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## Pool or Spa Submersion: Estimated Injuries and Reported Fatalities, 2011 Report

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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 estimates of the number of pool- or spa<sup>1</sup>-related submersion<sup>2</sup> injuries between 2008 and 2010, and presents counts of reported pool- or spa-related submersion fatalities involving children less than 15 years of age between 2006 and 2008. The subset of submersion injuries and fatalities involving children less 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.<sup>3</sup> 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 2008 through 2010, 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 2006 through 2008. 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, 5,100 pool- or spa-related emergency department (ED)-treated submersion injuries each year for 2008 through 2010, and 383 pool- or spa-related fatalities reported per year for 2006 through 2008, involving children younger than 15 years of age.
- Seventy-six 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 2008 through 2010 and the reported fatalities for 2006 through 2008 were associated with pools.
- Children between the ages of 1 and 3 (12 months through 47 months) represented 64 percent of estimated injuries for 2008 through 2010 and 66 percent of the reported fatalities for 2006 through 2008 involving children younger than 15 years.
- For children younger than 15 years old, 48 percent of the victims of ED-treated pool or spa submersion injuries for 2008 through 2010 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 (47 percent) than injured children between the ages of 5 and 14 years old (31 percent). Forty-four percent of children between the ages of 5 and 14 were admitted to the hospital, compared to 33 percent of children younger than age 5.

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<sup>1</sup> The term “spa” is used to refer to spas and hot tubs.

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

<sup>3</sup> 1999–2010 “Reported Circulation/Suction Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs, 2011 Report,” May 2011.

- Approximately 55 percent of the estimated injuries for 2008 through 2010 and 72 percent of the fatalities for 2006 through 2008, involving children younger than 15 occurred at a residence.
- Residential locations dominated incidents involving victims under 5 years of age (61 percent for injuries and 84 percent for fatalities). For incidents involving children 5 to 14 years of age, a greater share (41 percent for injuries and 45 percent for fatalities) occurred in public locations.
- Most reported fatalities occurred on the day of (72 percent) or within a week of (additional 24 percent) the submersion incident. Only 4 percent of fatal victims survived beyond a week of the submersion, and these victims had severe injuries and required intensive medical care.
- Parents, caregivers, and the media are encouraged to visit [www.PoolSafely.gov](http://www.PoolSafely.gov) for vital safety information regarding the prevention of child submersions in and around pools and spas.

## Emergency Department-Treated Injuries

For 2008 through 2010, an estimated annual average of 5,100 children under 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 under 5 years of age but are not provided for injured children 5 to 14 years of age due to the estimate being very small.<sup>4</sup> 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 2007 through 2009 are 4,200 children younger than 15 and 3,200 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 Less than 5 and 15 Years of Age, 2008–2010

Year	Estimated Emergency Department-Treated Injuries <sup>5</sup>	
	Under 5 Years	Under 15 Years
<b>Average</b>	4,000	5,100
<b>2010</b>	4,400	5,600
<b>2009</b>	4,400	5,500
<b>2008</b>	3,100	4,100

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

The 2010 estimates of children younger than 15 years of age and children younger than 5 years of age, who were treated in U.S. emergency departments for pool- or spa-related submersion injuries, are both marginally statistically different from the 2008 estimates.<sup>6</sup> On average, during 2008 through 2010, 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 76, 80, and 78 percent of the childhood pool- or spa-related treated injuries in 2008, 2009, and 2010, respectively.

<sup>4</sup> Estimates less than 1,200 are not routinely reported.

<sup>5</sup> The estimates are rounded to the nearest hundred.

<sup>6</sup> 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 2008 through 2010 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, 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 Less than 5 and 15 Years of Age by Product Type, 2008–2010

Product Type	Emergency Department-Treated Injury Percentages	
	Under 5 Years	Under 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.

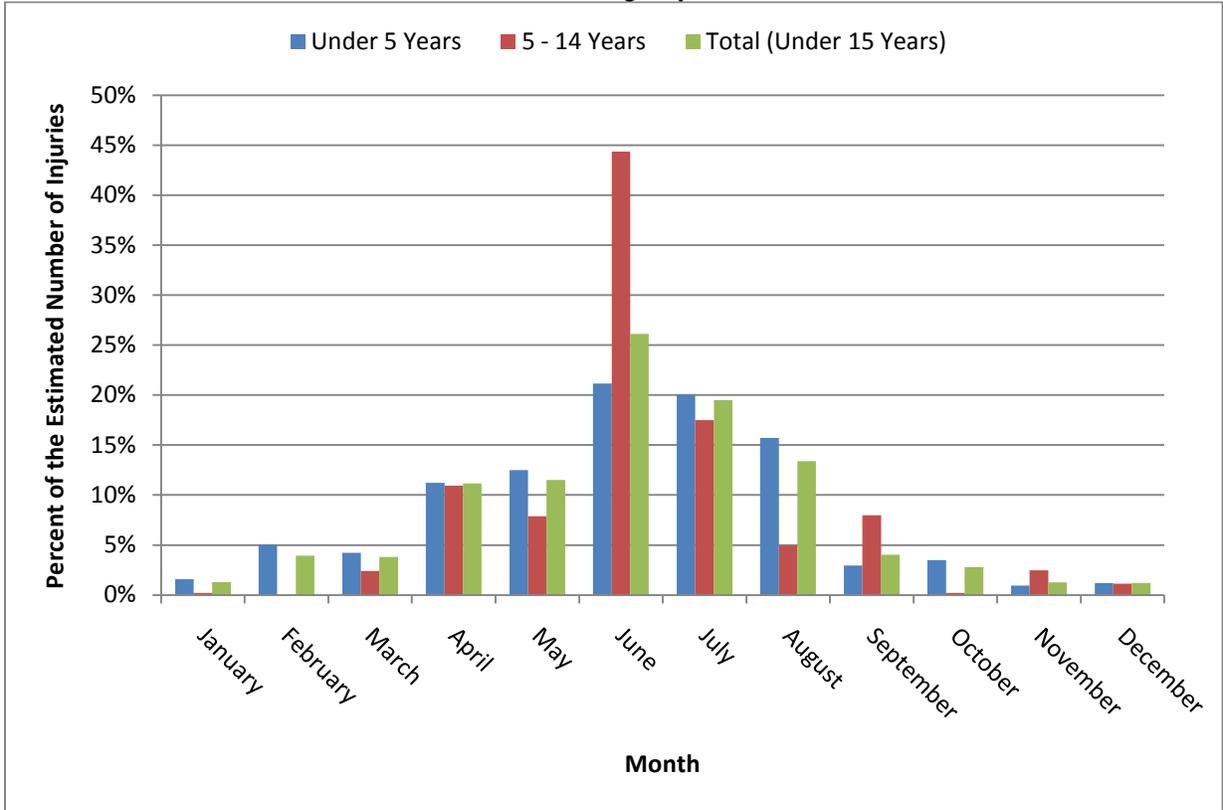
Table 3  
Percent of Emergency Department-Treated Pool or Spa Submersion Injuries  
Children Less than 5 and 15 Years of Age by Gender, 2008–2010

Gender	Estimated Emergency Department-Treated Injury Percentages	
	Under 5 Years	Under 15 Years
Male	59	59
Female	41	41

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 summer months of June, July, and August had the largest percentages.

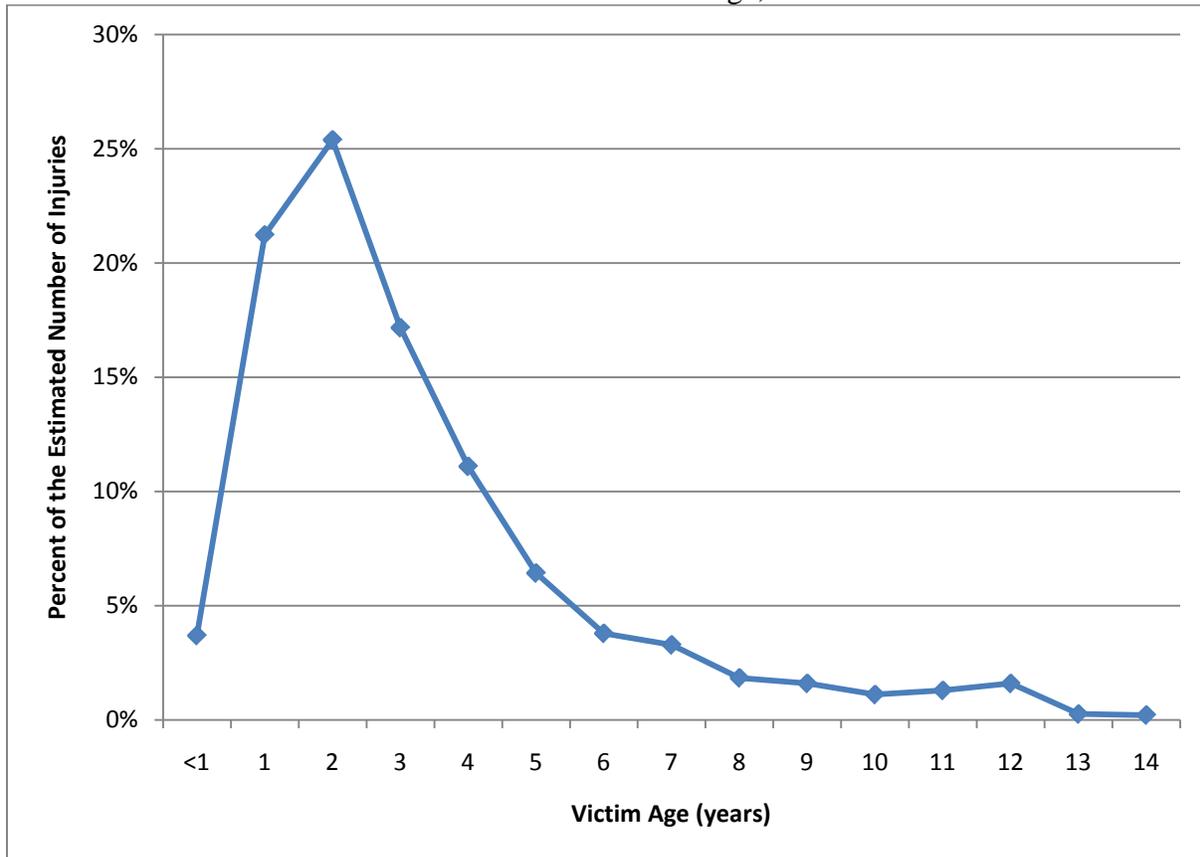
Figure 1  
 Percent of Emergency Department-Treated Pool or Spa Submersion Injuries  
 Children Less than 5 and 15 Years of Age by Month of Treatment 2008–2010



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 4 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 64 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.<sup>7</sup>

Figure 2  
Percent of Emergency Department-Treated Submersion Injuries by Age  
Children Less than 15 Years of Age, 2008–2010



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

<sup>7</sup> Percentages may not add up to 100 due to rounding.

Table 4 gives a breakdown of submersion injuries by disposition. Injured children under 5 years had a higher percentage (47) of *examined/treated and released* compared to the children 5 to 14 years of age (31 percent). For *admitted to hospital* and *treated and transferred* dispositions, injured children under 5 years had a lower percentage (45) compared to the percentage (62) 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 Less than 5 and 15 Years of Age by Disposition, 2008–2010

Disposition	Estimated Emergency Department-Treated Injury Percentages <sup>8</sup>		
	Under 5 Years	5–14 Years	Total (Under 15 Years)
<b>Examined or Treated and Released</b>	47	31	44
<b>Admitted to Hospital</b>	33	44	35
<b>Treated and Transferred</b>	12	18	13
<b>DOA or Died in Emergency Department</b>	4	3	4
<b>Held for Observation</b>	3	2	3
<b>Left without Being Seen</b>	1	1	1

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

<sup>8</sup> 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 under 5 years of age had the largest percentage (61) in a residential location, while children 5 to 14 years of age had the largest percentage (41) in a public location.

Table 5  
Percent of Emergency Department-Treated Pool or Spa Submersion Injuries  
Children Less than 5 and 15 Years of Age by Location, 2008–2010

Location	Estimated Emergency Department-Treated Injury Percentages <sup>9</sup>		
	Under 5 Years	5–14 Years	Total (Under 15 Years)
<b>Residential</b>	61	31	55
<b>Undisclosed Location</b>	28	28	28
<b>Public</b>	11	41	18

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

<sup>9</sup> Percentages may not add up to 100 due to rounding.

## Reported Fatalities

On average, 383 fatalities associated with pool or spa submersions involving children less than 15 years of age were reported to CPSC staff annually during the period from 2006 through 2008. 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-six 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 1,150 reported submersion fatalities from 2006 through 2008, 1,131 or 98 percent of the incidents involved 1 victim; 16 incidents involved 2 victims; and 3 incidents involved 1 victim who was included in the count, plus a second victim who was 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 Less than 15 Years of Age, 2006–2008

Year <sup>10</sup>	Reported Fatality Frequencies			Total (Under 15 Years)
	Under 5 Years <sup>11</sup>	5–9 Years	10–14 Years	
<b>Average</b>	291	64	29	383 <sup>12</sup>
<b>2008</b>	273	70	35	378
<b>2007</b>	286	62	27	375
<b>2006</b>	313	60	24	397
<b>Totals 2006-2008</b>	872	192	86	1150

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.

<sup>10</sup> Reporting is not considered complete for 2007 and 2008. The number of reported fatalities may change in the future.

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

<sup>12</sup> Average frequencies do not add up 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 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 less 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 Less than 15 Years of Age by Interval Between Injury and Death<sup>13</sup>, 2006–2008

<b>Days Between Incident &amp; Death</b>	<b>Percentage of Reported Fatalities<sup>14</sup></b>			<b>Total (Under 15 Years)</b>
	<b>Under 5 Years</b>	<b>5–9 Years</b>	<b>10–14 Years</b>	
<b>0 days</b>	73	72	59	72
<b>1 day</b>	9	14	14	10
<b>2–7 days</b>	13	12	21	14
<b>8–31 days</b>	3	1	3	3
<b>&gt; 31 days</b>	1	2	2	1

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.

<sup>13</sup> 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 14 fatalities where the difference was more than 31 days.

<sup>14</sup> 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 Less than 15 Years of Age by Product Type, 2006–2008

Product	Percentage of Reported Fatalities			Total (Under 15 Years)
	Under 5 Years	5–9 Years	10–14 Years	
Pool	95	99	98	96
Spa	5	1	2	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 more male children were treated in emergency departments for pool- or spa-related submersion injuries.

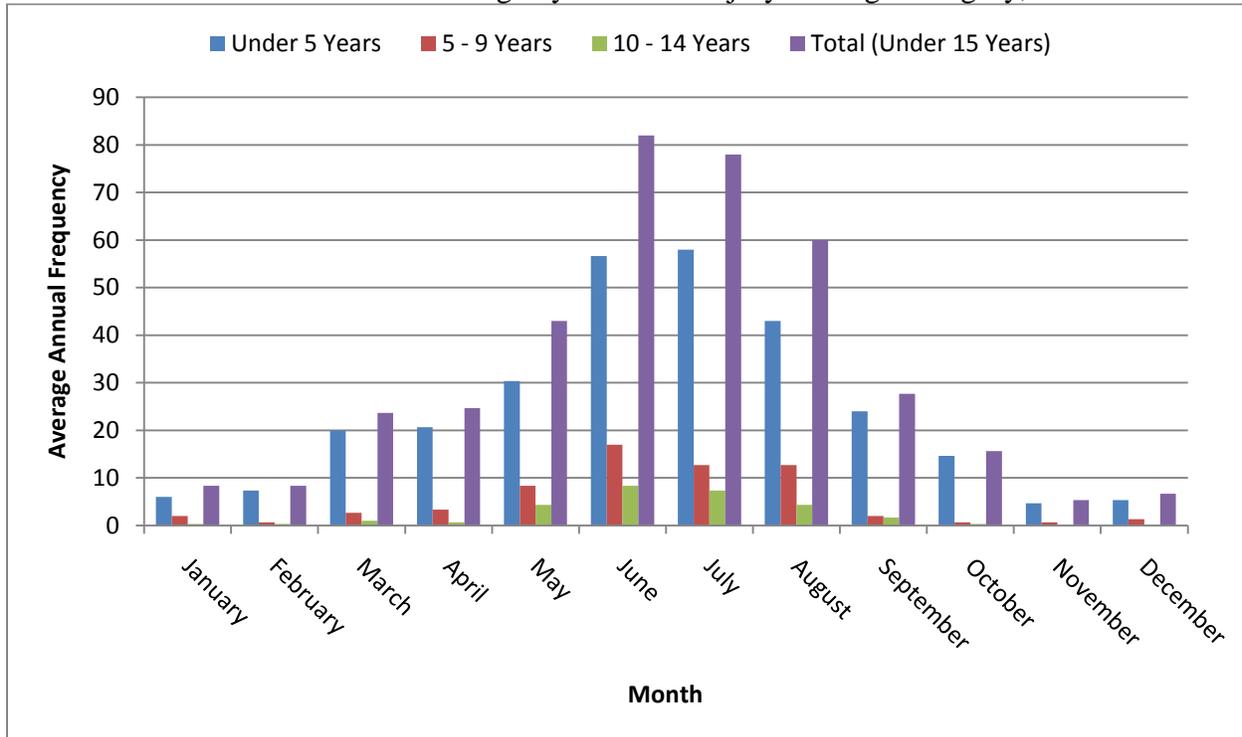
Table 9  
Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersions  
Children Less than 15 Years of Age by Gender, 2006–2008

Gender	Percentage of Reported Fatalities			Total (Under 15 Years)
	Under 5 Years	5–9 Years	10–14 Years	
Male	65	65	60	65
Female	35	35	40	35

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.

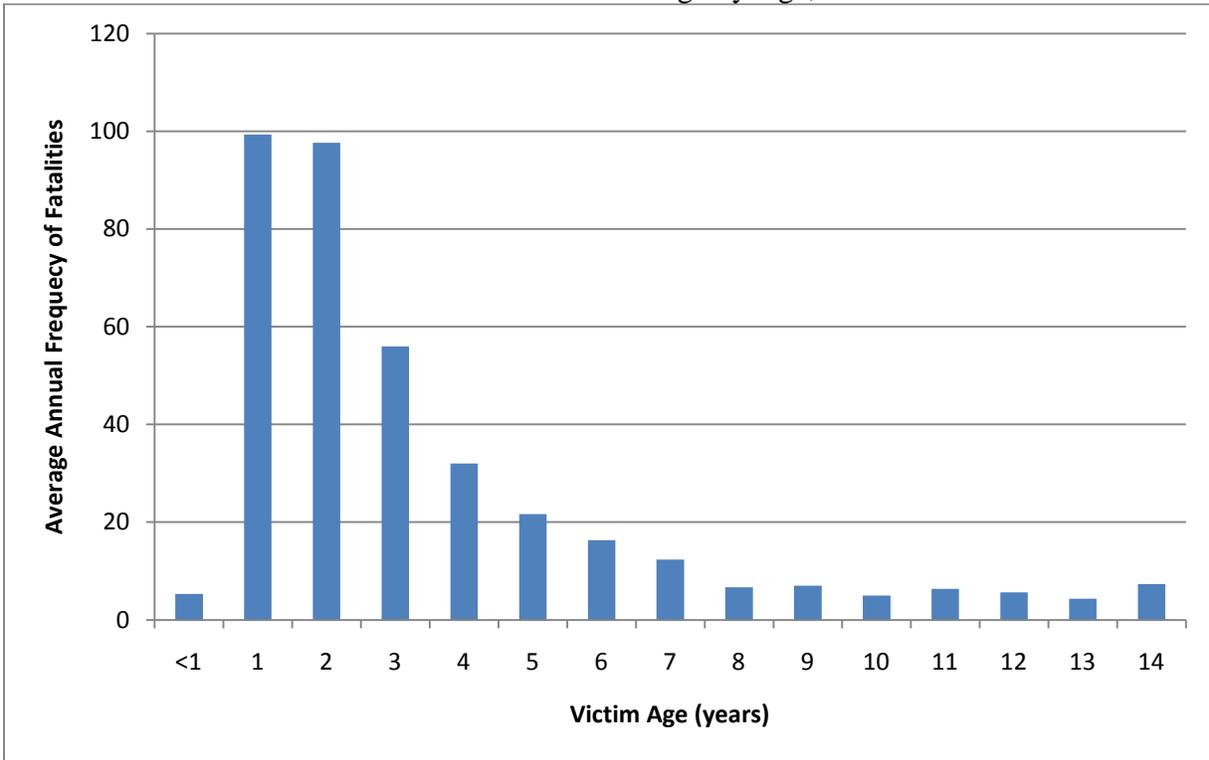
Figure 3  
Average Annual Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion Children Less than 15 Years of Age by Month of Injury and Age Category, 2006–2008



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 less than 15 years old as a frequency distribution of the victim's age. 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 Less than 15 Years of Age by Age, 2006–2008



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 (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 (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 Less than 15 Years of Age by Incident Location, 2006–2008

Location	Percentage of Reported Fatalities <sup>15</sup>			Total (Under 15 Years)
	Under 5 Years	5–9 Years	10–14 Years	
<b>Home</b>	53	15	14	44
<b>Family/ Friend</b>	25	18	8	23
<b>Public/ Community/ Business<sup>16</sup></b>	10	42	51	18
<b>Undisclosed Location</b>	6	20	22	10
<b>Neighbor</b>	6	6	5	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.

<sup>15</sup> Percentages may not add up to 100 due to rounding.

<sup>16</sup> 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 (59 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 Less than 15 Years of Age by Specific Pool/Spa Type Product Category, 2006–2008

Location	Percentage of Reported Fatalities <sup>17</sup>			Total (Under 15 Years)
	Under 5 Years	5–9 Years	10–14 Years	
In-Ground	60	54	56	59
Undisclosed Pool/Spa Type	10	41	42	17
Above- Ground (Pools Only)	17	3	1	13
Portable <sup>18</sup> (Pool Only)	11	2	-	9
Inside Home (Spa Only)	-	-	-	-
Outside Home (Spa Only)	2	1	1	1

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.

<sup>17</sup> Percentages may not add up to 100 due to rounding.

<sup>18</sup> 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 2006 through 2008 were evaluated, and common scenarios for children younger than 5 years of age for pools or spas (872 reported submersion fatalities) were classified. The highest percentage of the reports (57 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—in 12 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 17 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 Less than 5 Years of Age by Scenario, 2006–2008

Scenario	Percentage of Reported Fatalities for Pools and Spas
<b>Lost Contact or Knowledge of Whereabouts</b>	57
<b>Not Enough Information to Determine Scenario</b>	17
<b>Barrier Integrity or Circumvented Barrier</b>	14
<b>Near Pool/Spa or In Pool/Spa</b>	12

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.

## Appendix A

### Methodology for Pool or Spa Submersion—Estimated Injuries and Reported Fatalities (2011)

“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.<sup>19</sup> For this reason and because a considerable number of children are injured or do not die immediately, the term “submersion” encompasses the various events that have occurred more accurately than the term “drowning.”

Injury estimates came from National Electronic Injury Surveillance System (NEISS) data extracted on April 1, 2011, for calendar year 2010. 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 less 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 2008 and 2009 were also used from last year’s report to cover the 2008 through 2010 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 17, 2011, from NEISS, IPII, DTHS and INDP for pool- or spa- related submersion deaths involving children less than 15 years of age for the years 2006 to 2008. This data was merged with data from last year’s report for 2006 and 2007, to cover the 2006 through 2008 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 voluntarily submitted 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.

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<sup>19</sup> *Dorland’s Illustrated Medical Dictionary*, 30<sup>th</sup> Edition, Saunders, 2003.