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Pool or Spa Submersion: Estimated Nonfatal Drowning Injuries and Reported Drownings, 2018 Report

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

Executive Summary

- This report presents annual estimates of the number of emergency department-treated, pool- or spa[1]-related, nonfatal drownings (submersion injuries[2]) between 2015 and 2017, and it presents counts of reported pool- or spa-related drownings (submersion fatalities[3]) between 2013 and 2015 for children younger than 15 years of age. The subset of submersion injuries and fatalities involving children younger than 5 years of age is also provided. Please note that circulation/suction entrapments in pools or spas are presented in a separate document.[4] It is also important to note that 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. The period for reported injury and fatality statistics differs due to the lag in fatality reporting. Parents, caregivers, pool operators, state and local officials, and the media are encouraged to visit PoolSafely.gov for vital safety information regarding the prevention of child drownings and drain entrapments in and around pools and spas.

Key findings:

- There were, on average, an estimated 6,400 pool- or spa-related, hospital emergency department (ED)-treated nonfatal drowning injuries each year for 2015 through 2017, and 351 pool- or spa-related drownings reported per year for 2013 through 2015 involving children younger than 15 years of age.

- The majority of the estimated ED-treated, nonfatal drowning injuries for 2015 through 2017, and the reported drownings for 2013 through 2015, were associated with pools (versus spas).

- Annual estimates of the number of children who were treated in hospital emergency departments for pool- or spa-related nonfatal drowning injuries in 2017 were not statistically different from those in 2016.

- For children younger than 15 years of age, there were more than twice as many reported drownings involving male victims than reported drownings involving female victims.

- Seventy-six percent of the reported drownings from 2013 through 2015, and an annual average of 73 percent of the ED-treated nonfatal drowning injuries from 2015 through 2017, involved children younger than 5 years of age.

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[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.
[4] 2013–2017, "Reported Circulation/Suction Entrapment Incidents Associated with Pools, Spas, and Whirlpool Bathtubs, 2018 Report," May 2018.

- Children between the ages of 1 and 3 (12 months through 47 months) represented 60 percent of estimated nonfatal drowning injuries for 2015 through 2017, and that age group represented 63 percent of the reported drownings for 2013 through 2015, for victims younger than 15 years. According to the U.S. Census Bureau, the proportion of the population of children between the ages of 1 and 3 was 20 percent of the population under the age of 15, for each year from 2013 to 2017.[5]

- For children younger than 15 years old, 38 percent of the victims of estimated ED-treated pool or spa submersion injuries for 2015 through 2017, 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.

- Forty-five percent of the estimated nonfatal drowning injuries for 2015 through 2017, and 74 percent of the reported drownings for 2013 through 2015, involving children younger than 15 years old, occurred at a residence.

- Residential locations dominated reported incidents involving victims younger than 5 years of age (54 percent for nonfatal drowning injuries from 2015 through 2017, and 85 percent for drownings from 2013 through 2015).

- Most reported fatalities from drowning occurred on the day of (67 percent) or within a week of (additional 27 percent) the incident. Only 6 percent of fatal victims younger than 15 survived beyond a week of the incident, and these victims had severe injuries and required intensive medical care before death.

- Approximately 54 percent of reported drownings (annual average of 190) occurred in in-ground pools. Above-ground pools accounted for 19 percent (annual average of 66), with portable pools accounting for 4 percent (annual average of 14) for children younger than 15 years of age.

[5] Based on Estimates of the resident population by single year of age and sex for the United States: April 1, 2010 to December 1, 2017, from the U.S. Census Bureau at: https://www.census.gov/data/tables/2017/demo/popest/nation-detail.html.

Emergency Department-Treated Injury Estimates

For 2015 through 2017, an estimated annual average of 6,400 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.[6] 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 2014 through 2016 are 5,900 children younger than 15 years of age and 4,400 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 Emergency Department-Treated Pool or Spa Nonfatal Drowning Injuries
Children Younger than 15 Years of Age, 2015-2017

Year	Estimated Emergency Department-Treated Injuries[7]		
	Younger than 5 Years	5-14 Years	Younger than 15 Years
Average	4,700	1,800	6,400
2017	5,300	2,000	7,300
2016	4,200	1,800	6,000
2015	4,600	1,500	6,000

Source: U.S. Consumer Product Safety Commission: National Electronic Injury Surveillance System. Appendix A details the methodology for data extraction.

The 2017 estimates of children younger than 15 years of age and children younger than 5 years of age who were treated in U.S. hospital emergency departments for pool- or spa-related nonfatal drownings are not statistically different from the 2016 estimates. On average, during 2015 through 2017, 73 percent of children treated in emergency departments 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 76, 70, and 72 percent of the childhood pool- or spa- related treated injuries in 2015, 2016, and 2017, respectively.

[6] Estimates for children under age 5 and ages 5 to 14 may not sum to the under age 15 total due to rounding.
[7] The estimates are rounded to the nearest hundred.

Table 2 shows the percent of estimates for 2015 through 2017, 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 4 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 Emergency Department-Treated Pool or Spa Nonfatal Drowning Injuries
Children Younger than 15 Years of Age by Product Type, 2015-2017

Product Type	Emergency Department-Treated Injury Percentages		
	Younger than 5 Years	5-14 Years	Younger than 15 Years
Pool	96	100	97
Spa	4	0	3

Source: U.S. Consumer Product Safety Commission: National Electronic Injury Surveillance System. 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.

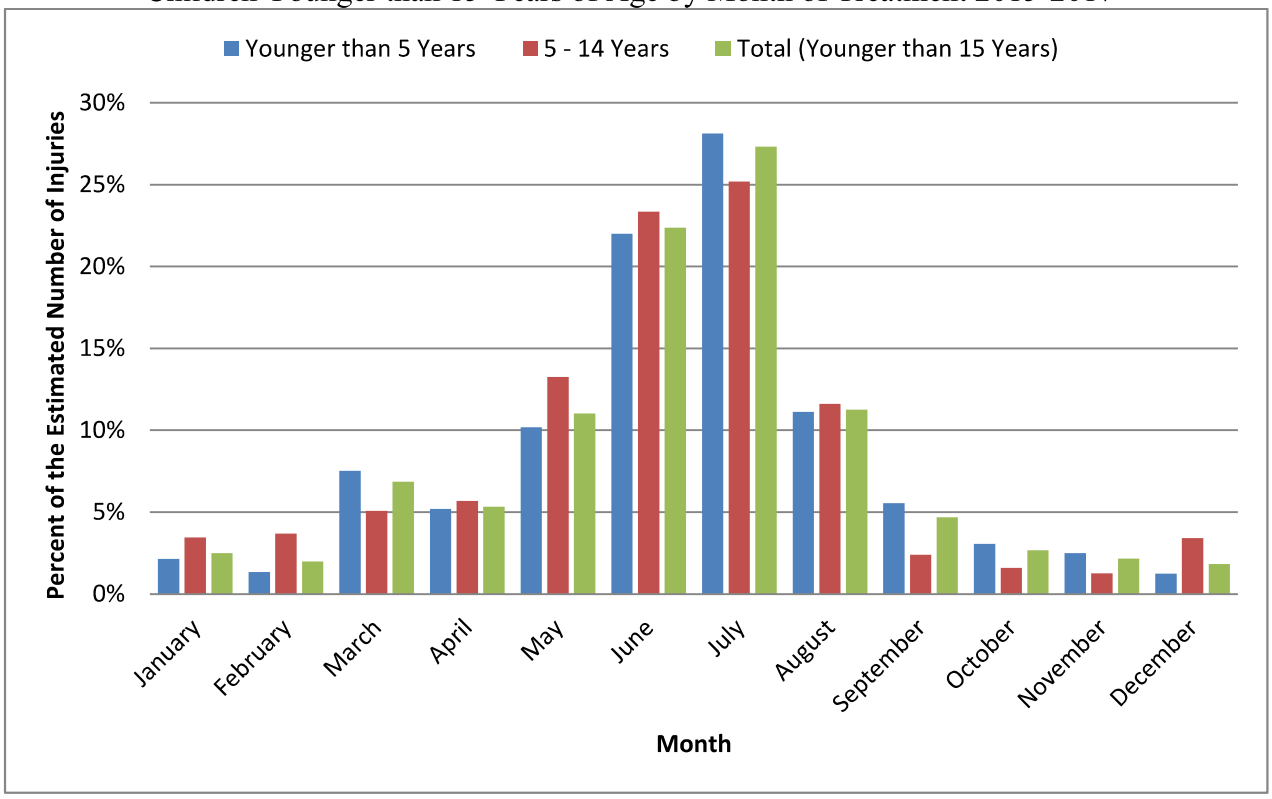
Table 3
Percent of Estimated Emergency Department-Treated Pool or Spa Nonfatal Drowning Injuries
Children Younger than 15 Years of Age by Gender, 2015-2017

Gender	Estimated Emergency Department-Treated Injury Percentages		
	Younger than 5 Years	5-14 Years	Younger than 15 Years
Male	60	74	64
Female	40	26	36

Source: U.S. Consumer Product Safety Commission: National Electronic Injury Surveillance System. Appendix A details the methodology for data extraction.

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.

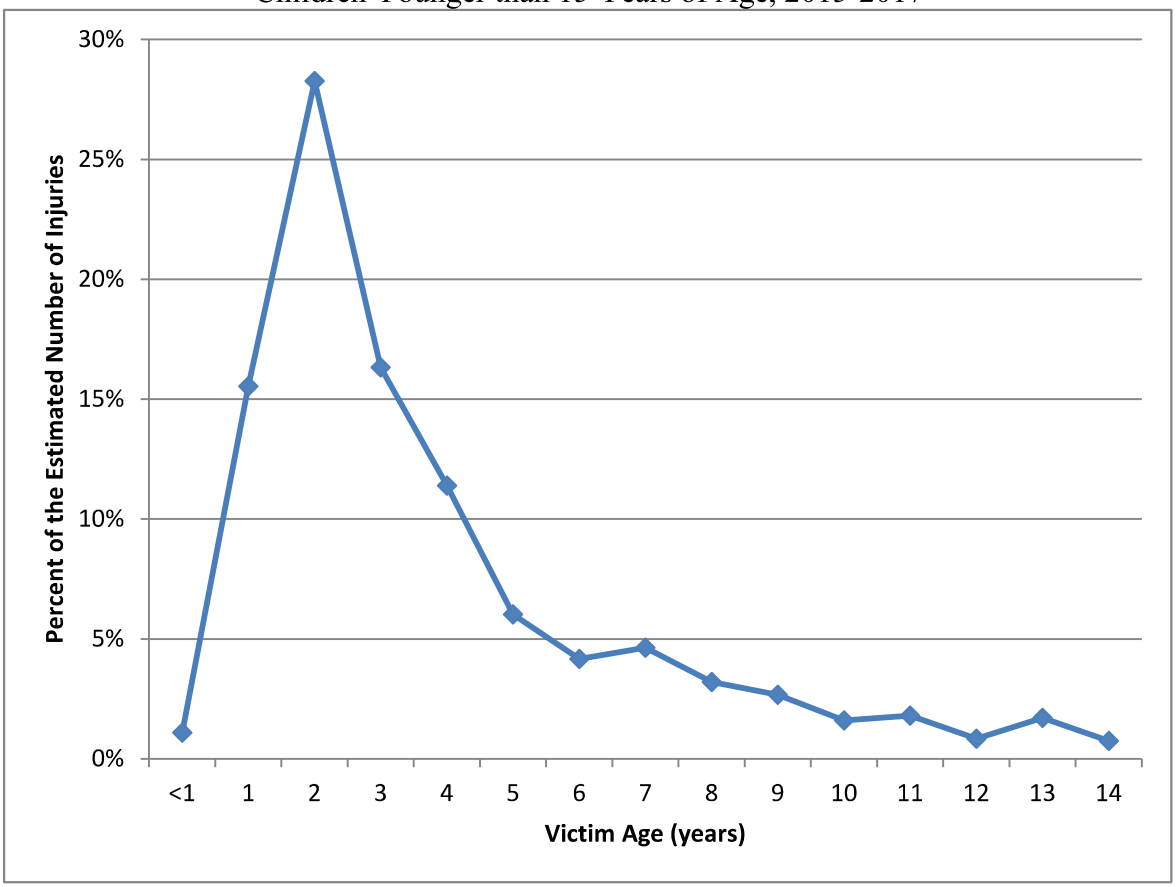
Figure 1
Percent of Estimated Emergency Department-Treated Pool or Spa Nonfatal Drowning Injuries
Children Younger than 15 Years of Age by Month of Treatment 2015-2017



Source: U.S. Consumer Product Safety Commission: National Electronic Injury Surveillance System.

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 1 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 60 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 21 and 7 percent, respectively, of the estimated ED-treated pool or spa-related, nonfatal drowning injuries.

Figure 2
Percent of Estimated Emergency Department-Treated Nonfatal Drowning Injuries by Age
Children Younger than 15 Years of Age, 2015-2017



Source: U.S. Consumer Product Safety Commission: National Electronic Injury Surveillance System.

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 38 percent of the time. For *Dead on Arrival (DOA), or died in the emergency department* percentages, drowning victims younger than 5 years comprised a majority of all child drownings. 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 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 Emergency Department-Treated Pool or Spa Submersion Injuries
Children Younger than 15 Years of Age by Disposition, 2015-2017

Disposition	Estimated Emergency Department-Treated Injury Percentages[8]		
	Younger than 5 Years	5–14 Years	Younger than 15 Years
Examined or Treated and Released	56	54	56
Admitted to Hospital	31	31	31
Treated and Transferred	6	11	7
DOA or Died in Emergency Department	4	4	4
Held for Observation	3	0	2
Left Without Being Seen	1	-	1

Source: U.S. Consumer Product Safety Commission: National Electronic Injury Surveillance System. Appendix A details the methodology for data extraction.

[8] Percentages may not add up to 100 due to rounding.

Table 5 shows the percentages of the estimated number of injuries for each age group by the type of location of the submersion incident. Overall, 45 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 (54%) of incidents in a residential location. For injured children 5 to 14 years of age, 38 percent of incidents occurred in public locations.

Table 5
Percent of Estimated Emergency Department-Treated Pool or Spa Nonfatal Drowning Injuries
Children Younger than 15 Years of Age by Location, 2015-2017

Location	Estimated Emergency Department-Treated Injury Percentages[9]		
	Younger than 5 Years	5–14 Years	Younger than 15 Years
Residential	54	22	45
Undisclosed Location	27	40	31
Public	19	38	24

Source: U.S. Consumer Product Safety Commission: National Electronic Injury Surveillance System. Appendix A details the methodology for data extraction.

[9] Percentages may not add up to 100 due to rounding.

Reported Fatalities

On average, 351 fatalities associated with pool or spa submersions involving children younger than 15 years of age were reported to CPSC staff annually from 2013 through 2015. The years for reported injury and fatality statistics differ as a result of the lag in fatality reporting.

Reported fatality frequencies by year and age category are shown in Table 6. Seventy-six percent of the victims of the reported pool- or spa-related, childhood submersion fatalities were younger than 5 years of age. As noted previously, victims in this age category also accounted for an average of 73 percent of the childhood submersion injuries related to pools or spas between 2015 and 2017. Cases in NEISS that were classified as DOA or died in the ED are also included in fatality case counts for their respective years.

For the 1,038 reported drowning incidents from 2013 through 2015, there were 1,022 fatalities (98 percent of the incidents) that involved one victim; 13 incidents that involved two victims; 1 incident that involved three victims; and two incidents that 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, 2013-2015

Year[10]	Reported Fatality Frequencies			
	Younger than 5 Years	5–9 Years	10–14 Years	Younger than 15 Years[11]
Average[12]	266	57	27	351
2015	261	62	23	347
2014	254	60	35	349
2013	284	49	24	357
Totals 2013-2015	799	171	82	1053

Source: CPSC databases including NEISS, IPII, DTHS, and INDP. Appendix A details the methodology for data extraction.

[10] Reporting is not considered complete for 2014 and 2015. The number of reported fatalities may change in the future.
[11] This category includes one case in 2015, where the victim's unknown age is inferred to be under 15 years of age.
[12] Row averages may not add to total due to rounding.

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 lapse between the submersion incident and 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,[13] 2013-2015

Days Between Incident & Death	Percentage of Reported Fatalities[14]			
	Younger than 5 Years	5–9 Years	10–14 Years	Younger than 15 Years
0 days	67	70	56	67
1 day	9	9	10	9
2–7 days	17	15	28	18
8–31 days	4	5	5	4
> 31 days	3	1	1	2

Source: CPSC databases, including NEISS, IPII, DTHS, and INDP. Appendix A details the methodology for data extraction.

[13] 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 23 fatalities where the difference was more than 31 days.
[14] 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, 2013-2015

Product	Percentage of Reported Fatalities			
	Younger than 5 Years	5–9 Years	10–14 Years	Younger than 15 Years
Pool	95	99	100	96
Spa	5	1	-	4

Source: CPSC databases, including NEISS, IPII, DTHS, and INDP. 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 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, 2013-2015

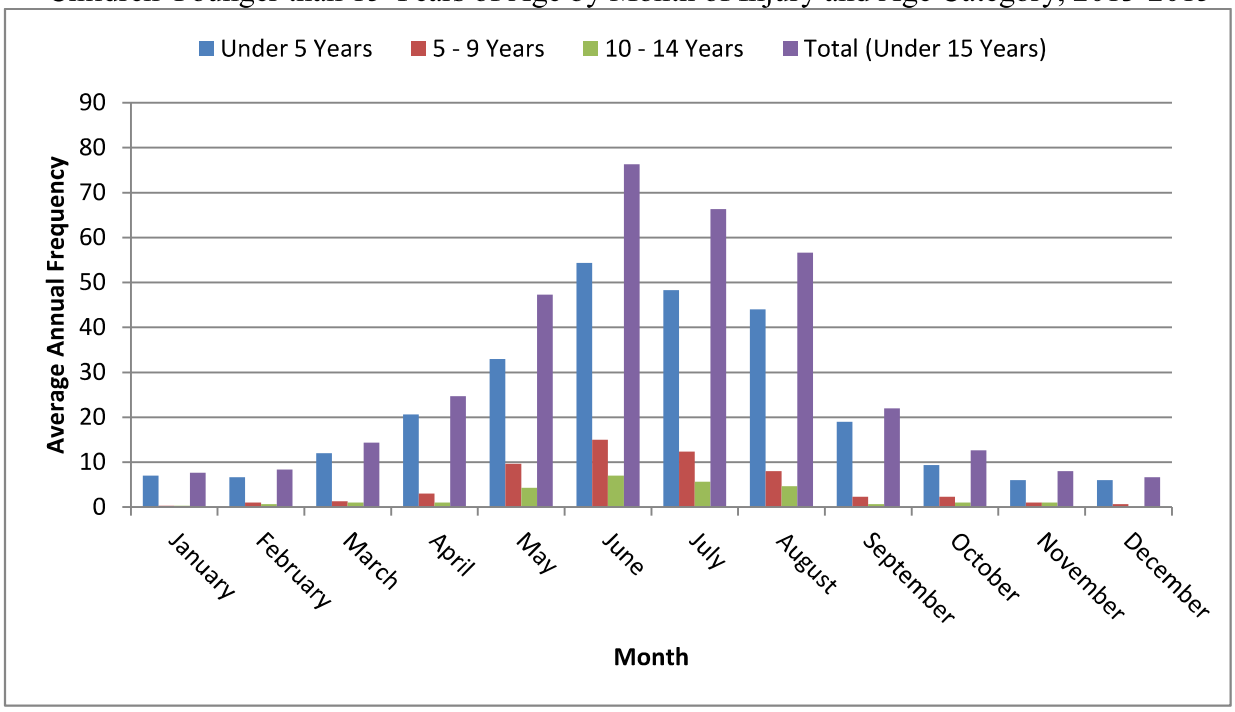
Gender	Percentage of Reported Fatalities[15]			
	Younger than 5 Years	5–9 Years	10–14 Years	Younger than 15 Years
Male	67	72	78	69
Female	33	27	22	31

Source: CPSC databases, including NEISS, IPII, DTHS, and INDP. Appendix A details the methodology for data extraction.

[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.

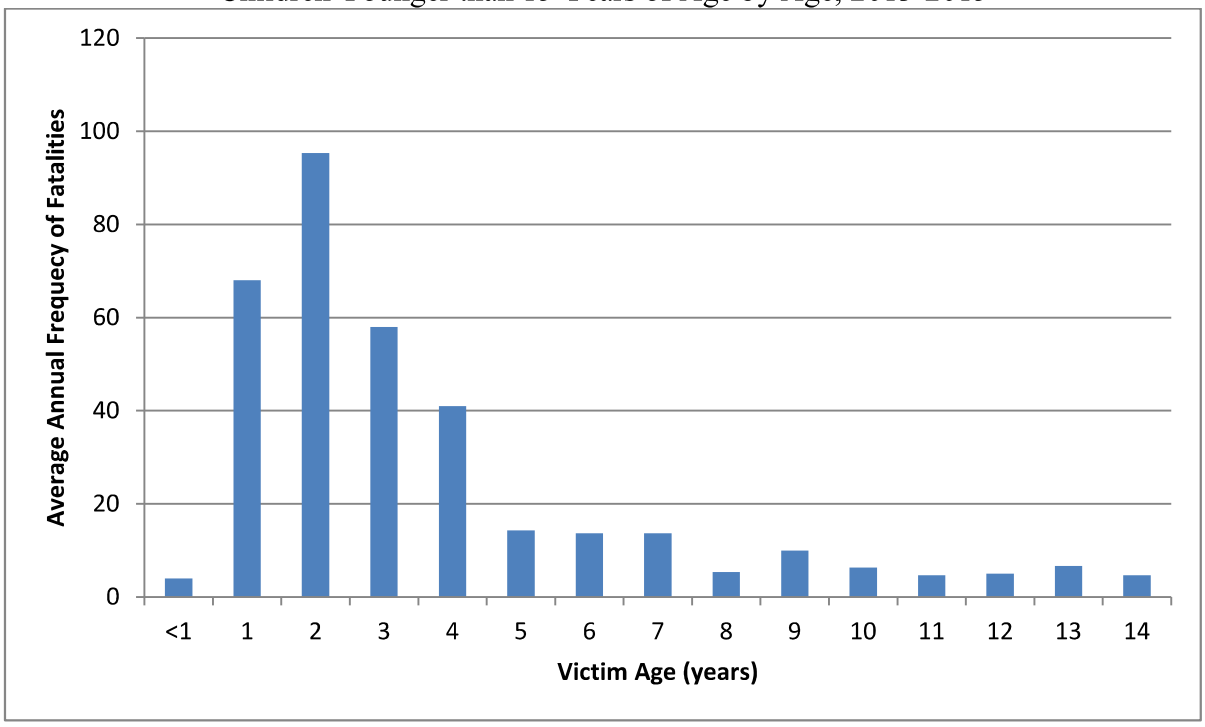
Figure 3
Average Annual Drowning Deaths Reported to CPSC Staff Associated with Pools or Spas
Children Younger than 15 Years of Age by Month of Injury and Age Category, 2013-2015



Source: CPSC databases, including NEISS, IPII, DTHS, and INDP.

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 63 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, 2013-2015



Source: CPSC databases, including NEISS, IPII, DTHS, and INDP.

Table 10 records the percentages of reported pool or spa drownings by incident location. The majority of reported deaths (74 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 (50 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, 2013-2015

Location	Percentage of Reported Fatalities[16]			
	Younger than 5 Years	5–9 Years	10–14 Years	Younger than 15 Years
Home	58	25	20	50
Family/ Friend	21	9	5	18
Public/ Community/ Business[17]	11	43	59	20
Undisclosed Location	4	16	13	6
Neighbor	6	6	4	6

Source: CPSC databases, including NEISS, IPII, DTHS, and INDP. 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 (54 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,
2013-2015

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	62	67	54
Undisclosed Pool/Spa Type	15	36	26	19
Above-Ground (Pool Only)	24	2	5	19
Portable[19] (Pool Only)	5	-	2	4
Inside Home (Spa Only)	1	1	-	1
Outside Home (Spa Only)	4	-	-	3

Source: CPSC databases, including NEISS, IPII, DTHS, and INDP. Appendix A details the methodology for data extraction.

[18] Percentages may not add up to 100 due to rounding.
[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 2013 through 2015 were evaluated, and common scenarios for children younger than 5 years of age for pools or spas (799 reported drownings) were classified. The highest percentage of the reports (62 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). Ten percent of the reports indicated barrier compromise or circumvention. Another common scenario—13 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 15 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, 2013-2015

Scenario	Percentage of Reported Fatalities for Pools and Spas
Lost Contact or Knowledge of Whereabouts	62
Not Enough Information to Determine Scenario	15
Barrier Integrity or Circumvented Barrier	10
Observed Near Pool/Spa or In Pool/Spa Prior to Incident	13

Source: CPSC databases, including NEISS, IPII, DTHS, and INDP. Appendix A details the methodology for data extraction.

Appendix A

Methodology for Pool or Spa Submersion:
Estimated Nonfatal Drowning Injuries and Reported Drownings (2018)

"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 "non-fatal 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 April 2, 2018, for calendar year 2017. 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 2015 and 2016 were also used from last year's report to cover the 2015 through 2017 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 16, 2018, from NEISS, IPII, DTHS and INDP for pool- or spa-related submersion deaths involving children younger than 15 years of age for the years 2013 to 2015. These data were merged with data from last year's report for 2013 and 2014, to cover the 2013 through 2015 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 for IPII and DTHS. In particular, additional reports for prior reported years are generally received for 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. As pool submersion incidents are notable events in the community where they occur, there were often multiple news reports (IPII), a medical examiner's report (IPII), a death certificate (DTHS), an in-depth investigation (INDP), and less frequently, a hospital emergency department report (NEISS) for a single incident. IPII is a mixture of various types of information, including newspaper clippings, consumer complaints, and reports from other government agencies, such as medical examiners/coroners. Information is submitted voluntarily to IPII, so staff cannot be sure that information on all the deaths has been received. Source documents were checked to eliminate duplicate incident reports.

[20] *Dorland's Illustrated Medical Dictionary*, 30th Edition, Saunders, 2003.