



Pool or Spa Submersion: Estimated Nonfatal Drowning Injuries and Reported Drownings, 2019 Report



May 2019

Ted Yang
Directorate for Epidemiology
Division of Hazard Analysis
U.S. Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814

This analysis was prepared by CPSC staff and has not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

Executive Summary

This report presents annual estimates of the number of emergency department-treated, pool- or spa¹-related, nonfatal drownings (submersion injuries²) that occurred between 2016 and 2018, involving children younger than 15 years of age. The report sets forth the counts of reported pool- or spa-related drownings (submersion fatalities³) that happened between 2014 and 2016, to children younger than 15 years of age. In addition, the report details the subset of submersion injuries and fatalities involving children younger than 5 years of age.⁴

There were, on average, an estimated 6,600 pool- or spa-related, hospital emergency department (ED)-treated, nonfatal drowning injuries each year for 2016 through 2018, and 363 pool- or spa-related drownings reported per year for 2014 through 2016, involving children younger than 15 years of age. Additionally, an annual average of 73 percent of the ED-treated nonfatal drowning injuries from 2016 through 2018, and 74 percent of the reported drownings from 2014 through 2016, involved children younger than 5 years of age.

For children younger than 15 years old, 39 percent of the victims of estimated ED-treated pool or spa submersion injuries for 2016 through 2018, were admitted to the hospital or treated and transferred to another hospital, compared to 4 percent for ED-treated injuries to children younger than 15 years old involving all consumer products in the CPSC's jurisdiction during the same period. Overall, annual estimates of the number of children who were treated in hospital emergency departments for pool- or spa-related nonfatal drowning injuries in 2018 (6,400 injuries), were not statistically different from those in 2017 (7,300 injuries).

The total number of fatal drownings in 2016 (389 fatalities) was higher than the total number of fatal drownings in 2015 (348 fatalities). For children younger than 5 years of age, the total number of fatal drownings in 2016 (289 fatalities) was also higher than the total number of fatal drownings in 2015 (262 fatalities).

¹ The term "spa" is used to refer to spas and hot tubs.

² The term "submersion injury" is used instead of "nonfatal drowning," when comparing or referring to injuries resulting from incidents involving other products or hazards.

³ The term "submersion fatality" is used instead of "drowning," when comparing or referring to fatalities resulting from incidents involving other products or hazards. The period for reported injury and fatality statistics differs due to the lag in fatality reporting. Incidents covered by this report were associated with a pool or spa, but the primary cause of the incident was not necessarily the pool or spa product.

⁴ Note that circulation/suction entrapments in pools or spas are presented in a separate document: "2014–2018 Reported Circulation/Suction Entrapment Incidents Associated with Pools, Spas, and Whirlpool Bathtubs, 2019 Report," May 2019.

Emergency Department-Treated Injury Estimates

For 2016 through 2018, an estimated annual average of 6,600 children younger than 15 years of age were treated in U.S. hospital emergency departments (EDs) for nonfatal injuries associated with pool or spa submersions. Estimates are shown in Table 1. Estimates are also provided for injured children younger than 5 years of age and children 5 to 14 years of age.⁵ Injury estimates came from CPSC’s National Electronic Injury Surveillance System (NEISS) data, where sampling weights are used to project the cases from NEISS hospitals to national estimates. The corresponding annual average estimates for the years 2015 through 2017, are 6,400 children younger than 15 years of age and 4,700 children younger than 5 years of age treated in hospital emergency departments for nonfatal drowning injuries related to pools or spas.

Table 1
Estimated Number of ED-Treated Nonfatal Pool or Spa Drowning Injuries
Children Younger than 15 Years of Age, 2016-2018

Year	Estimated Emergency Department-Treated Injuries ⁶		
	Younger than 5 Years	5-14 Years	Younger than 15 Years
Average	4,800	1,800	6,600
2018	4,900	1,500	6,400
2017	5,300	2,000	7,300
2016	4,200	1,800	6,000

Source: U.S. CPSC: NEISS. Appendix A details the methodology for data extraction.

The 2018 estimates of children younger than 15 years of age and children younger than 5 years of age, who were treated in U.S. hospital EDs for pool- or spa-related nonfatal drownings, are not statistically different than the 2017 estimates. On average, during 2016 through 2018, 73 percent of children treated in EDs for pool- or spa-related, nonfatal drowning injuries were younger than 5 years of age. Children younger than 5 years of age comprised an estimated 70, 72, and 76 percent of the childhood pool- or spa- related treated injuries in 2016, 2017, and 2018, respectively.

⁵ Estimates for children under age 5 and ages 5 to 14 may not sum to the under age 15 total, due to rounding.

⁶ The estimates are rounded to the nearest hundred.

Table 2 shows the percent of estimates for 2016 through 2018, associated with pool or spa submersions, by type of product. Spa-related submersions constitute 3 percent of the estimated number of the pool or spa submersion treated nonfatal drowning injuries for children younger than 15 years of age, and 3 percent of the estimated number of the pool or spa submersion treated nonfatal drowning injuries for children younger than 5 years of age.

Table 2
Percent of Estimated ED-Treated Nonfatal Pool or Spa Drowning Injuries
Children Younger than 15 Years of Age by Product Type, 2016-2018

Product Type	Emergency Department-Treated Injury Percentages		
	Younger than 5 Years	5-14 Years	Younger than 15 Years
Pool	97	100	97
Spa	3	0	3

Source: U.S. CPSC: NEISS. Appendix A details the methodology for data extraction.

Table 3 shows the percentage of the estimated number of pool- or spa-related, nonfatal drowning injuries by victim gender. Male children are more frequently treated for pool- or spa-related nonfatal drowning injuries than female children. This is true of all injured children younger than 15 and the subset of children younger than 5 years of age.

Table 3
Percent of Estimated ED-Treated Nonfatal Pool or Spa Drowning Injuries
Children Younger than 15 Years of Age by Gender, 2016-2018

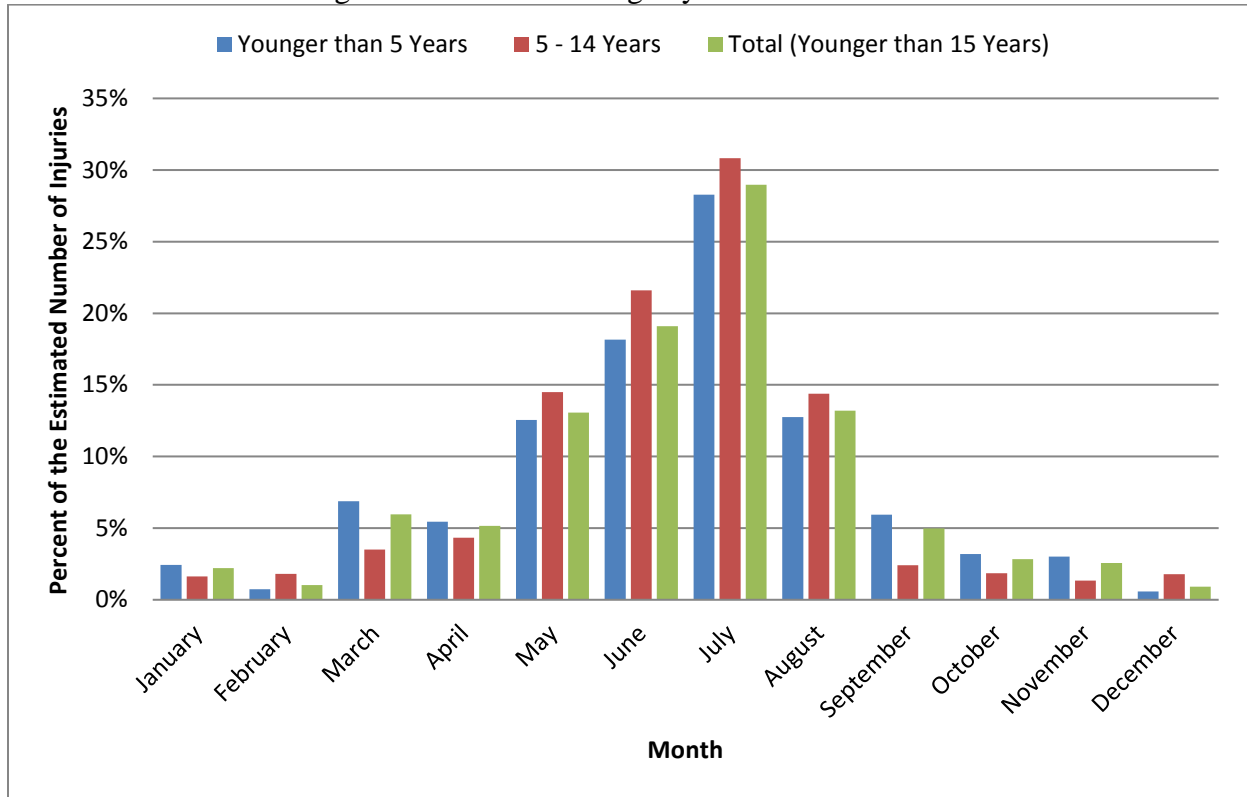
Gender	Estimated Emergency Department-Treated Injury Percentages ⁷		
	Younger than 5 Years	5-14 Years	Younger than 15 Years
Male	60	69	62
Female	40	31	37

Source: U.S. CPSC: NEISS. Appendix A details the methodology for data extraction.

⁷ Percentages may not add up to 100, due to rounding.

Figure 1 illustrates the monthly distribution of the percentages of the estimated emergency department-treated, nonfatal drowning injuries for each age group. The months of May, June, July, and August had the largest percentages.

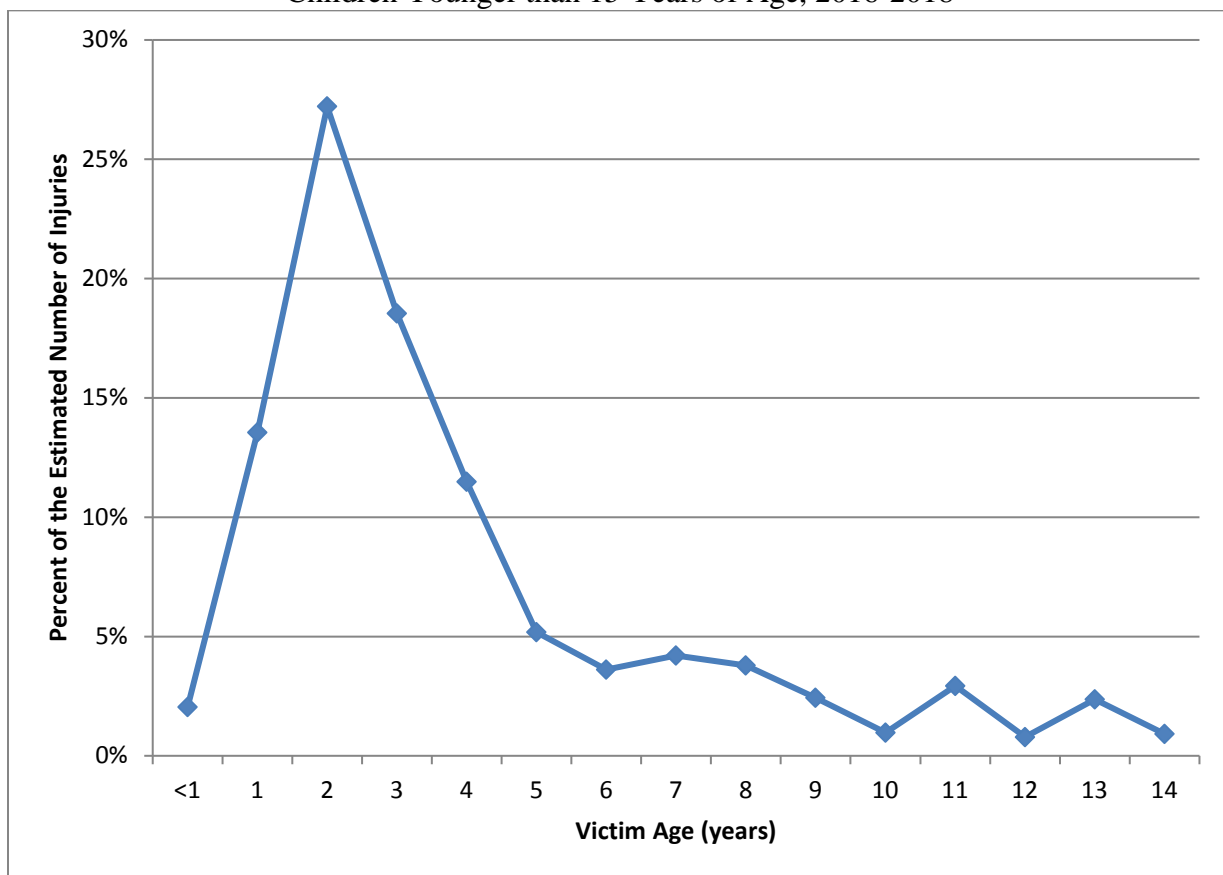
Figure 1
 Percent of Estimated ED-Treated Nonfatal Pool or Spa Drowning Injuries
 Children Younger than 15 Years of Age by Month of Treatment 2016-2018



Source: U.S. CPSC: NEISS.

Figure 2 plots the percentage of the estimated number of ED-treated, nonfatal drowning injuries as a function of the victim's age. Children younger than 1 year of age accounted for 2 percent of the estimated pool- or spa-related, nonfatal drowning injuries. Children between the ages of 1 and 3 years (12 to 47 months) comprised approximately 59 percent of the estimated number of children treated for pool- or spa-related, nonfatal drowning injuries. An additional 11 percent of the estimated childhood pool- or spa-related, nonfatal drowning injuries occurred in children 4 years of age (48 to 59 months). Children ages 5 to 9 and 10 to 14 accounted for 19 and 8 percent, respectively, of the estimated ED-treated pool or spa-related, nonfatal drowning injuries.

Figure 2
 Percent of Estimated ED-Treated Nonfatal Pool or Spa Drowning Injuries by Age
 Children Younger than 15 Years of Age, 2016-2018



Source: U.S. CPSC: NEISS.

Table 4 gives a breakdown of estimated submersion injuries by disposition. Children younger than 15 years of age were admitted to the hospital or treated and transferred to another hospital 39 percent of the time. For Dead on Arrival (DOA), or Died in Emergency Department percentages, drowning victims younger than 5 years comprised a majority of all child drownings (see Table 6). The deaths recorded in NEISS are also included in the fatality count in the section on reported fatalities. In contrast, for all consumer products in the CPSC’s jurisdiction, of those children treated or examined in an emergency department for a product-related injury, only 4 percent of children in the younger than 15 years of age category were either admitted to the hospital, or treated and transferred.

Table 4
Percent of Estimated ED-Treated Pool or Spa Submersion Injuries
Children Younger than 15 Years of Age by Disposition, 2016-2018

Disposition	Estimated Emergency Department-Treated Injury Percentages ⁸		
	Younger than 5 Years	5–14 Years	Younger than 15 Years
Examined or Treated and Released	52	58	54
Admitted to Hospital	31	25	29
Treated and Transferred	9	10	9
DOA or Died in Emergency Department	2	6	3
Held for Observation	4	1	3
Left Without Being Seen	2	0	1

Source: U.S. CPSC: NEISS. Appendix A details the methodology for data extraction.

⁸ Percentages may not add up to 100, due to rounding: In this table, 0 actually represents <0.5%.

Table 5 shows the percentages of the estimated number of injuries for each age group by the location of the submersion incident. Overall, 42 percent of the incidents involving injuries that led to emergency department visits occurred at a residence. Injured children younger than 5 years of age had the largest percentage (49%) of incidents in a residential location. For injured children 5 to 14 years of age, 36 percent of incidents occurred in public locations.

Table 5
Percent of Estimated ED-Treated Nonfatal Pool or Spa Drowning Injuries
Children Younger than 15 Years of Age by Location, 2016-2018

Location	Estimated Emergency Department-Treated Injury Percentages ⁹		
	Younger than 5 Years	5–14 Years	Younger than 15 Years
Residential	49	23	42
Undisclosed Location	30	42	33
Public	21	36	25

Source: U.S. CPSC: NEISS. Appendix A details the methodology for data extraction.

⁹ Percentages may not add up to 100, due to rounding.

Reported Fatalities

On average, 363 fatalities associated with pool or spa submersions involving children younger than 15 years of age were reported to CPSC staff annually from 2014 through 2016. The years for reported injury and fatality statistics differ due to the lag in fatality reporting.

Reported fatality frequencies by year and age category are shown in Table 6. Seventy-four percent of the victims of the reported pool- or spa-related, childhood submersion fatalities were younger than 5 years of age. As noted, victims in this age category also accounted for an average of 73 percent of the childhood submersion injuries related to pools or spas between 2016 and 2018. Cases in NEISS that were classified as DOA, or died in the ED, are included in fatality case counts for their respective years.

For the 1,071 reported drowning incidents from 2014 through 2016, there were 1,054 fatalities (98 percent of the incidents) that involved one victim; 15 incidents that involved two victims; one incident involved three victims; and one incident involved one victim who was included in the count, plus additional victims who were 15 years of age and older, and therefore, excluded from the counts.

The numbers of drownings related to pools or spas presented in this section are based on all incidents reported to CPSC staff. These numbers are considered minimum counts only derived from anecdotal data and cannot be used as generalized estimates for the U.S. population.

Table 6
Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 15 Years of Age, 2014-2016

Year ¹⁰	Reported Fatality Frequencies			
	Younger than 5 Years	5-9 Years	10-14 Years	Younger than 15 Years
Average ¹¹	269	65	29	363
2016	289	73	27	389
2015	262	62	24	348
2014	255	60	36	351
Totals 2014-2016	806	195	87	1088

Source: U.S. CPSC: CPSRMS. Appendix A details the methodology for data extraction.

Table 7 provides information on the interval between the submersion incident and the time of death for pool- or spa-related drownings. In some instances, a great deal of time may

¹⁰ Reporting is not considered complete for 2015 and 2016. The number of reported fatalities may change in the future.

¹¹ Row averages may not add to total, due to rounding.

lapse from the submersion incident to death. In a few cases, the lapse may be years. For most of the fatalities (75 percent), the date of death was either the same as the date of the incident, or 1 day later. However, 25 percent of the victims younger than 15 years of age succumbed days, weeks, and even years after the submersion, often after extensive medical treatment.

Table 7
Percentage of Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 15 Years of Age by Interval Between Injury and Death,¹² 2014-2016

Days Between Incident & Death	Percentage of Reported Fatalities¹³			
	Younger than 5 Years	5–9 Years	10–14 Years	Younger than 15 Years
0 days	67	67	53	66
1 day	9	7	10	9
2–7 days	17	19	22	18
8–31 days	5	5	11	5
> 31 days	2	2	3	2

Source: U.S. CPSC: CPRMS. Appendix A details the methodology for data extraction.

¹² Note that the age at time of death is used to determine the appropriate age category. In most cases, the difference between the date of incident and date of death is not sufficient to change the age category. There were 24 fatalities where the difference was more than 31 days.

¹³ Percentages may not add up to 100, due to rounding.

Reported drownings occurred predominantly in pools. A small number of drownings were associated with spas. Children younger than 5 years of age comprised almost all of the reported spa-related drownings. Table 8 records these percentages by product type.

Table 8
Percentage of Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 15 Years of Age by Product Type, 2014-2016

Product	Percentage of Reported Fatalities ¹⁴			
	Younger than 5 Years	5-9 Years	10-14 Years	Younger than 15 Years
Pool	96	99	100	97
Spa	4	1	-	3

Source: U.S. CPSC: CPSRMS. Appendix A details the methodology for data extraction.

Table 9 gives the percentages of pool or spa drownings by victim age and gender. For all age groups under age 15, there were more reported male submersion victims than reported female submersion victims. This is consistent with the injury data, which show that more male children were treated in emergency departments for pool- or spa-related submersion injuries.

Table 9
Percentage of Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 15 Years of Age by Gender, 2014-2016

Gender	Percentage of Reported Fatalities ¹⁵			
	Younger than 5 Years	5-9 Years	10-14 Years	Younger than 15 Years
Male	67	67	74	67
Female	33	32	26	33

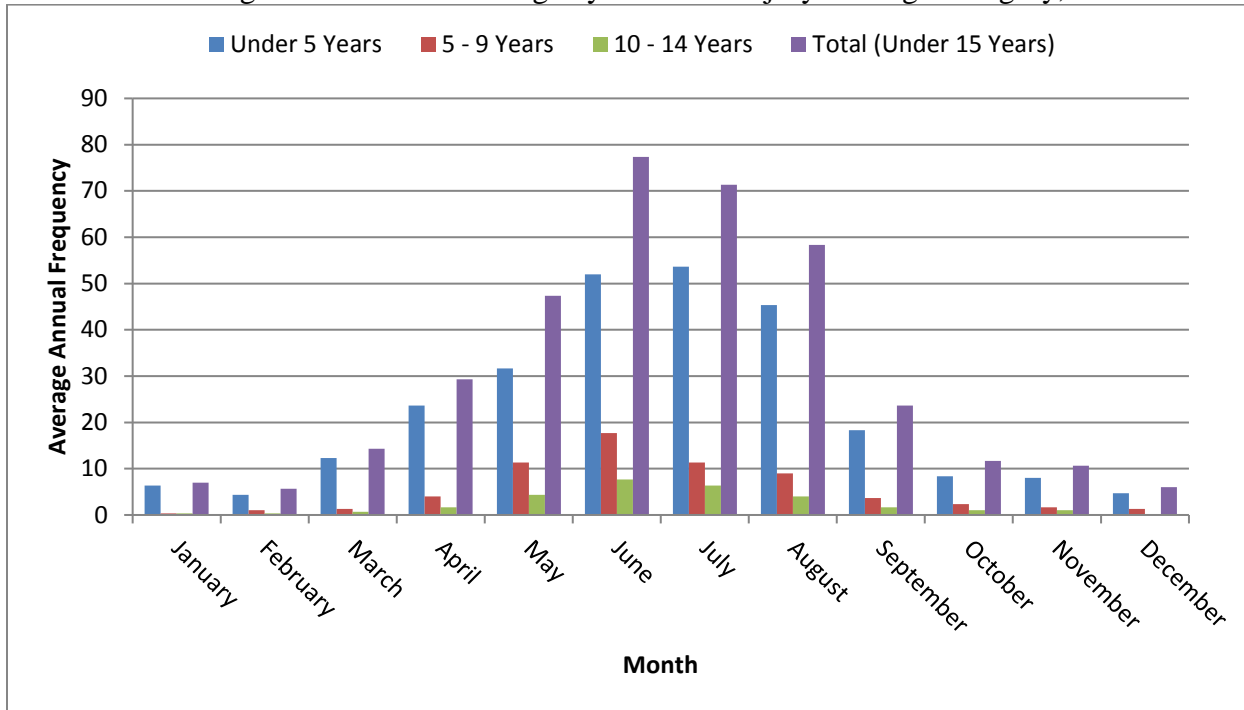
Source: U.S. CPSC: CPSRMS. System. Appendix A details the methodology for data extraction.

¹⁴ “-” denotes no data recorded.

¹⁵ Percentages may not add up to 100, due to rounding.

Figure 3 illustrates the monthly distribution of reported pool- or spa-related childhood drownings as a function of victim age. As expected, the summer months of May, June, July, and August had the largest annual frequencies for all age groups.

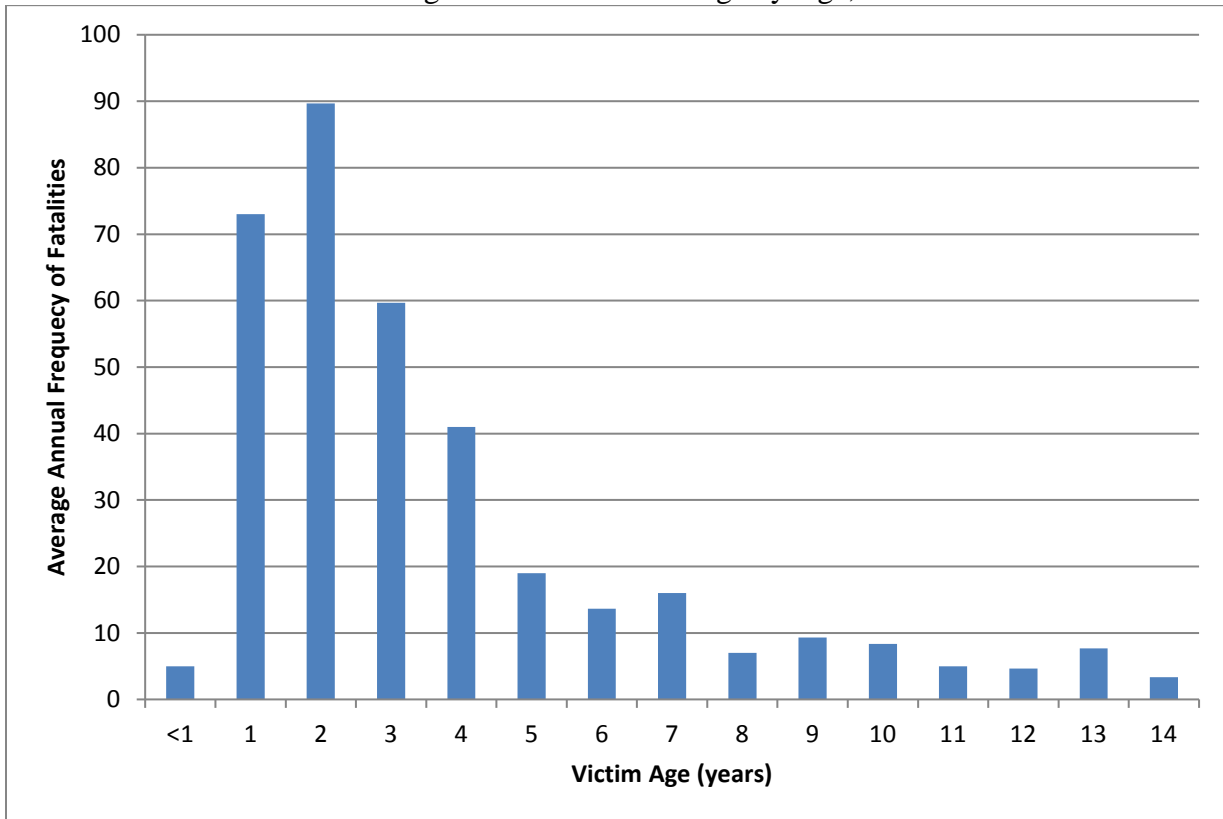
Figure 3
Average Annual Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 15 Years of Age by Month of Injury and Age Category, 2014-2016



Source: U.S. CPSC: CPRMS.

Figure 4 shows the annual average of reported pool or spa drownings in children younger than 15 years old as a frequency distribution of the victim's age. Children between the ages of 1 and 3 years (12 to 47 months) comprised approximately 61 percent of the reported pool or spa submersion fatalities. The graph shows a sharp decrease after age 2 (less than or equal to 35 months).

Figure 4
Average Annual Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 15 Years of Age by Age, 2014-2016



Source: U.S. CPSC: CPRMS.

Table 10 records the percentages of reported pool or spa drownings by incident location. The majority of reported deaths (72 percent for pools or spas) occurred in residential settings, such as the victim’s home, a family or friend’s house, or a neighbor’s residence. The victim’s home accounts for the largest percentage (46 percent) for all location categories for victims younger than 15 years of age. For children 5 to 9 years of age and children 10 to 14 years of age, the public/community/business location accounted for the largest percentage of reported drownings.

Table 10
Percentage of Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 15 Years of Age by Incident Location, 2014-2016

Location	Percentage of Reported Fatalities ¹⁶			
	Younger than 5 Years	5–9 Years	10–14 Years	Younger than 15 Years
Home	54	25	15	46
Family/ Friend	23	9	6	19
Public/ Community/ Business¹⁷	12	43	56	21
Undisclosed Location	4	14	16	7
Neighbor	7	9	7	7

Source: U.S. CPSC: CPSRMS. Appendix A details the methodology for data extraction.

¹⁶ Percentages may not add up to 100, due to rounding.

¹⁷ Condominium and apartment complex pools are included in this category.

Table 11 presents the percentages of reported drownings by pool/spa type. The in-ground product type accounted for the largest percentage of known pool/spa types (53 percent for victims younger than 15). This was followed by the above-ground pool category and portable pool category for cases where pool/spa type was known.

Table 11
Percentage of Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 15 Years of Age by Specific Pool/Spa Type Product Category,
2014-2016

Location	Percentage of Reported Fatalities ¹⁸			
	Younger than 5 Years	5–9 Years	10–14 Years	Younger than 15 Years
In-Ground (Pool Only)	51	58	66	53
Undisclosed Pool/Spa Type	14	38	30	20
Above-Ground (Pool Only)	25	3	3	19
Portable ¹⁹ (Pool Only)	6	-	1	5
Inside Home (Spa Only)	0	1	-	0
Outside Home (Spa Only)	4	-	-	3

Source: U.S. CPSC: CPSRMS. Appendix A details the methodology for data extraction.

¹⁸ Percentages may not add up to 100 due to rounding: In this table, 0 actually represents <0.5%, “-” denotes no data recorded.

¹⁹ A “portable pool” is defined as any pool that can be set up/taken down or moved to another location with relative ease.

Because the majority of reported drowning victims were younger than 5 years of age, the incident reports from 2014 through 2016 were evaluated, and common scenarios for children younger than 5 years of age for pools or spas (806 reported drownings) were classified. The highest percentage of the reports (59 percent) attributed the incident to a gap in adult supervision (an adult losing contact or knowledge of the whereabouts of the child and, during this time period, the child managed to access the pool/spa). Eight percent of the reports indicated barrier compromise or circumvention. Another common scenario—17 percent of the reports—involved observation of the victim in close proximity to the pool/spa, with the victim last seen in the pool/spa, or near the pool/spa, before the incident occurred. In 16 percent of the reports, there was too little information available to determine the scenario. The scenarios are categorized in Table 12. Hazard scenarios for older children are not characterized because CPSC staff receives fewer reports of drownings involving this age group.

Table 12
Percentage of Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 5 Years of Age by Scenario, 2014-2016

Scenario	Percentage of Reported Fatalities for Pools and Spas
Lost Contact or Knowledge of Whereabouts	59
Not Enough Information to Determine Scenario	16
Barrier Integrity or Circumvented Barrier	8
Observed Near Pool/Spa or In Pool/Spa Prior to Incident	17

Source: U.S. CPSC: CPSRMS. Appendix A details the methodology for data extraction.

Appendix A
Methodology for Pool or Spa Submersion:
Estimated Nonfatal Drowning Injuries and Reported Drownings (2019)

“Drowning” is defined as suffocation and death resulting from filling of the lungs with water or other substances or fluid, so that gas exchange becomes impossible. A “nonfatal drowning” is defined as survival for any length of time after submersion in water and temporary suffocation. “Submersion” is defined as the act of placing or the condition of being under the surface of a liquid.²⁰

Injury estimates came from NEISS data extracted on May 7, 2019, for calendar year 2018. The NEISS product codes used for the data were 3251 (Built-in pools), 3221 (Above-ground pools), 5043 (Portable pools), 1284 (Pools, not specified), 3274 (Swimming, activity) and 698 (Hot tubs and Spas). Diagnoses codes of 69 (Submersions), 65 (Anoxia), and 42 (Aspirated on) were also used, along with the age constraint of “children younger than 15 years of age,” to restrict the extracted data. Cases involving the activity of swimming were reviewed for potential inclusion in the data set. NEISS data from 2016 and 2017 were also used from last year’s report to cover the 2016 through 2018 timeframe. NEISS data is from a probability-based sample. Sampling weights are used to project the cases from NEISS hospitals to national estimates. Because incidents in NEISS are unique, there were no duplicates.

The estimated numbers of emergency department-treated injuries are rounded to the nearest hundred. Percentages in this report are rounded to the nearest integer. Because NEISS is a weighted sample, injury category percentages were based on the category weighted estimate (not rounded), divided by the total weighted estimate (not rounded).

Data were extracted on March 29, 2019, from CPSC’s Consumer Product Safety Risk Management System (CPSRMS), for pool- or spa-related submersion deaths involving children younger than 15 years of age for the years 2014 to 2016. These data were merged with data from last year’s report for 2014 and 2015, to cover the 2014 through 2016, reporting period. It should be noted that for a given year, date of death was used to determine the appropriate year category, and incidents are included on an ongoing basis. In particular, additional reports for several prior reported years are generally received during the most recent years.

Fatal incidents associated with product codes 3251 (Built-in pools), 3221 (Above-ground pools), 5043 (Portable pools), 1284 (Pools, not specified), 3274 (Swimming, activity), and 698 (Hot tubs and Spas) were examined for inclusion in counts. Information from these cases was extracted into an Excel spreadsheet and sorted by date and incident location. CPSRMS contains various types of submitted voluntary information, including reports from consumers through the public-facing component SaferProducts.gov, newspaper clippings, state/local authorities, medical examiners, advocacy groups, as well as national death certificates, so staff cannot be sure that information on all the deaths has been received. Since pool drowning incidents are notable events in the community where they occur, there were often multiple news reports, a medical examiner’s report, a death certificate, an in-depth investigation, and less frequently, a

²⁰ *Dorland’s Illustrated Medical Dictionary*, 30th Edition, Saunders, 2003.

hospital emergency department report (NEISS) for a single incident. As a result, source documents were checked to eliminate duplicate incident reports.