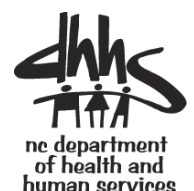


THE BURDEN OF
Unintentional Drowning
among Children:
North Carolina
2008-2012



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North Carolina
2008-2012

Anna Austin, MPH



State of North Carolina • Pat McCrory, Governor
Department of Health and Human Services
Aldona Z. Wos, M.D., Secretary
Division of Public Health • Robin Cummings, M.D., Acting State Health Director
Injury and Violence Prevention Branch

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Acknowledgements:

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Highlights:

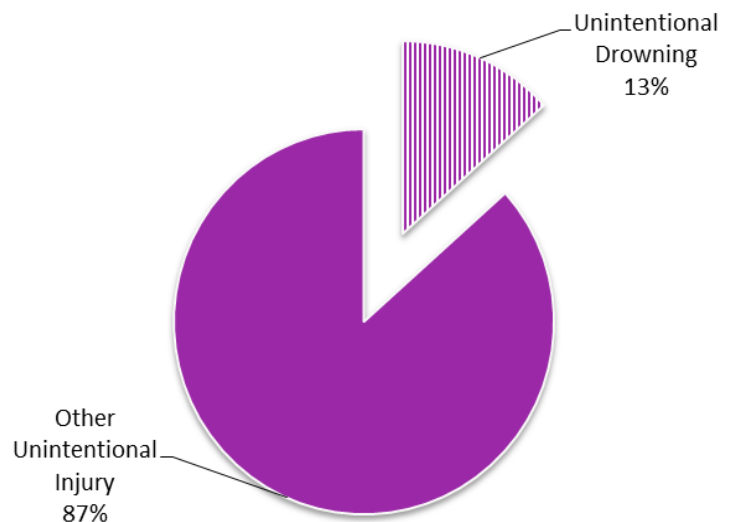
- Between 2008 and 2012, 138 children under the age of 18 died as the result of unintentional drowning in North Carolina.
- The rate of unintentional drowning death among children was generally lower in North Carolina than in the U.S. as a whole.
- Among children, males were three times as likely to die as the result of unintentional drowning as females.
- Children between the ages of 0 and 4 had the highest rate of death due to unintentional drowning in North Carolina.
- Hospital discharges and emergency department visits for unintentional non-fatal drownings and non-fatal submersion injuries outnumbered deaths due to unintentional drownings between 2008 and 2012.

Overview and Trends

Unintentional injury is one of the leading causes of death among children under 18 years of age in the state of North Carolina. Of all causes of death, motor vehicle injuries and other unintentional injuries represent the third and fourth leading causes of death among children in North Carolina, surpassed only by perinatal conditions and congenital malformations.¹ In 2012 alone, unintentional injuries were the cause of 202 deaths in children under the age of 18.

A common form of unintentional injury death among children in North Carolina is drowning. Between 2008 and 2012, 138 child deaths were attributed to unintentional drowning. Drowning accounted for about 13 percent of all unintentional injury deaths among children under the age of 18 during this time period (Figure 1).²

Figure 1. Percent of Unintentional Injury Deaths due to Drowning among Children Under the Age of 18: North Carolina 2008-2012

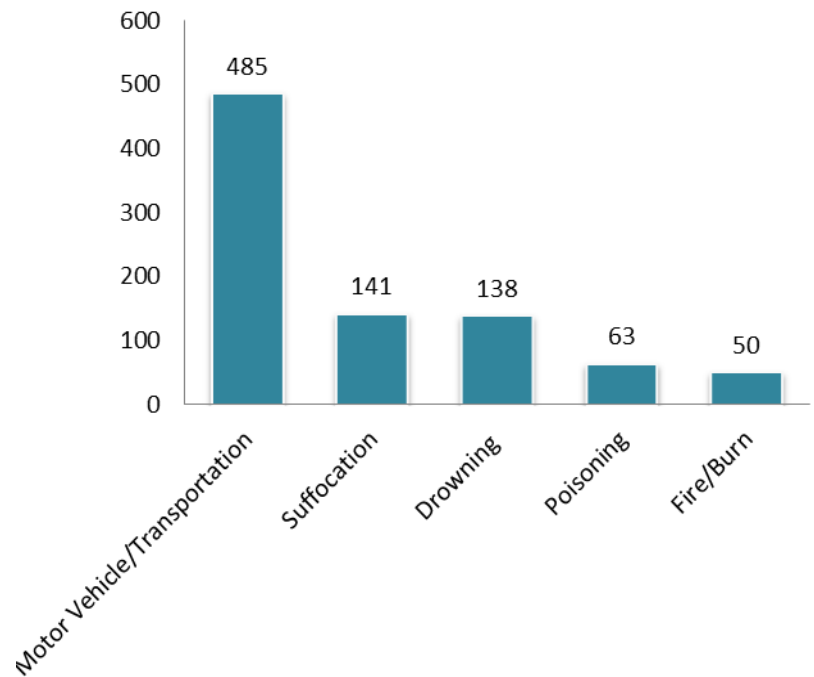


Data: Deaths, N.C. Center for Health Statistics, 2008-2012
Analysis: Injury Epidemiology and Surveillance Unit

Drowning was the third leading cause of unintentional injury death among children in North Carolina between 2008 and 2012 (Figure 2). While almost half (47.0%) of unintentional injury deaths among children during this period were attributed to motor vehicle crashes, drowning (13.4%) accounted for a substantial portion of unintentional injury deaths.¹

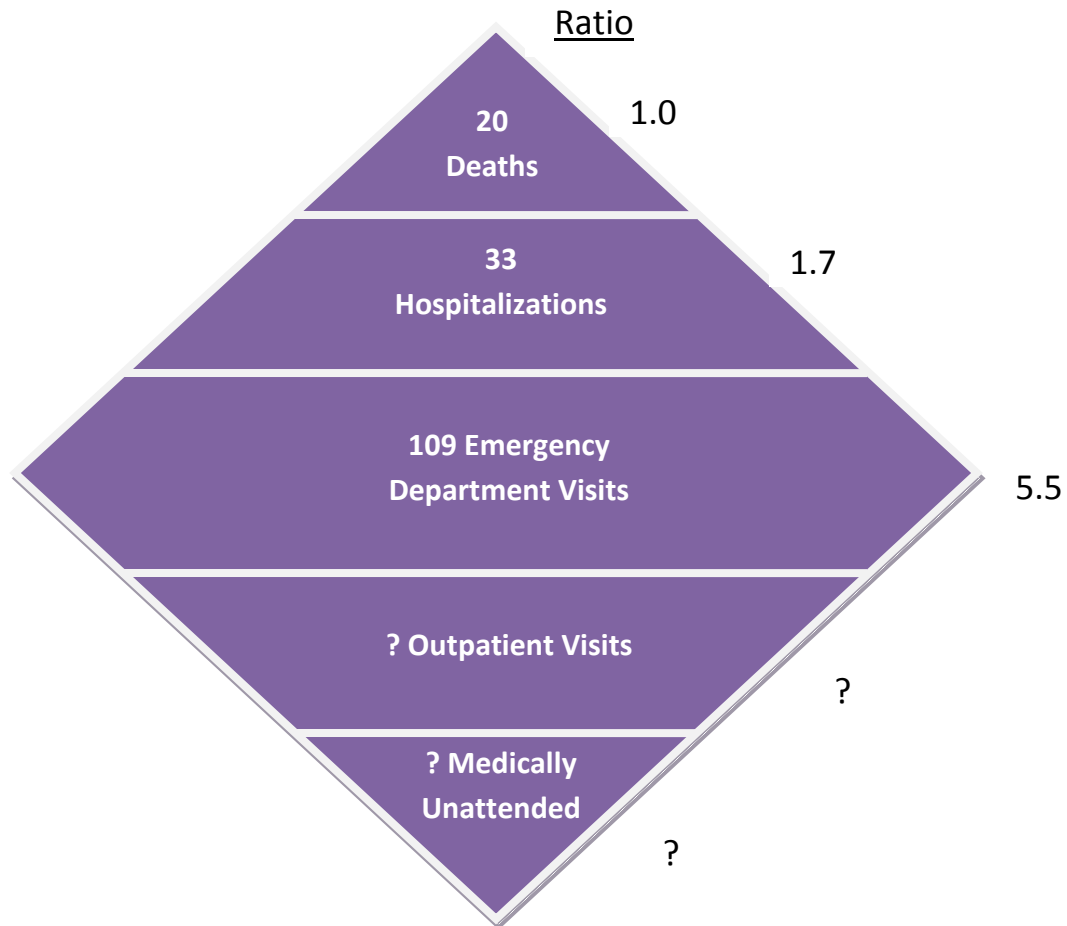
Nationally, drowning is the second leading cause of unintentional injury death for children between the ages 0 and 14, second only to motor vehicle crashes. Each day in the United States, two children age 14 or younger die from an unintentional drowning.³

Figure 2. Top 5 Leading Causes of Unintentional Injury Death among Children Under 18: North Carolina 2008-2012



Data: N.C. Center for Health Statistics, 2008-2012
Analysis: Injury Epidemiology and Surveillance Unit

Figure 3. The Injury Iceberg—Unintentional Drowning among Children Under 18: North Carolina 2011



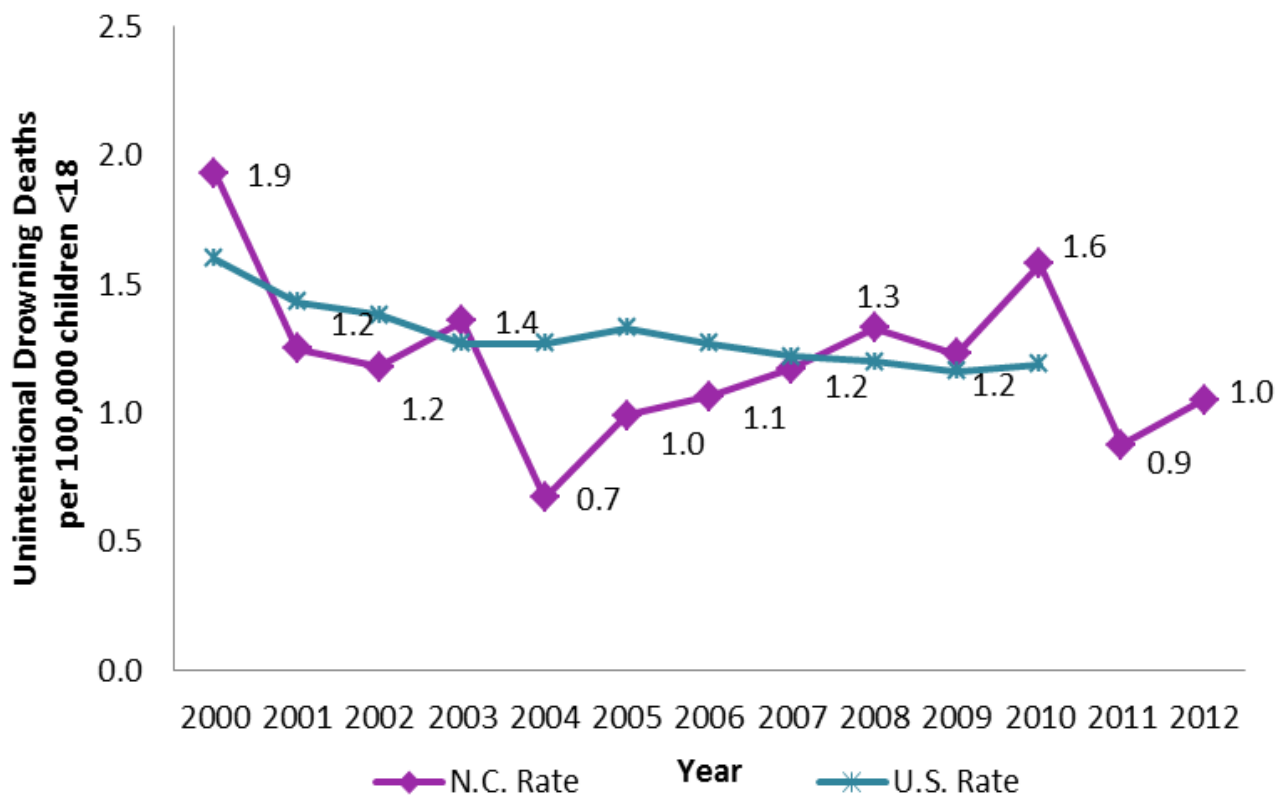
Nationally, for every child who dies from an unintentional drowning, five or six more visit the emergency department (ED) for non-fatal drownings. In 2010, there were 886 unintentional drowning deaths among children under the age of 18 in the United States, but 6,012 visits to emergency departments for non-fatal drownings.⁴ The number of children who receive outpatient care or seek no medical attention in the event of a non-fatal drowning is unknown, though they are expected to represent a relatively small portion of cases. Importantly, non-fatal drownings can cause severe morbidity among victims. These injuries can range in severity: an extreme severe brain damage that can result in long-term disabilities such as memory loss, learning disabilities and permanent loss of basic functioning (permanent vegetative state).⁵

The Injury Iceberg illustrates the overall burden that unintentional drowning places on children in North Carolina. Deaths account for only the “tip” of the iceberg with regard to unintentional drowning. In 2011, for each child death, there were 1.7 hospitalizations and 5.5 ED visits for non-fatal drownings (Figure 3).^{1, 6, 7} Surveillance data are not available for outpatient clinics or for non-fatal drownings that are not medically attended, though these numbers are likely to be small.

Unintentional drowning deaths among children in North Carolina have varied over the past 12 years. The overall rate of unintentional drowning deaths among children was 1.2 per 100,000 (95% CI 0.6, 1.5) between 2000 and 2012. In 2012, the rate was 1.0, which is slightly less than the overall rate observed during this time period (Figure 4).

The national rate of unintentional drowning deaths among children has gradually declined since 2000. Between 2000 and 2010 (the most recent year for which national data are available), the overall rate of unintentional drowning death was 1.3 deaths per 100,000 children (95% CI 1.27, 1.32).⁴ The rate of unintentional drowning death among children is generally lower in North Carolina than in the nation as a whole.

Figure 4. Rate of Unintentional Drowning Deaths among Children Under 18: North Carolina and U.S. 2000-2012



Data: N.C. Center for Health Statistics, 2000-2012; WISQARS, 2000-2010
 Analysis: Injury Epidemiology and Surveillance Unit

Characteristics of Unintentional Drowning Deaths

Between 2008 and 2012, there were 138 unintentional drowning deaths among children under the age of 18 in North Carolina. Table 1 provides the demographic characteristics of these deaths. In North Carolina, certain populations were at a greater risk of death due to unintentional drowning.

- Among children, males were considerably more likely to die as the result of an unintentional drowning than females. More than three-fourths (77.5%) of all unintentional drowning deaths in children were among males. Males under the age of 18 had a death rate of 1.8 per 100,000 residents (95% CI 1.5, 2.2) whereas females had a rate of 0.6 per 100,000 residents (0.4, 0.8).
- Hispanic (1.3, 95% CI 0.7, 1.9) and non-Hispanic (1.2, 95% CI 1.0, 1.4) children had comparable rates of unintentional drowning deaths. Similarly, white (1.1, 95% CI 0.9, 1.4) and black (1.3, 95% CI 0.8, 1.7) children had comparable rates of unintentional drowning deaths.
- While unintentional drowning affects children of all ages, certain age groups are particularly vulnerable. Children between the ages of 0 and 4 had the highest rate of unintentional drowning death of all children under the age of 18 (2.3, 95% CI 1.8, 2.9), a rate 3.3 times higher than the rate among children between the ages of 5 and 9 (0.7, 95% CI 0.4, 0.9).

Drowning:

The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) define **drowning** as:

*“the process of experiencing respiratory impairment from submersion or immersion in liquid”.*⁸

Drownings can be fatal or non-fatal.

The main factors influencing drowning risk include:³

- **Lack of swimming ability**
Participation in formal swimming lessons can reduce the risk of drowning, especially in children between the ages of 1 and 4.^{9,10}
- **Lack of barriers such as pool fencing**
Barriers are particularly important for preventing drowning in young children.¹¹
- **Lack of close supervision**
Drowning can happen quickly and quietly anywhere there is water.³
- **Location**
National data reveal that most young children drown in home swimming pools while the prevalence of drowning in lakes, rivers, and oceans increases with age.¹²
- **Failure to wear life jackets**
- **Alcohol use**
Alcohol use is a risk factor for drowning among adolescents and adults.^{12,13}
- **Seizure disorders**
Drowning is the most common cause of unintentional death among those with seizure disorders.¹⁴

All drowning deaths, hospitalizations, and ED visits are classified using the World Health Organization’s International Classification of Disease codes ICD-10 (deaths) and ICD-9-CM (nonfatal injuries). See the Notes (page 18) for additional information.

Table 1. Unintentional Drowning Deaths among Children under the age of 18 by Sex, Race, Hispanic-Ethnicity, and Age: North Carolina 2008-2012

	Number	Percent [‡]	Rate [†]	95% Confidence Interval	
				Lower	Upper
Sex					
Male	107	77.5%	1.8	1.5	2.2
Female	31	22.5%	0.6	0.4	0.8
Hispanic Ethnicity[§]					
Hispanic	20	14.5%	1.3	0.7	1.9
Non-Hispanic	117	84.7%	1.2	1.0	1.4
Race					
Asian	6	4.3%	*	*	*
American Indian	4	2.9%	*	*	*
Black	37	26.8%	1.3	0.8	1.7
Other	2	1.4%	*	*	*
White	89	64.5%	1.1	0.9	1.4
Age Group					
0-4	75	54.3%	2.3	1.8	2.9
5-9	21	15.2%	0.7	0.4	0.9
10-14	14	10.1%	*	*	*
15-17	28	20.3%	1.5	0.9	2.0
Total	138	100.0%	1.2	1.0	1.4

*Rate is based on fewer than 20 deaths and is considered statistically unreliable.

‡ Percents may not sum to 100% due to rounding and missing values.

† All rates are per 100,000 North Carolina residents.

§ Missing 1 of unknown ethnicity.

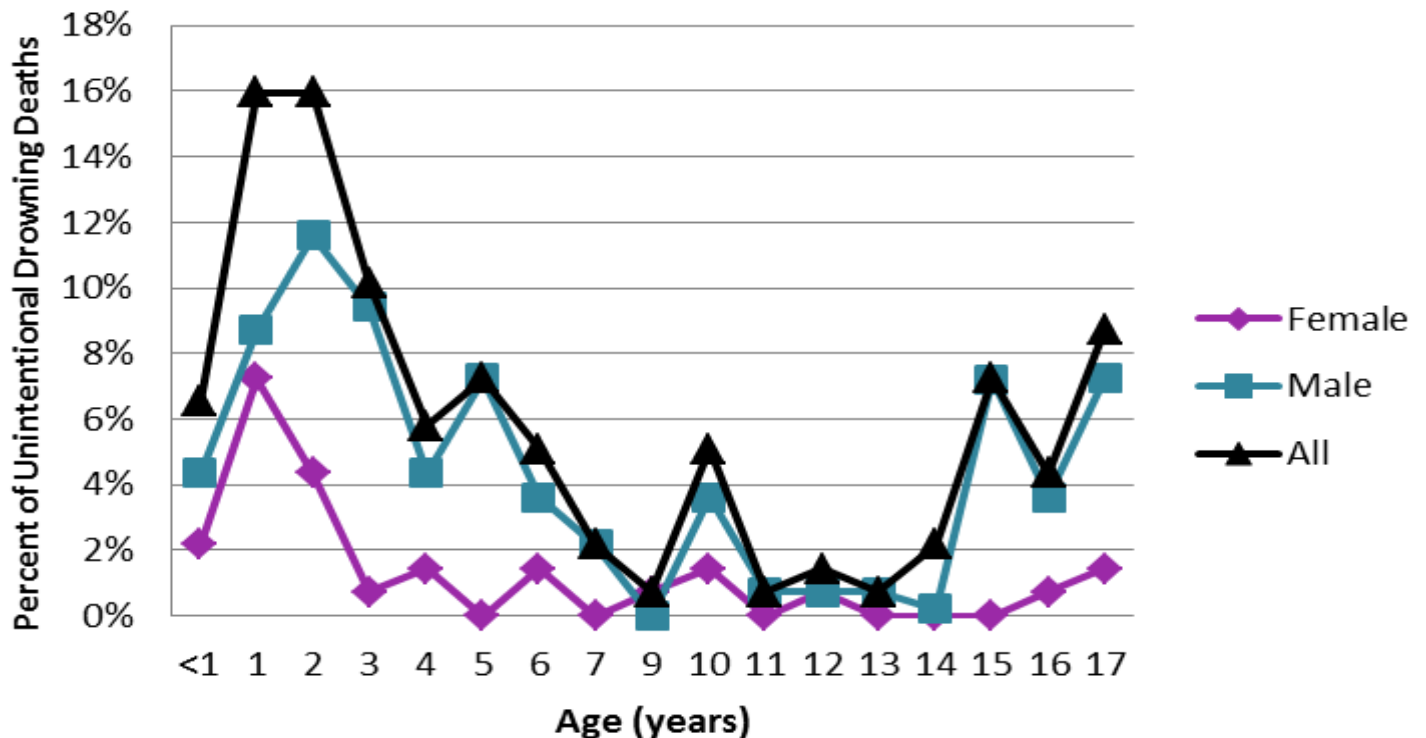
Data: N.C. Center for Health Statistics, 2008-2012
Analysis: Injury Epidemiology and Surveillance Unit

The risk of unintentional drowning death differs by age and sex among children in North Carolina (Figure 4).

- Between 2008 and 2012, males represented a greater percentage of all unintentional drowning deaths than females across all age groups.
- For males, the highest prevalence of unintentional drowning death was at ages 2 and 3 years while for females, the highest prevalence was for ages 1 and 2 years during this time period.
- Figure 5 is best described as U-shaped, meaning that the highest risk of death due to unintentional drowning was among the youngest and the oldest children. For children between the ages of 15 and 17, the risk is almost entirely driven by the numbers among males.

Such trends are not unique to North Carolina. Nationally, males have higher rates of death due to unintentional drowning in comparison to females for all age groups. In addition, children under the age of 4 in the U.S. have the highest risk of death due to unintentional drowning compared to children of other ages.⁴

Figure 5. Percent of Unintentional Drowning Deaths among Children under the age of 18 by Age and Sex: North Carolina 2008-2012

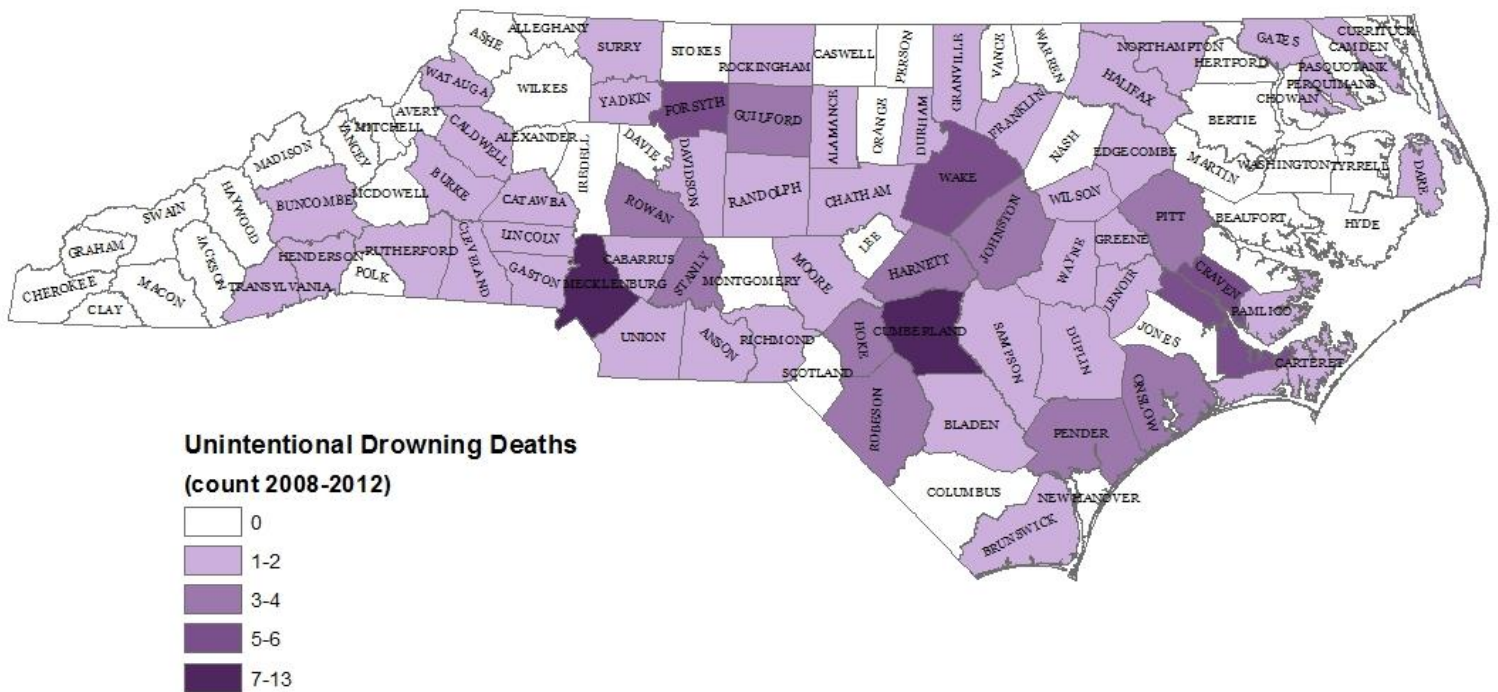


Data: N.C. Center for Health Statistics, 2008-2012
Analysis: Injury Epidemiology and Surveillance Unit

Figure 6 presents the number of unintentional drowning deaths among children under the age of 18 between 2008 and 2012 by county of residence. Please note that the county in which the victim lived is not necessarily the county in which the drowning took place or the death occurred.

- A total of 42 counties had no child resident deaths due to unintentional drowning between 2008 and 2012.
- The majority of the remaining counties had one or two child residents die as the result of unintentional drowning during this time period.
- Mecklenburg and Cumberland counties had the highest counts of child resident deaths due to unintentional drowning between 2008 and 2012 with 12 and 13 deaths, respectively. The county with the next highest count was Wake County, which had six deaths.

Figure 6: Unintentional Drowning Deaths among Children under 18 by County of Residence: North Carolina 2008-2012



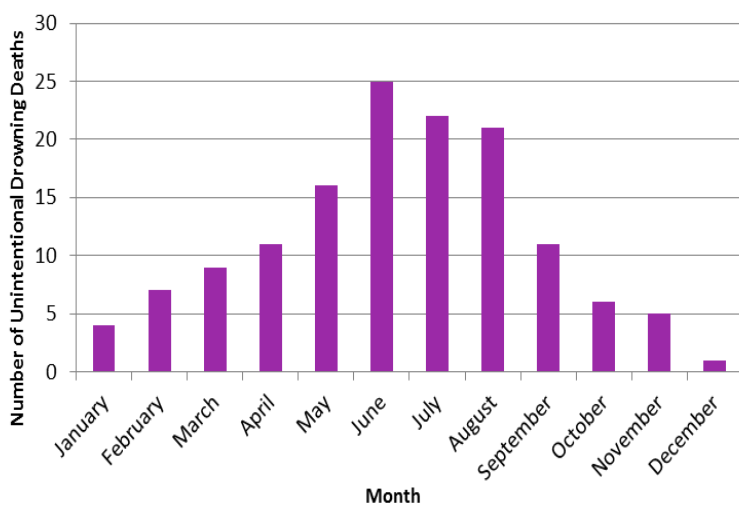
Data: N.C. Center for Health Statistics, 2008-2012
 Analysis: Injury Epidemiology and Surveillance Unit

Circumstances of Unintentional Drowning Deaths

Almost half (49.3%) of unintentional drowning deaths among children between 2008 and 2012 occurred during the summer months (Figure 7).

- Beginning in January, the number of unintentional drowning deaths among children in each month gradually increased through June.
- June, July, and August had the highest number of deaths with 25, 22, and 21 deaths respectively.
- At the end of the summer months, the number of deaths in each month dropped and continued to decrease through the end of the year with only one child death due to unintentional drowning in December.

Figure 7. Number of Unintentional Drowning Deaths among Children under 18 by Month: North Carolina 2008-2012



Data: NC Center for Health Statistics, 2008-2012
Analysis: Injury Epidemiology and Surveillance Unit

Drowning:

Deaths due to unintentional drowning are preventable. There are several measures that can be taken to protect against the risk of drowning among children, including.^{3,15}

- **Teaching children how to swim**
- **Learning CPR**
In the time it takes for paramedics to arrive, CPR can save a child's life.
- **Fencing off access to pools**
Barriers help to prevent unsupervised access to pools. Pool fences should be at least four feet high and have self-closing and self-latching gates that open outward and are out of the reach of children.
- **Requiring children to use the Buddy System when swimming**
- **Selecting swimming sites with life guards**
- **Designating an adult to closely watch children in or around water**
"Touch supervision" is recommended for very young children. This means the supervisor is close enough to touch each of the children at all times. The supervising adult should not be involved in any other activity such as reading, texting, or talking on the phone while watching the children.
- **Using U.S. Coast Guard approved life jackets**
Air-filled or foam toys such as water wings, noodles, or inner-tubes should not be used in the place of life jackets.
- **Ensuring that children do not hyperventilate before swimming underwater and do not try to hold their breath for long periods of time underwater.**
Such actions can cause children to pass out and drown.

Many (42.8%) of the unintentional drowning deaths among children between 2008 and 2012 took place at home (Figure 8). The most common specified water sources involved in these deaths were swimming pools followed by natural water sources (Figure 9).

- Over half (51%) of unintentional drowning deaths among children during this time period occurred while the child was already in the water as opposed to occurring after a fall into the water.
- Of the 59 unintentional drowning deaths that took place at home during this time period, 22 (37.3%) occurred in a swimming pool.
- A substantial number of unintentional drownings took place in an unspecified place (22.5%) and involved an unspecified water source (46.4%) making the circumstances surrounding these deaths difficult to categorize.

Figure 8: Unintentional Drowning Deaths among Children under 18 by Place: North Carolina 2008-2012

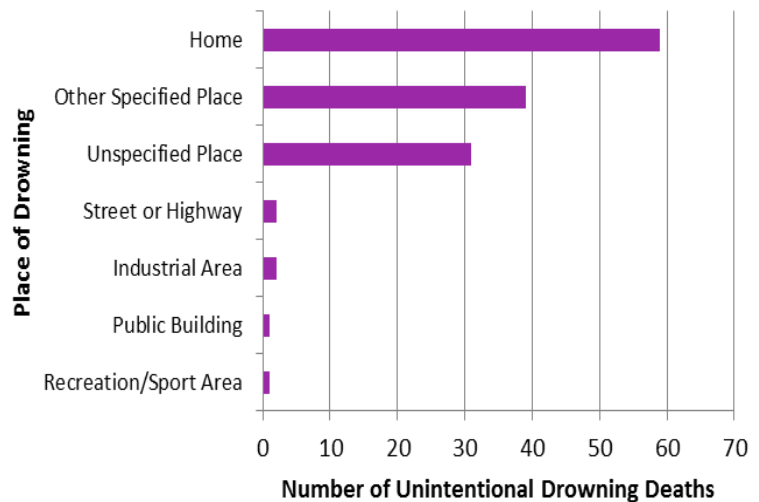
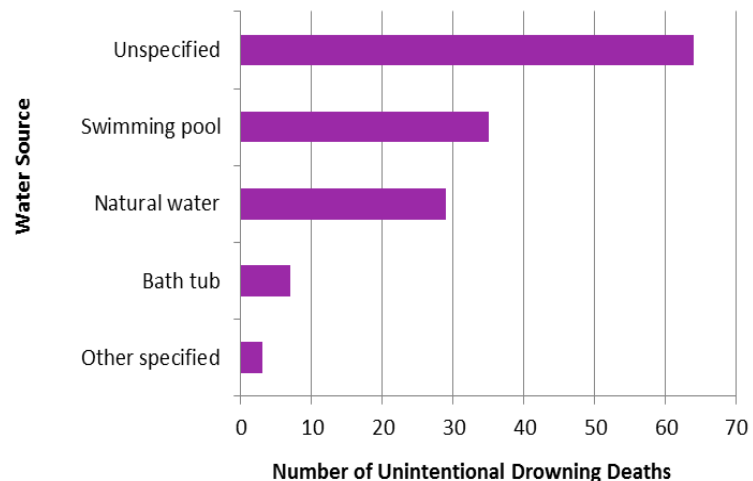


Figure 9: Unintentional Drowning Deaths among Children under 18 by Water Source: North Carolina 2008-2012



Data: N.C. Center for Health Statistics, 2008-2012
Analysis: Injury Epidemiology and Surveillance Unit

Non-fatal Drowning Hospital Discharges and Emergency Department (ED) Visits

Deaths make up only a portion of all unintentional drownings. Hospital discharge records and ED visit data provide additional insight into the extent of unintentional non-fatal drownings among children in North Carolina. These numbers may not provide the full picture of non-fatal drownings in North Carolina, but it is unlikely that many non-fatal drownings are treated in outpatient clinics or at home. Table 2 presents hospital discharge and ED visit data among children under the age of 18:

In 2011, the median hospital bill for all hospital discharges due to unintentional non-fatal drownings among children was \$6,285 (\$873 - \$311,646). The total hospital charges for North Carolina were over \$900,000.

- Hospitalizations and ED visits due to unintentional non-fatal drownings displayed similar patterns by age and sex as fatal unintentional drownings.
- Males had a higher rate of hospitalizations and ED visits due to non-fatal drownings than females.
- The highest rate of hospitalizations and ED visits due to non-fatal drownings was among the youngest children. Children between the ages of 0 and 4 had a hospitalization rate of 3.3 per 100,000 residents (95% CI 2.6, 3.9) between 2008 and 2011 and an ED visit rate of 10.5 per 100,000 residents (9.3, 11.8) between 2008 and 2012.

Table 2. Sex and Age of Hospital Discharges (2008-2011) and Emergency Department Visits (2008-2012) due to Unintentional Non-Fatal Drowning among Children under the age of 18: North Carolina

	Hospital Discharges				Emergency Department Visits			
	Number	Rate [†]	95% CI		Number	Rate [†]	95% CI	
			<i>Lower</i>	<i>Upper</i>			<i>Lower</i>	<i>Upper</i>
Gender								
Male	83	1.8	1.4	2.2	379	6.5	5.9	7.2
Female	52	1.2	0.9	1.5	239	4.3	3.8	4.8
Age Group								
0-4	84	3.3	2.6	3.9	336	10.5	9.4	11.6
5-9	20	0.8	0.4	1.1	100	3.1	2.5	3.8
10-14	21	0.9	0.5	1.2	109	3.5	2.8	4.2
15-17	10	*	*	*	73	3.9	3.0	4.8
Total	135	1.5	1.2	1.7	618	5.4	5.0	5.9

*Rate is based on fewer than 20 deaths and is considered statistically unreliable

†All rates are per 100,000 North Carolina residents.

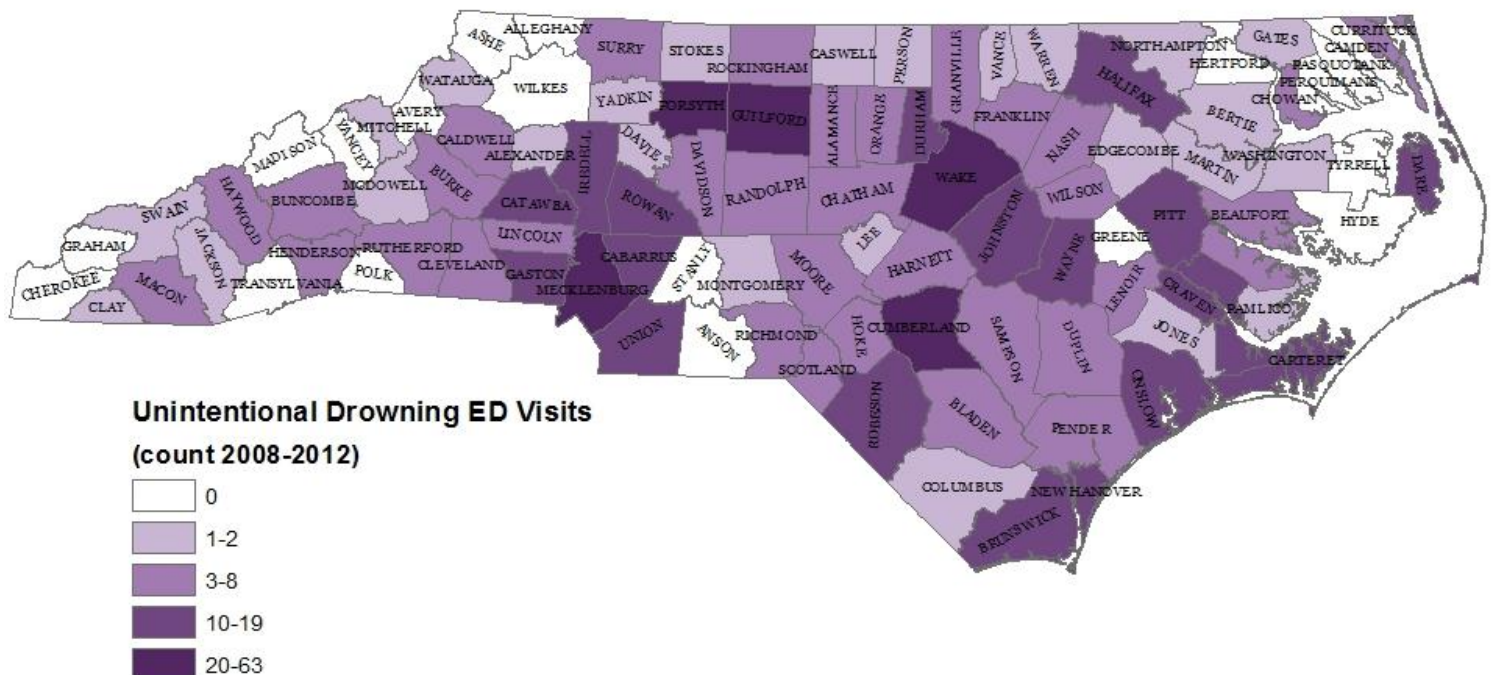
Data: Hospital Discharges, N.C. Center for Health Statistics, 2008-2011; ED Visits, N.C. DETECT, 2008-2012

Analysis: Injury Epidemiology and Surveillance Unit

Figure 10 presents the number of Emergency Department visits due to unintentional non-fatal drowning among children under the age of 18 between 2008 and 2012 by county of residence. Please note that the county in which the victim lived is not necessarily the county in which the drowning took place or ED visit occurred.

- A total of 19 counties had no child resident ED visits due to non-fatal drowning between 2008 and 2012.
- The majority of the remaining counties had between one and 19 child residents visit the ED as the result of non-fatal drowning during this time period.
- Wake and Mecklenburg counties had the highest counts of child resident ED visits due to non-fatal drowning between 2008 and 2012 with 55 and 63 visits, respectively. The county with the next highest count was Cumberland County, which had 26 visits.

Figure 10: Emergency Department Visits due to Unintentional Non-Fatal Drowning among Children under 18 by County of Residence: North Carolina 2008-2012



Data: N.C. DETECT, 2008 -2012
Analysis: Injury Epidemiology and Surveillance Unit

Conclusions:

Unintentional drowning is an important source of morbidity and mortality among children under the age of 18 in North Carolina. Of significance is the fact that unintentional drownings are predictable and preventable, with certain circumstances increasing risk and certain demographic groups particularly vulnerable. Advocacy and educational groups, government organizations, policy makers and parents can work together to take the steps necessary to decrease the toll that unintentional drownings takes on children, families and communities each year. Continuing population-based surveillance will be essential to providing data on changing trends in unintentional drowning as well as informing the development of appropriate interventions.

Additional Sources of Information:**North Carolina:****North Carolina Division of Public Health, Injury and Violence Prevention Branch**Email: beinjuryfreenc@dhhs.nc.govWebsite: www.injuryfreenc.ncdhhs.gov**Safe Kids North Carolina**Email: Kelly.Ransdell@ncdoi.govWebsite: <http://www.ncdoi.com/OSFM/SafeKids>**National:****Centers for Disease Control and Prevention, National Center for Injury Prevention and Control****Safe Child Home: Drownings**Email: cdcinfo@cdc.govWebsite: <http://www.cdc.gov/SafeChild/Drowning>**U.S. Consumer Product Safety Commission****Drowning Prevention Toolkit**Website: <http://www.cpsc.gov/en/Safety-Education/Neighborhood-Safety-Network/Toolkits/Drowning-Prevention>**Pool Safely**Email: poolsafely@cpsc.govWebsite: <http://www.poolsafely.gov>**Safe Kids Worldwide****Water Safety**Email: esamuel@safekids.orgWebsite: <http://www.safekids.org/water-safety>**National Drowning Prevention Alliance**Email: kim@ndpa.orgWebsite: <http://ndpa.org/home>

Notes

Rates: All rates (unless documented otherwise) are per 100,000 North Carolina residents. Rates are not age-adjusted unless labeled as such.

95% Confidence Intervals: Data are frequently reported as point estimates with an associated 95% confidence interval. A confidence interval is the range of values within which the expected “true” value falls 95% of the time. In general, a rate with a large numerator will have a narrower 95% confidence interval than a rate with a small numerator.¹⁷

Population Estimates: The North Carolina State Center for Health Statistics provided population data for the years 2000-2012. These estimates originate from the National Center of Health Statistics’ Bridged Population Files.

Death Data: The North Carolina State Center for Health Statistics provided death certificate data for every death in North Carolina. Only North Carolina residents with a North Carolina county address were considered in our analyses. Deaths were limited to events in which the primary cause of death was identified as an injury. Primary cause of death was assigned with the International Classification, 10th Revision (ICD-10) codes. The coding used to classify unintentional drowning was: W65-74.

Hospital Discharge Data: The North Carolina Center for Health Statistics provided hospital discharge data for every hospital discharge of North Carolina residents. A hospital discharge occurs after a patient leaves a hospital following admission. This data does not represent number of patients, but number of discharges (multiple discharges per patient are possible). Cause of injury was assigned with International Classification, 9th Revision, Clinical Modification (ICD-9-CM) External Causes of Injury codes (E Codes). The coding used to classify unintentional drowning was: 994.1, E832.1, E832.3, and E910-E910.9. By international standards, boating-related drowning (V90 and V92) is classified as transportation-related death.¹³

Emergency Department Data: The North Carolina Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT) is a state system that collects and monitors emergency departments for public health purposes. NC DETECT receives data on at least a daily basis from hospital emergency departments statewide to provide early detection and timely public health surveillance. As of 2010, NC DETECT captured ED records from 113 of 114 (99%) 24/7 acute care hospital-affiliated EDs in N.C. and captured and estimated 99.5% of all eligible ED visits. Cause of injury was assigned with International Classification, 9th Revision, Clinical Modification (ICD-9-CM) External Causes of Injury codes (E Codes). The coding used to classify unintentional drowning was: 994.1, E832.1, E832.3, and E910-E910.9. By international standards, boating-related drowning (V90 and V92) is classified as transportation-related death.¹³

Glossary

Child: Person less than 18 years of age at date of death/injury.

Drowning: The process of experiencing respiratory impairment from submersion or immersion in liquid. Outcomes can be fatal or non-fatal.⁸

Non-fatal injury: Bodily harm resulting from severe exposure to an external force or substance or a submersion.¹⁷

North Carolina resident: A resident of North Carolina with a verifiable county of residence. All deaths and injuries reported in this report are North Carolina residents.

Rate: Calculated as count x 100,000/population.

Unintentional injury: An injury that is not caused by an act with intent to harm oneself or another individual.

Unspecified: The medical examiner/hospital/emergency department did not have enough information to describe the cause/circumstances of the injury.

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