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Pool or Spa Submersion: Estimated Injuries and Reported Fatalities, 2012 Report

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Executive Summary

This report presents estimates of the number of pool- or spa¹-related submersion² injuries between 2009 and 2011, and it presents counts of reported pool- or spa-related submersion fatalities involving children younger than 15 years of age between 2007 and 2009. The subset of submersion injuries and fatalities involving children younger than 5 years of age is also provided. Please note that injuries and fatalities associated with circulation/suction entrapments in pools or spas are presented in a separate document.³ It is 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.

Annual estimates for 2009 through 2011 and an average annual estimate of the number of emergency department-treated submersion injuries are presented. This is followed by a count of fatal submersions reported to CPSC staff for 2007 through 2009. The years for reported injury and fatality statistics differ as a result of the lag in fatality reporting.

Key findings include:

- There were, on average, an estimated 5,200 pool- or spa-related hospital emergency department (ED)-treated submersion injuries each year for 2009 through 2011, and 390 pool- or spa-related fatalities reported per year for 2007 through 2009, involving children younger than 15 years of age.
- Seventy-five percent of the reported fatalities and 79 percent of the ED-treated injuries involved children younger than 5 years of age.
- The majority of the estimated ED-treated submersion injuries for 2009 through 2011 and the reported fatalities for 2007 through 2009 were associated with pools.
- Children between the ages of 1 and 3 (12 months through 47 months) represented 66 percent of estimated injuries for 2009 through 2011 and 67 percent of the reported fatalities for 2007 through 2009 involving children younger than 15 years.
- For children younger than 15 years old, 47 percent of the victims of ED-treated pool or spa submersion injuries for 2009 through 2011 were admitted to the hospital or treated and transferred to another hospital, compared to 4 percent for all product-related, ED-treated injuries involving children younger than 15 years old during the same time period.
- Injured children younger than 5 years old were treated and released more frequently (49 percent) than injured children between the ages of 5 and 14 years old (29 percent). Forty-one percent of children between the ages of 5 and 14 were admitted to the hospital, compared to 32 percent of children younger than age 5.

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

² The term “submersion” is used in lieu of the term “drowning” to encompass a broader scope of incidents.

³ 1999–2011 “Reported Circulation/Suction Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs, 2012 Report,” May 2012.

- Approximately 51 percent of the estimated injuries for 2009 through 2011 and 73 percent of the fatalities for 2007 through 2009 involving children younger than 15 years old occurred at a residence.
- Residential locations dominated incidents involving victims younger than 5 years of age (54 percent for injuries and 85 percent for fatalities).
- Most reported fatalities occurred on the day of (71 percent) or within a week of (additional 24 percent) the submersion incident. Only 5 percent of fatal victims survived beyond a week of the submersion, and these victims had severe injuries and required intensive medical care.
- Approximately 58 percent of fatalities (annual average of 226) occurred in in-ground pools. Portable pools accounted for 10 percent of the reported fatalities (annual average of 40) to children younger than 15 years of age.
- Parents, caregivers, and the media are encouraged to visit www.PoolSafely.gov for vital safety information regarding the prevention of child submersions in and around pools and spas.

Emergency Department-Treated Injuries

For 2009 through 2011, an estimated annual average of 5,200 children younger than 15 years of age were treated in U.S. hospital emergency departments (EDs) for 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 but are not provided for injured children 5 to 14 years of age due to the estimate being very small.⁴ Injury estimates came from 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 2008 through 2010 are 5,100 children younger than 15 and 4,000 children younger than 5 years of age treated in hospital emergency departments for submersion injuries related to pools or spas.

Table 1
Estimated Number of Emergency Department-Treated Pool or Spa Submersion Injuries
Children Younger than 5 and 15 Years of Age, 2009–2011

Year	Estimated Emergency Department-Treated Injuries ⁵	
	Younger than 5 Years	Younger than 15 Years
Average	4,100	5,200
2011	3,400	4,400
2010	4,400	5,600
2009	4,400	5,500

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

The 2011 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 submersion injuries are both marginally statistically different from the 2010 estimates.⁶ On average, during 2009 through 2011, 79 percent of children treated in emergency departments for pool- or spa-related submersion injuries were younger than 5 years of age. Children younger than 5 years of age comprised an estimated 80, 78, and 78 percent of the childhood pool- or spa-related treated injuries in 2009, 2010, and 2011, respectively.

⁴ Estimates less than 1,200 are not routinely reported.

⁵ The estimates are rounded to the nearest hundred.

⁶ The level of significance is 0.04 for younger than 15 years of age and younger than 5 years of age. The p-values are not corrected for multiple comparisons.

Table 2 shows the percent of estimates for 2009 through 2011 associated with pool or spa submersions by type of product. Spa-related submersions constitute 2 percent of the estimated number of treated injuries for children younger than 15 years of age, and 2 percent of the pool or spa submersion treated injuries for children younger than 5 years of age.

Table 2
Percent of Emergency Department-Treated Pool or Spa Submersion Injuries
Children Younger than 5 and 15 Years of Age by Product Type, 2009–2011

Product Type	Emergency Department-Treated Injury Percentages	
	Younger than 5 Years	Younger than 15 Years
Pool	98	98
Spa	2	2

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

Table 3 shows the percentage of the estimated number of pool- or spa-related submersion injuries by victim gender. Male children are more frequently treated for pool- or spa-related submersion 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.

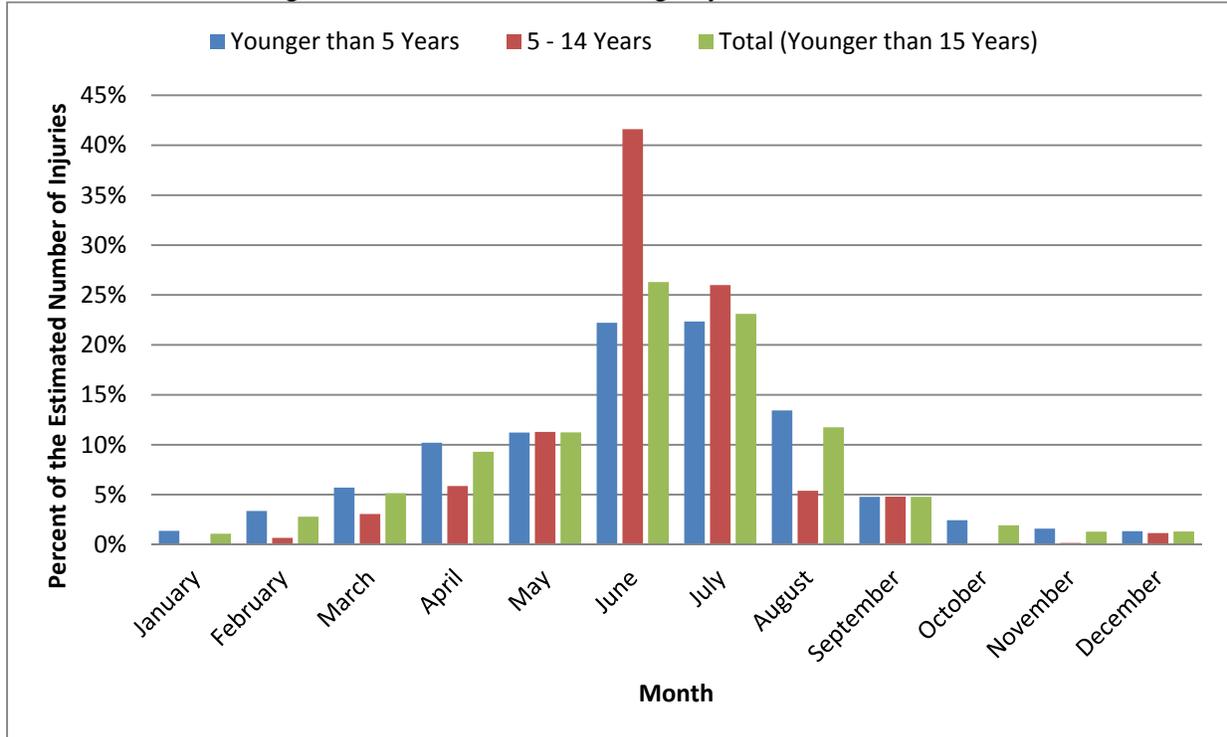
Table 3
Percent of Emergency Department-Treated Pool or Spa Submersion Injuries
Children Younger than 5 and 15 Years of Age by Gender, 2009–2011

Gender	Estimated Emergency Department-Treated Injury Percentages	
	Younger than 5 Years	Younger than 15 Years
Male	57	58
Female	43	42

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

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

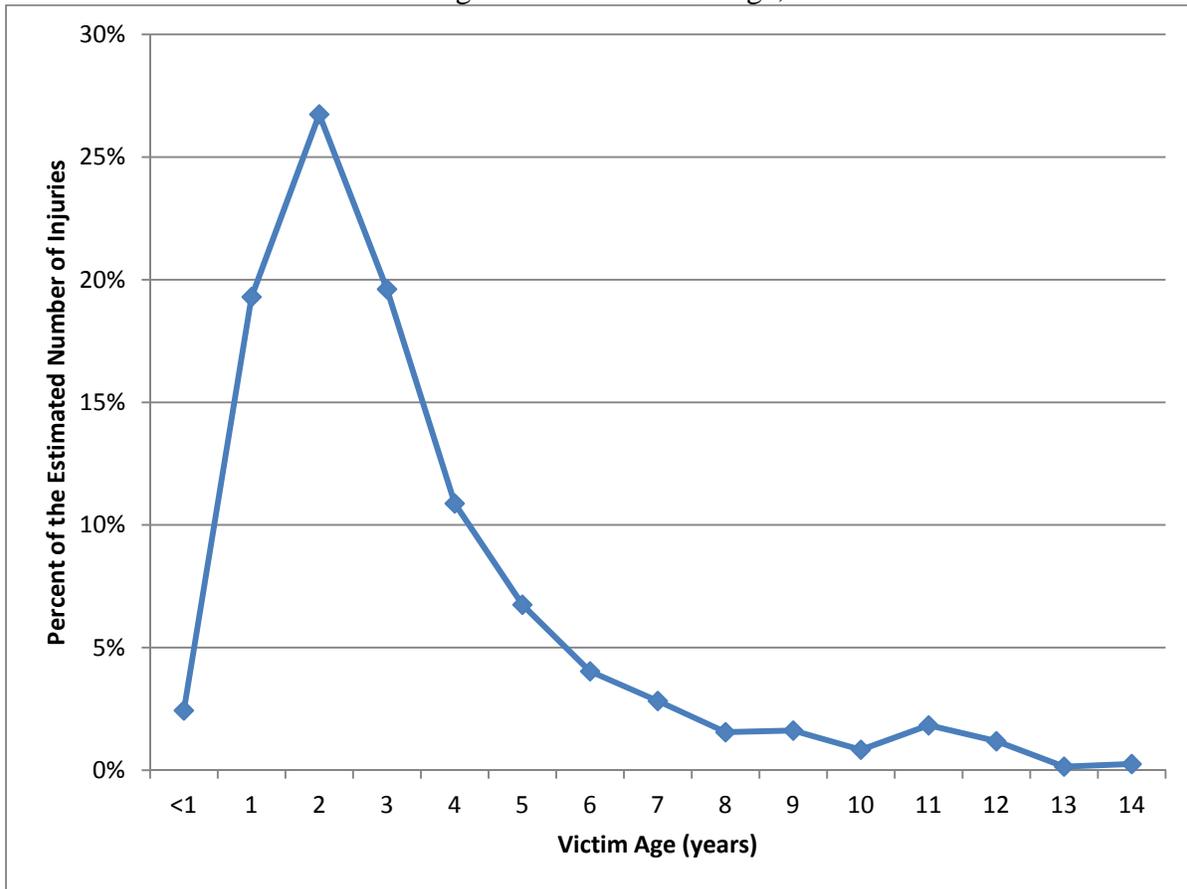
Figure 1
 Percent of Emergency Department-Treated Pool or Spa Submersion Injuries
 Children Younger than 5 and 15 Years of Age by Month of Treatment 2009–2011



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

Figure 2 plots the percent of the estimated number of ED-treated submersion 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 submersion injuries. Children between the ages of 1 and 3 years (12 to 47 months) comprised approximately 66 percent of the estimated number of children treated for pool- or spa-related submersion injuries. An additional 11 percent of the estimated childhood pool- or spa-related submersion injuries occurred in children 4 years of age (48 to 59 months). Children ages 5 to 9 and 10 to 14 accounted for 17 and 4 percent, respectively, of the estimated ED-treated pool or spa related submersion injuries.⁷

Figure 2
Percent of Emergency Department-Treated Submersion Injuries by Age
Children Younger than 15 Years of Age, 2008–2011



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

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

Table 4 gives a breakdown of submersion injuries by disposition. Injured children younger than 5 years had a higher percentage (49%) of the *examined/treated and released* disposition compared to children 5 to 14 years of age (29%). For *admitted to hospital and treated and transferred* dispositions, injured children younger than 5 years had a lower percentage (42%) compared to the percentage (65%) for children 5 to 14 years of age. *DOA or died in the emergency department* percentages are close for the two age groups. 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, only 4 percent of children in the younger than 5 and younger than 15 years of age categories treated or examined in an emergency department for a product-related injury were either admitted to the hospital or treated and transferred.

Table 4
Percent of Emergency Department-Treated Pool or Spa Submersion Injuries
Children Younger than 5 and 15 Years of Age by Disposition, 2009–2011

Disposition	Estimated Emergency Department-Treated Injury Percentages ⁸		
	Younger than 5 Years	5–14 Years	Total (Younger than 15 Years)
Examined or Treated and Released	49	29	45
Admitted to Hospital	32	41	34
Treated and Transferred	10	25	13
DOA or Died in Emergency Department	5	2	4
Held for Observation	3	3	3
Left Without Being Seen	1	1	1

Source: U. S. Consumer Product Safety Commission: National Electronic Injury Surveillance System (NEISS). 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, the majority of the incidents that led to these emergency department visits occurred at a residence. Injured children younger than 5 years of age had the largest percentage (54%) in a residential location. Children 5 to 14 years of age had the largest percentages split between residential (39%) and public locations (36%).

Table 5
Percent of Emergency Department-Treated Pool or Spa Submersion Injuries
Children Younger than 5 and 15 Years of Age by Location, 2009–2011

Location	Estimated Emergency Department-Treated Injury Percentages ⁹		
	Younger than 5 Years	5–14 Years	Total (Younger than 15 Years)
Residential	54	39	51
Undisclosed Location	32	25	31
Public	14	36	19

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

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

Reported Fatalities

On average, 390 fatalities associated with pool or spa submersions involving children younger than 15 years of age were reported to CPSC staff annually during the period from 2007 through 2009. The years for reported injury and fatality statistics differ as a result of the lag in fatality reporting. Reported frequencies by year and age category are shown in Table 6. Seventy-five percent of the victims of the reported pool- or spa-related childhood submersion fatalities were younger than 5 years of age. Victims in this age category also accounted for 79 percent of the childhood submersion injuries related to pools or spas. 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 1,169 reported submersion fatalities from 2007 through 2009, 1,149 or 98 percent of the incidents involved 1 victim; 8 incidents involved 2 victims; and 4 incidents involved 1 victim who was included in the count, plus additional victims who were older than 14 years of age and therefore excluded from the counts.

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

Table 6
Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
Children Younger than 15 Years of Age, 2007–2009

Year ¹⁰	Reported Fatality Frequencies			Total (Younger than 15 Years)
	Younger than 5 Years ¹¹	5–9 Years	10–14 Years	
Average	294	66	30	390
2009	299	61	25	385
2008	285	73	37	395
2007	298	63	28	389
Totals 2007-2009	882	197	90	1169

Source: CPSC databases including NEISS, IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). Appendix A details the methodology for data extraction.

¹⁰ Reporting is not considered complete for 2008 and 2009. The number of reported fatalities may change in the future.

¹¹ One case is included in this category where the age is unknown, but the term “toddler” was used to describe the victim.

Table 7 provides information on the interval between the submersion incident and the time of death for pool- or spa-related submersion fatalities. For most of the fatalities (82 percent), the date of death was either the same as the date of the incident or one day later. However, 18 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 Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
Children Younger than 15 Years of Age by Interval Between Injury and Death,¹² 2007–2009

Days Between Incident & Death	Percentage of Reported Fatalities¹³			Total (Younger than 15 Years)
	Younger than 5 Years	5–9 Years	10–14 Years	
0 days	72	71	59	71
1 day	10	14	12	11
2–7 days	12	12	23	13
8–31 days	4	2	1	3
> 31 days	1	2	4	2

Source: CPSC databases including NEISS, IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). 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 20 fatalities where the difference was more than 31 days.

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

Reported fatalities occurred predominantly in pools. A small number of fatalities were associated with spas. Children younger than 5 years of age comprised the largest percentage of reported spa-related submersion fatalities compared to the other age subcategories. Table 8 records these percentages by product type.

Table 8
Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
Children Younger than 15 Years of Age by Product Type, 2007–2009

Product	Percentage of Reported Fatalities			Total (Younger than 15 Years)
	Younger than 5 Years	5–9 Years	10–14 Years	
Pool	96	99	97	96
Spa	4	1	3	4

Source: CPSC databases including NEISS, IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). Appendix A details the methodology for data extraction.

Table 9 gives the estimated percentages of pool or spa submersion fatalities by victim age and gender. For all age groups, roughly two-thirds of victims were males. 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.

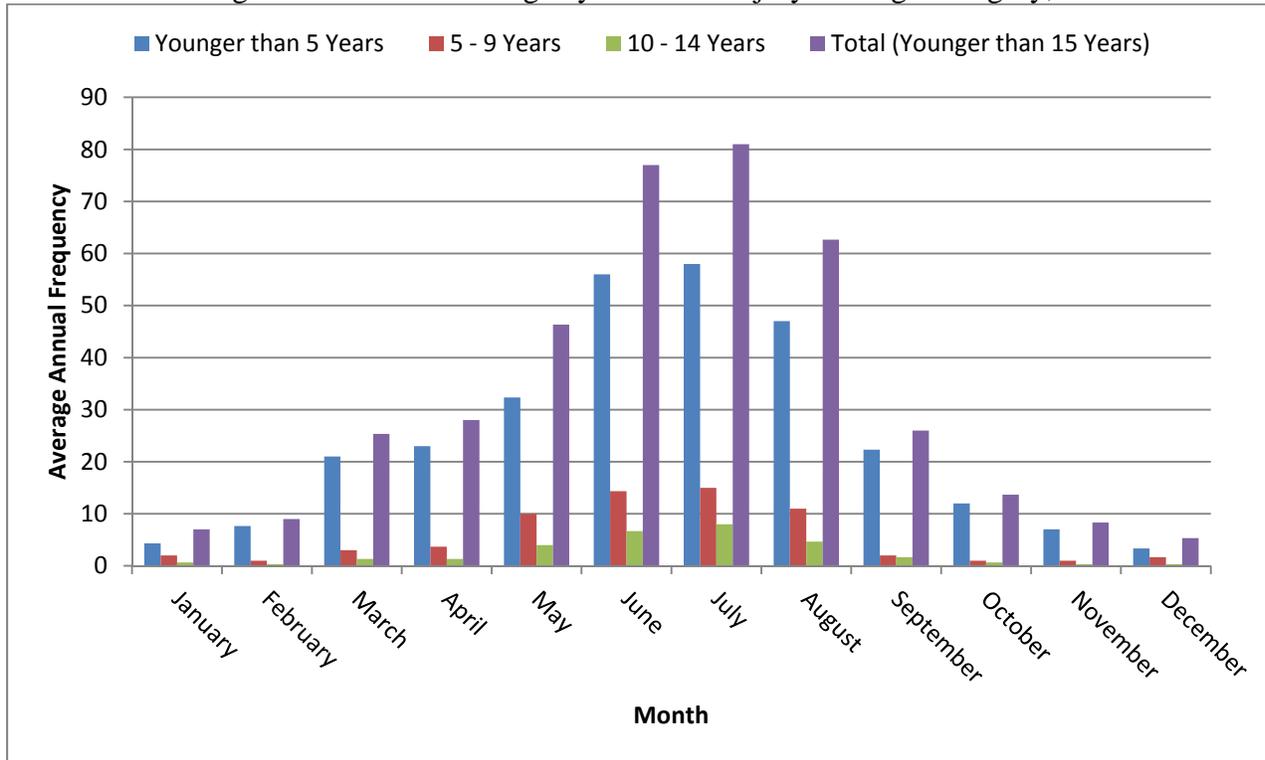
Table 9
Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersions
Children Younger than 15 Years of Age by Gender, 2007–2009

Gender	Percentage of Reported Fatalities			Total (Younger than 15 Years)
	Younger than 5 Years	5–9 Years	10–14 Years	
Male	67	66	61	66
Female	33	34	39	34

Source: CPSC databases including NEISS, IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). Appendix A details the methodology for data extraction.

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

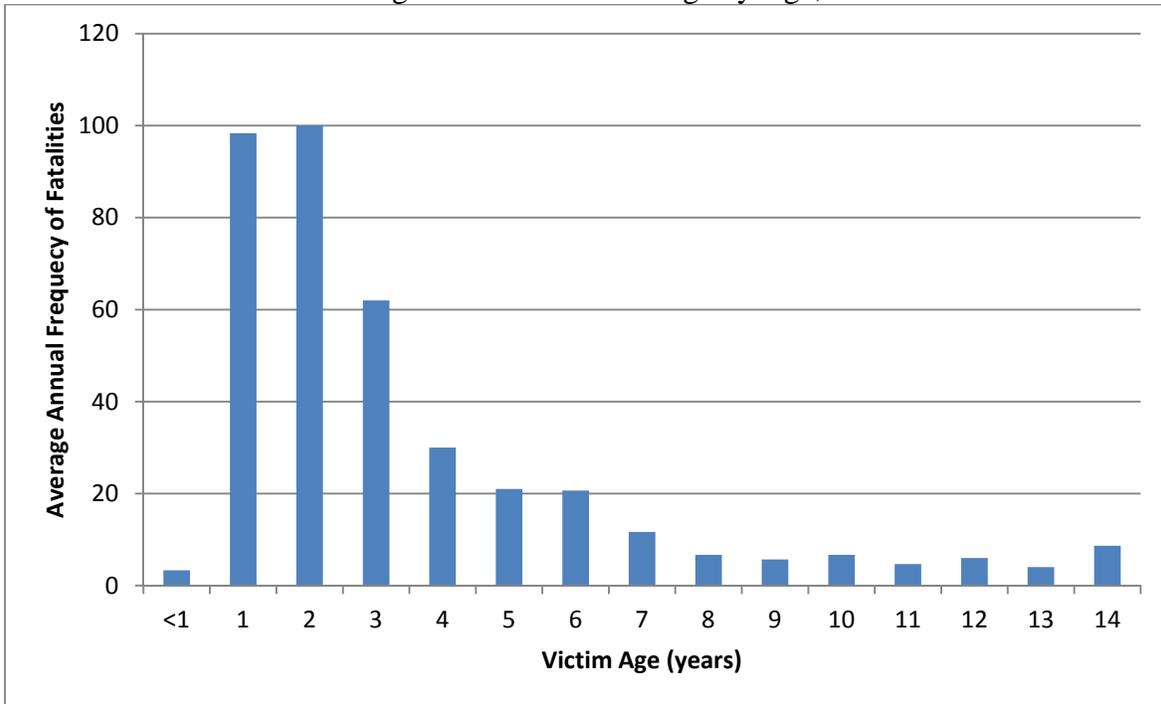
Figure 3
Average Annual Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion Children Younger than 15 Years of Age by Month of Injury and Age Category, 2007–2009



Source: CPSC databases including NEISS, IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). Appendix A details the methodology for data extraction.

Figure 4 shows the annual average of reported pool or spa submersion fatalities 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 67 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 Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
Children Younger than 15 Years of Age by Age, 2007–2009



Source: CPSC databases including NEISS, IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations).

Table 10 records the percentages of reported pool or spa fatalities by incident location. The majority of reported deaths (73 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 (44 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 submersion fatalities.

Table 10
Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
Children Younger than 15 Years of Age by Incident Location, 2007–2009

Location	Percentage of Reported Fatalities ¹⁴			Total (Younger than 15 Years)
	Younger than 5 Years	5–9 Years	10–14 Years	
Home	54	13	10	44
Family/ Friend	25	21	10	23
Public/ Community/ Business¹⁵	9	45	57	18
Undisclosed Location	6	16	19	9
Neighbor	6	6	4	6

Source: CPSC databases including NEISS, IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). Appendix A details the methodology for data extraction.

¹⁴ Percentages may not add up to 100 due to rounding.

¹⁵ Condominium and apartment complex pools are included in this category.

Table 11 presents the percentages of reported fatalities by pool/spa type. The in-ground product type accounted for the largest percentage of known pool/spa types (58 percent for victims younger than 15). This was followed by the above-ground pool category and portable pool category.

Table 11
 Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
 Children Younger than 15 Years of Age by Specific Pool/Spa Type Product Category,
 2007–2009

Location	Percentage of Reported Fatalities ¹⁶			Total (Younger than 15 Years)
	Younger than 5 Years	5–9 Years	10–14 Years	
In-Ground	58	59	61	58
Undisclosed Pool/Spa Type	10	37	34	16
Above- Ground (Pools Only)	17	3	1	13
Portable ¹⁷ (Pool Only)	13	1	2	10
Inside Home (Spa Only)	-	-	-	-
Outside Home (Spa Only)	2	1	1	2

Source: CPSC databases including NEISS, IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). Appendix A details the methodology for data extraction.

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

¹⁷ A “portable pool” is defined as any pool that can be set up/taken down or moved to another location with relative ease.

Since the majority of reported fatal submersion victims were younger than 5 years of age, the incident reports from 2007 through 2009 were evaluated, and common scenarios for children younger than 5 years of age for pools or spas (882 reported submersion fatalities) were classified. The highest percentage of the reports (54 percent) attributed the incident to a lapse 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). Fourteen percent of the reports indicated barrier compromise or circumvention. Another common scenario—13 percent of the reports—involved 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 18 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 fatal submersions involving this age group.

Table 12
Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
Children Younger than 5 Years of Age by Scenario, 2007–2009

Scenario	Percentage of Reported Fatalities for Pools and Spas ¹⁸
Lost Contact or Knowledge of Whereabouts	54
Not Enough Information to Determine Scenario	18
Barrier Integrity or Circumvented Barrier	14
Near Pool/Spa or In Pool/Spa	13

Source: CPSC databases including NEISS, IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). Appendix A details the methodology for data extraction.

¹⁸ Percentages do not add up to 100 due to rounding.

Appendix A

Methodology for Pool or Spa Submersion—Estimated Injuries and Reported Fatalities (2012)

“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 “near 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.¹⁹ For this reason and because a considerable number of children are injured or do not die immediately, the term “submersion,” rather than the term “drowning,” encompasses more accurately the various events that occur.

Injury estimates came from National Electronic Injury Surveillance System (NEISS) data extracted on April 11, 2012, for calendar year 2011. The NEISS product codes used for the data were 3251 (Built-in pools), 3221 (Above-ground pools), 1246 (Wading 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 2009 and 2010 were also used from last year’s report to cover the 2009 through 2011 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 22, 2012, from NEISS, IPII, DTHS and INDP for pool- or spa-related submersion deaths involving children younger than 15 years of age for the years 2007 to 2009. These data were merged with data from last year’s report for 2007 and 2008, to cover the 2007 through 2009 reporting period. It should be noted that for a given year, incidents are included on an ongoing basis for IPII and DTHS. In particular, additional reports are generally received for the most recent years. Fatal incidents associated with product codes 3251 (Built-in pools), 3221 (Above-ground pools), 1246 (Wading 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.

¹⁹ *Dorland’s Illustrated Medical Dictionary*, 30th Edition, Saunders, 2003.