurate surveillance, interagency coordination and the development of targeted drowning prevention strategies statewide.

Lesson 2. Evaluation of drowning prevention efforts is often neglected.

The evaluation of drowning prevention efforts presents an important opportunity for improvement. In Michigan, numerous organizations implement valuable interventions, such as life jacket loaner programs, school-based water safety awareness initiatives and swim lessons. However, many of these organizations have not yet evaluated the effectiveness of their programs. By conducting thorough evaluations, they can gain insights into the impact, efficacy and cost effectiveness of these initiatives, ultimately enhancing their strategies to save lives and promote water safety.

Consideration 2. State government agencies and community partners should consider incorporating evaluation into their drowning prevention intervention plans and programs from the outset.

By ensuring these evaluations are well-planned and adequately funded, the effectiveness of these programs can be significantly enhanced. Including cost-benefit analyses in these evaluations will provide valuable insights. Additionally, presenting the findings in an easily digestible format will empower policymakers and decision makers to take informed and actionable steps toward improving water safety.

Lesson 3. Drowning prevention efforts in natural bodies of water are limited by the narrow scope and capacity of environmental data collection, which is primarily led by the National Oceanic and Atmospheric Association (NOAA). Currently, these efforts focus exclusively on the Great Lakes and lack broader applicability to other water bodies such as inland lakes and rivers.

Data describing environmental conditions, such as dangerous currents, related to drowning incidents is currently collected only for the Great Lakes, and this effort is primarily sustained by a single NOAA employee. The limited capacity and scope of this work constrain its applicability to broader prevention strategies, leaving significant gaps in understanding how environmental factors influence drowning risk in other natural water bodies—such as inland lakes and rivers—which account for a substantial share of drowning incidents in the state.

Consideration 3. To enhance drowning prevention, environmental data collection efforts should be implemented beyond the Great Lakes to include all natural bodies of water.

Additionally, investments are needed in the resources and infrastructure required to effectively analyze and apply this data. This could support real-time public safety interventions such as location-based mobile alerts, improved signage and beach flag systems, and statewide awareness campaigns that educate the public about how changing environmental conditions elevate drowning risk in all natural water settings.

Lessons and considerations to strengthen drowning prevention strategies

Lesson 1. Drowning data is not regularly reported to the public or decision makers.

MDHHS collects and shares drowning data nationally with the US Centers for Disease Control and Prevention (CDC); however, these data are not regularly highlighted in public-facing reports or dashboards. As a result, decision makers and the public may not fully understand the extent and circumstances of the drowning burden in Michigan.

Consideration 1. MDHHS may consider publishing drowning data in an annual report or a regularly updated platform, such as an online dashboard or database. Decision makers and communities may be better equipped to recognize and address factors to prevent drowning with the implementation of regular public reporting of drowning statistics.

Lesson 2. Certain demographic groups experience disproportionately high drowning rates within their respective populations, including children aged one to four, adults aged 75 and older, males of all ages and non-Hispanic Native American and non-Hispanic Black Michiganders.

Consideration 2. To reduce drowning among high-risk groups including young children, older adults, males of all ages and non-Hispanic Native American and non-Hispanic Black Michiganders, the state should prioritize targeted, evidence-based prevention strategies.

For children aged one to four, this includes enforcing four-sided pool fencing, ensuring consistent adult supervision near all water sources and expanding caregiver education. For older adults, prevention efforts should focus on increasing awareness of water-related risks associated with age, health conditions and medication use, while promoting the use of flotation devices and fall prevention strategies around water. For males, public awareness campaigns should address risk-taking behaviors and encourage safe decision-making during recreational water activities. Tailored outreach and culturally responsive engagement strategies are also critical to address the elevated risk among specific racial and ethnic groups.

Lesson 3. Regional and community-level water safety and drowning prevention programs are vital strengths that must be expanded.

Michigan already has a strong network of drowning prevention initiatives. Still, the patchwork nature of this framework can sometimes lead to gaps in coverage, particularly for those most vulnerable to drowning, such as those historically underserved populations in lower socioeconomic and more rural areas. To improve water safety and drowning prevention across the state, it would be beneficial to build on the existing strengths of local partners to expand regional and community-level programs.

Consideration 3. The strengths of existing local and regional drowning prevention programs should serve as models for similar initiatives across Michigan.

Establishing a Michigan-based coalition of water safety partners from all regions, like the Great Lakes Water Safety Consortium (GLWSC), could help build a stronger culture of water safety, reduce duplication of efforts and leverage existing strengths. Implementing such a network within the state would also create a platform to highlight and share successful programs, enabling more communities across Michigan to adopt and adapt proven drowning prevention strategies.

Lesson 4. Increased funding and capacity for drowning research and prevention are fundamentally needed throughout the state.

While critically important, drowning data collection, research and prevention represent just one of many injury-related priorities for the state health department and other agencies. To expand the data collection, analysis, reporting and evaluation efforts recommended in this report, these agencies will require increased funding and support to build the necessary capacity.

Consideration 4. Leaders and decision makers at every level need a call to action to fight for increased funding and capacity for drowning data collection and prevention.

Further efforts are essential, such as this water safety report, to draw attention to leaders and the public to the costs of drowning to increase awareness of drowning rates, risk factors and prevention methods, which could be significantly enhanced with increased funding.





Conclusions

This report highlights both the progress and persistent challenges in drowning surveillance and prevention in Michigan. While the Michigan Department of Health and Human Services (MDHHS) tracks drowning-related deaths, hospitalizations and emergency department (ED) visits, data on the circumstances surrounding these incidents remain fragmented, inconsistently collected and difficult to access across agencies. A statewide, coordinated drowning data system—integrating information from local partners, such as emergency medical services (EMS), law enforcement, healthcare providers and natural resource agencies—would significantly improve the completeness, consistency and utility of drowning data.

Standardized reporting tools and broader public access to drowning data, through regular reports or online dashboards, can help raise awareness, inform decision making and guide prevention efforts at all levels. Additionally, evaluating existing programs remains a critical yet underutilized strategy. Incorporating evaluation and cost-effectiveness assessments into program design will ensure that effective interventions can be identified, refined and scaled.

Environmental data related to drowning is another area in need of expansion. Current efforts led by the National Oceanic and Atmospheric (NOAA) primarily focus on the Great Lakes and lack the capacity to monitor risks across Michigan's numerous inland lakes and rivers. Investing in tools and strategies that connect environmental conditions to public safety messaging can enhance drowning prevention in natural water settings statewide.

Children ages one to four are among the most vulnerable populations, with the highest nonfatal drowning rates and one of the highest fatal drowning rates, underscoring the need for targeted interventions and outreach to families with young children across all aquatic environments. Other high-risk groups also warrant focused attention, including adults ages 75 and older, who may face increased risk due to health conditions, limited mobility and medication effects, as well as males of all ages, who are more likely to engage in high-risk behaviors around water.

Additionally, non-Hispanic Native American and non-Hispanic Black Michiganders experience disproportionately high drowning rates. Prevention efforts should include age- and culturally appropriate education, expanded access to swim lessons and water safety resources, promotion of life jacket use and awareness campaigns addressing the specific risks faced by each group.

Finally, expanding drowning prevention in Michigan will require increased funding and sustained investment in data systems, evaluation, public communication and local capacity. Community-based programs remain a vital strength and should be supported and scaled to ensure equitable access across the state.

By acting on the lessons and recommendations outlined in this report, Michigan can build a stronger, more coordinated approach to drowning prevention—one that saves lives, reduces the health and financial burdens associated with nonfatal drowning, and creates safer communities for all.

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Michigan Drowning Data Report

CDC Foundation