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Pool or Spa Submersion: Estimated Injuries and Reported Fatalities, 2010 Report

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May 2010

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Executive Summary

This report presents estimates of the number of pool or spa¹ related submersion² injuries and the number of reported pool or spa related submersion fatalities involving children less than fifteen years of age. Submersion injuries and fatalities for children less than five years of age are also provided. Please note that injuries and fatalities associated with circulation/suction entrapments in pools or spas are presented in a separate document³. 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 2007 – 2009 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 2005 – 2007. The years for reported injury and fatality statistics differ as a result of the lag in fatality reporting.

Highlighted findings include:

- There were, on average, 4,200 pool or spa related emergency department (ED)-treated submersion injuries each year for 2007 – 2009 and 385 pool or spa related fatalities per year for 2005 – 2007 involving children younger than fifteen years of age.
- 77 percent of both the reported fatalities and the ED-treated injuries were to children younger than five years of age.
- The overwhelming majority of the estimated ED-treated submersion injuries for 2007 – 2009 and the reported fatalities for 2005 – 2007 were associated with pools.
- Children between the ages of one and two (12 to 35 months) represented 47 percent of estimated injuries for 2007 – 2009 and 53 percent of the 2005 – 2007 reported fatalities for children younger than fifteen.
- For children younger than fifteen, 46 percent of the victims of ED-treated pool or spa submersion injuries for 2007 – 2009 were admitted to the hospital or treated and transferred to another hospital compared to four percent for all product related ED-treated injuries involving children younger than fifteen for the same time period.
- Injured children younger than five were treated and released at a higher percentage (46 percent) than injured children between the ages of five and fourteen (41 percent). Thirty-eight percent of children between the ages of five and fourteen were admitted to the hospital compared to 31 percent of children younger than five.
- Approximately 54 percent of the estimated injuries for 2007 – 2009 and 74 percent of the fatalities for 2005 – 2007 involving children younger than fifteen occurred at a residence.

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

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

³ 1999 – 2009 Reported Circulation/Suction Entrapments Associated with Pools, Spas, and Whirlpool Tubs, 2010 Memorandum, May 24, 2010.

- Residential locations dominated incidents for victims under five years of age (61 percent for injuries and 84 percent for fatalities). For incidents involving children five to fourteen years of age, a greater share (48 percent for injuries and 43 percent for fatalities) occurred in public locations.
- Most reported fatalities occurred on the day of (73 percent) or within a week of (additional 23 percent) the submersion incident. Only four percent of fatal victims survived beyond a week of the submersion, and these victims had severe injuries and required intensive medical care.

Emergency Department-Treated Injuries

For 2007 – 2009, an estimated annual average of 4,200 children under fifteen 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 five years of age but could not be produced for injured children five to fourteen years of age due to the estimate being very small⁴. 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 2006 – 2008 are 3,900 children younger than fifteen and 3,100 children younger than five 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 Five and Fifteen Years of Age
2007 – 2009

Year	Estimated Emergency Department-Treated Injuries ⁵	
	Under 5 Years	Under 15 Years
Average	3,200	4,200
2009	4,400	5,500
2008	3,100	4,100
2007	2,200	3, 000

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

The 2009 estimate of children younger than fifteen years of age who were treated in U.S. emergency departments for pool or spa related submersion injuries is not statistically different from the 2007 or 2008 estimates. When victims younger than five years of age are considered, the 2009 estimated number of treated injuries is marginally different statistically from the 2007 estimate⁶. On average, during 2007 – 2009, 77 percent of children treated in emergency departments for pool or spa related submersion injuries were younger than five years of age. Children younger than five comprised an estimated 71, 76, and 80 percent of the childhood pool or spa related treated injuries in 2007, 2008, and 2009, respectively.

Table 2 shows the percent of estimates for 2007 – 2009 associated with pool or spa submersions by type of product. Spas related submersions constitute one percent of the

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 and the p-value is not corrected for multiple comparisons.

estimated number of treated injuries for children younger than fifteen and two percent of the pool or spa submersion treated injuries for children younger than five years of age.

Table 2
Percent of Emergency Department-Treated Pool or Spa Submersion Injuries
Children Less than Five and Fifteen Years of Age by Product Type
2007 – 2009

Product Type	Emergency Department-Treated Injury Percentages	
	Under 5 Years	Under 15 Years
Pool	98	99
Spa	2	1

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 injured children younger than fifteen and younger than five years of age.

Table 3
Percent of Emergency Department-Treated Pool or Spa Submersion Injuries
Children Less than Five and Fifteen Years of Age by Gender
2007 – 2009

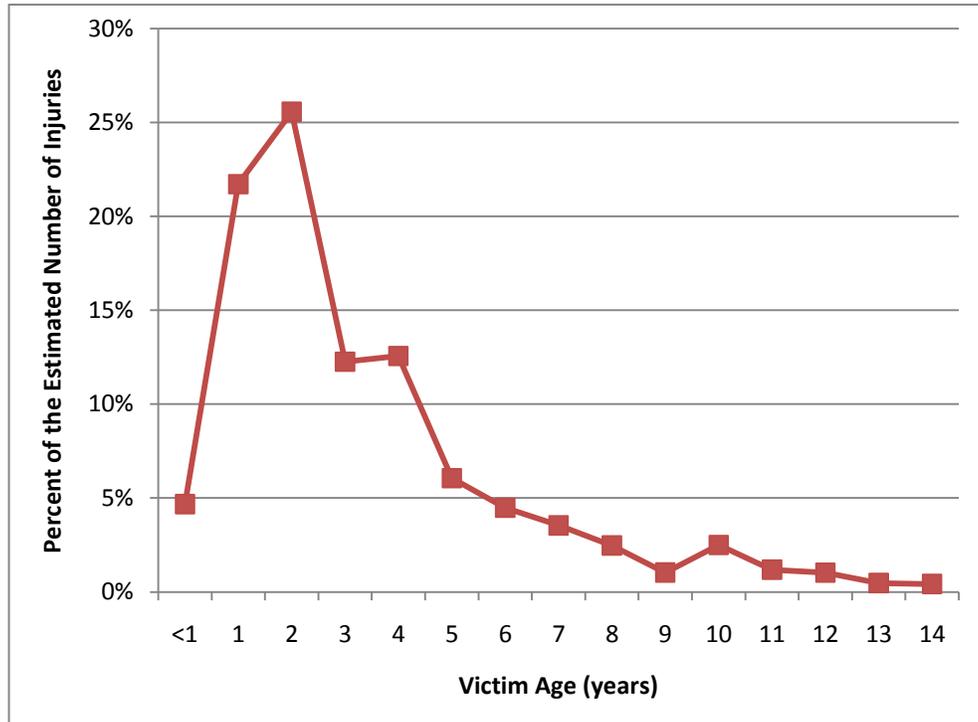
Gender	Estimated Emergency Department-Treated Injury Percentages	
	Under 5 Years	Under 15 Years
Male	60	60
Female	40	40

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

Figure 1 plots the estimated number of ED-treated submersion injuries as a percentage frequency distribution by age of victim. Children younger than one year of age accounted for five percent of the estimated pool or spa related submersion injuries. Children between the ages of one and two years (12 to 35 months) comprised approximately 47 percent of the estimated number of children treated for pool or spa related submersion injuries. Twenty five percent of the estimated childhood pool or spa related submersion injuries occurred in children between the ages of 3 and 4 (36 to 59 months). Children aged five to nine and ten to fourteen accounted for

18 and six percent, respectively, of the estimated ED-treated pool or spa related submersion injuries⁷.

Figure 1
Percent of Emergency Department-Treated Submersion Injuries by Age
Children Less than Fifteen Years of Age
2007 – 2009



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

Table 4 gives a breakdown of submersion injuries by disposition. Injured children under five years had a higher percentage (46) of *examined/treated and released* compared to the children five to fourteen years of age (41 percent). For *admitted to hospital and treated and transferred* dispositions, injured children under five years had a lower percentage (45) compared to the percentage (49) for children five to fourteen 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 CPSC’s jurisdiction, only four percent of children in the younger than five and younger than fifteen 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.

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

Table 4
 Percent of Emergency Department-Treated Pool or Spa Submersion Injuries
 Children Less than Five and Fifteen Years of Age by Disposition
 2007 – 2009

Disposition	Estimated Emergency Department-Treated Injury Percentages ⁸		
	Under 5 Years	5 – 14 Years	Total (Under 15 Years)
Examined or Treated and Released	46	41	45
Admitted to Hospital	31	38	33
Treated and Transferred	14	11	13
DOA or Died in Emergency Department	4	6	5
Held for Observation	4	4	4
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.

Table 5 shows the percentages of the estimated number of injuries by the type of location of the submersion incident for each age group. Overall, the majority of the incidents that led to these emergency department visits occurred at a residence. Injured children under five years of age had the largest percentage (61) in a residential location while children five to fourteen years of age had the largest percentage (48) in a public location.

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

Table 5
 Percent of Emergency Department-Treated Pool or Spa Submersion Injuries
 Children Less than Five and Fifteen Years of Age by Location
 2007 – 2009

Location	Estimated Emergency Department-Treated Injury Percentages ⁹		
	Under 5 Years	5 – 14 Years	Total (Under 15 Years)
Residential	61	30	54
Undisclosed Location	27	23	26
Public	12	48	20

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

Reported Fatalities

On average, 385 fatalities associated with pool or spa submersions involving children less than fifteen years of age were reported to CPSC staff annually during the period from 2005 through 2007. Reported frequencies by year and age category are shown in Table 6. Seventy-seven percent of the victims of the reported pool or spa related childhood submersion fatalities were younger than five years of age. Victims in this age category also accounted for seventy-seven 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 case counts for their respective years.

For the 1,155 reported submersion fatalities from 2005 through 2007, 1,132 or 98 percent of the incidents involved one victim, 10 incidents involved two victims, and 3 incidents involved one victim who was included in the count plus a second victim who was over fourteen 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 and cannot be generalized to the U.S. population since they are derived from anecdotal data.

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

Table 6
 Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
 Children Less than Fifteen Years of Age
 2005 – 2007

Year	Reported Fatality Frequencies			Total (Under 15 Years)
	Under 5 Years ¹⁰	5 – 9 Years ¹¹	10 – 14 Years	
Average	299	58	28	385
2007¹²	269	62	25	356
2006	311	60	24	395
2005	316 ¹³	53	35	404
Totals 2005-2007	896	175	84	1155

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 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 (83 percent), the date of death was either the same as the date of the incident or one day later. However, 17 percent of the victims less than fifteen years of age succumbed days, weeks, and even years after the submersion, often after extensive medical treatment.

¹⁰ One case is included in this category where the age is unknown but the term “toddler” was used to describe the victim.

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

¹² Reporting is not considered complete for this year. The number of reported fatalities may change in the future.

¹³ The count was reduced from last year’s count for this year due to reports being identified as reporting the same incident.

Table 7
 Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
 Children Less than Fifteen Years of Age by Interval Between Injury and Death¹⁴
 2005 – 2007

Days Between Incident & Death	Percentage of Reported Fatalities ¹⁵			Total (Under 15 Years)
	Under 5 Years	5 – 9 Years	10 – 14 Years	
0 days	74	72	67	73
1 day	9	10	10	9
2 – 7 days	13	14	11	13
8 – 31 days	3	1	7	3
> 31 days	1	2	6	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.

Reported fatalities occurred predominantly in pools. A small number of fatalities were associated with spas. Children younger than five 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 Fifteen Years of Age by Product Type
 2005 – 2007

Product	Percentage of Reported Fatalities			Total (Under 15 Years)
	Under 5 Years	5 – 9 Years	10 – 14 Years	
Pool	95	99	99	96
Spa	5	1	1	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.

¹⁴ 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.

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

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.

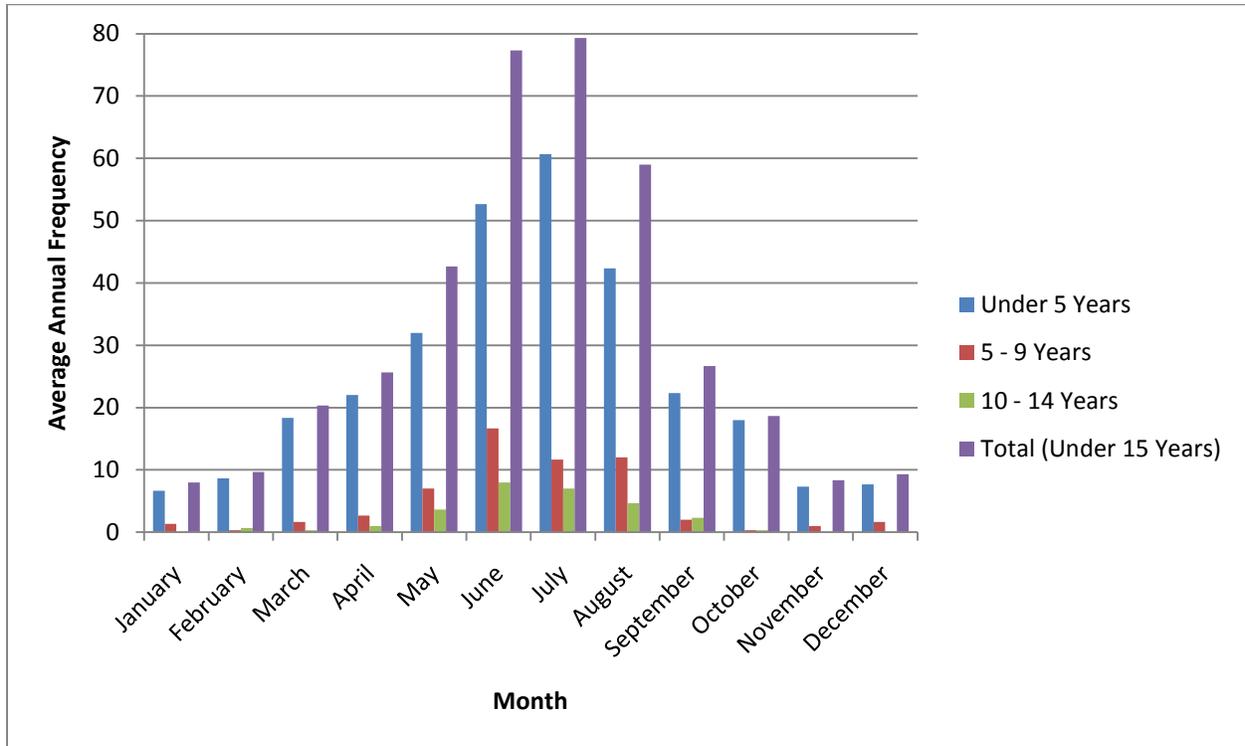
Table 9
 Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersions
 Children Less than Fifteen Years of Age by Gender
 2005 – 2007

Gender	Percentage of Reported Fatalities			Total (Under 15 Years)
	Under 5 Years	5 – 9 Years	10 – 14 Years	
Male	65	66	70	66
Female	35	34	30	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 2 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.

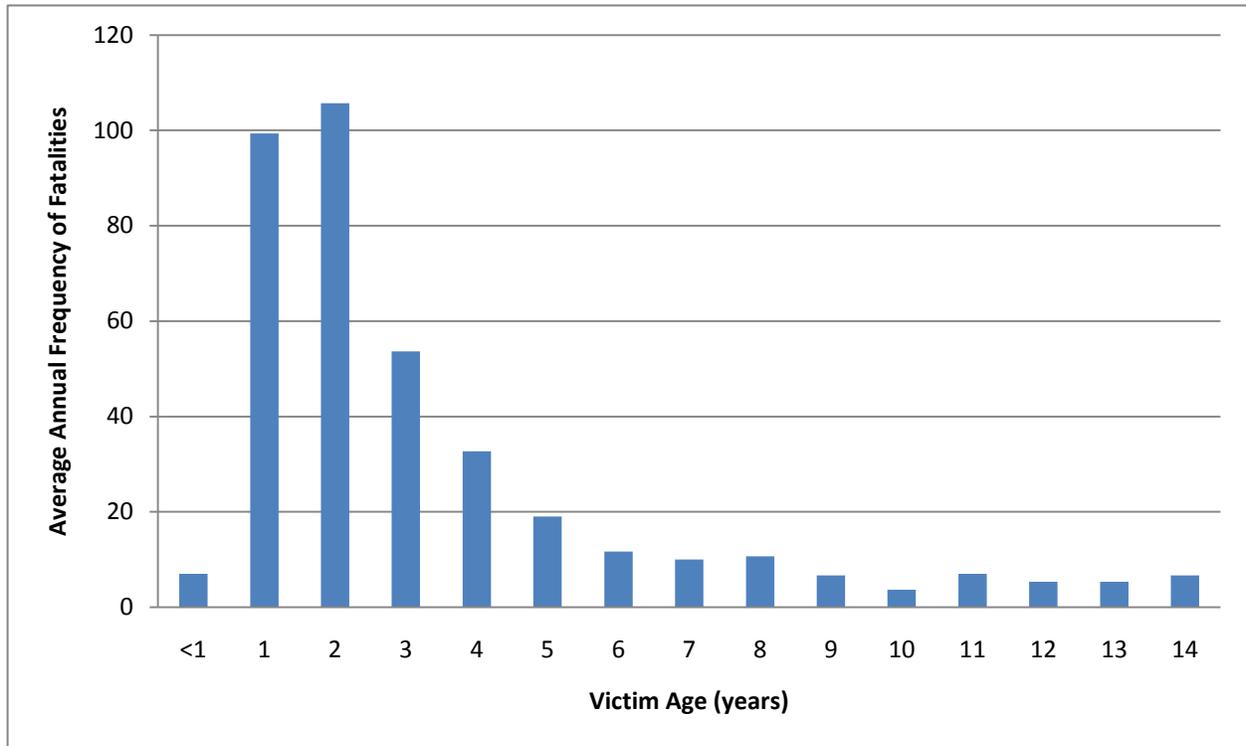
Figure 2
 Average Annual Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
 Children Less than Fifteen Years of Age by Month of Injury and Age Category
 2005 – 2007



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 shows the annual average of reported pool or spa submersion fatalities in children less than fifteen years old as a frequency distribution of the victims' age. The graph shows a sharp decrease after age two.

Figure 3
 Average Annual Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
 Children Less than Fifteen Years of Age by Age
 2005 – 2007



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 (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 location accounts for the largest percentage (46 percent) for all location categories for victims younger than fifteen years of age. For children five to nine years of age and children ten to fourteen 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 Fifteen Years of Age by Incident Location
 2005 – 2007

Location	Percentage of Reported Fatalities ¹⁶			Total (Under 15 Years)
	Under 5 Years	5 – 9 Years	10 – 14 Years	
Home	54	18	18	46
Family/ Friend	25	16	6	22
Public/ Community/ Business ¹⁷	9	38	52	16
Undisclosed Location	7	21	21	10
Neighbor	5	7	2	5

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 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 fifteen). This was followed by the above-ground pool category and portable pool category.

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

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

Table 11
 Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
 Children Less than Fifteen Years of Age by Specific Pool/Spa Type Product Category
 2005 – 2007

Location	Percentage of Reported Fatalities ¹⁸			Total (Under 15 Years)
	Under 5 Years	5 – 9 Years	10 – 14 Years	
In Ground	58	51	61	58
Undisclosed Pool/Spa Type	12	45	37	19
Above Ground (Pools Only)	17	2	2	14
Portable ¹⁹ (Pool Only)	11	2	-	9
Inside Home (Spa Only)	-	-	-	-
Outside Home (Spa Only)	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.

Since the majority of reported fatal submersion victims were younger than five years of age, the incident reports from 2005 – 2007 were evaluated and common scenarios for children younger than five years of age for pools or spas (896 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). Sixteen percent of the reports indicated barrier compromise or circumvention. Another common scenario with 11 percent of the reports involved close proximity to the pool/spa with the victim being last seen in the pool/spa or near the pool/spa before the incident occurred. In 19 percent of the reports, there was too little information available to determine the scenario. The scenarios are categorized in Table 12. It is harder to determine hazard scenarios for older children since CPSC staff receives fewer

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.

reports of fatal submersions involving this age group. The data that are available indicate that hazard scenarios appear to be different for older children as well.

Table 12
 Percentage of Fatalities Reported to CPSC Staff Associated with Pool or Spa Submersion
 Children Less than Five Years of Age by Scenario
 2005 – 2007

Scenario	Percentage of Reported Fatalities for Pools and Spas ²⁰
Lost Contact or Knowledge of Whereabouts	54
Not Enough Information to Determine Scenario	19
Barrier Integrity or Circumvented Barrier	16
Near Pool/Spa or In Pool/Spa	11
Miscellaneous²¹	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.

²⁰ Percentages may not add up to 100 due to rounding.

²¹ These six incidents uniquely differ from the more common hazard scenarios. They include reports where the caregiver tripped and the child fell into the pool, another child placed the victim in the pool, and the child fell out of a floatation device while in the pool.

Appendix A

Methodology for Pool or Spa Submersion - Estimated Injuries and Reported Fatalities (2010)

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 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 liquid²². For this reason and since a considerable number of children are injured or do not die immediately, the term “submersion” encompasses the various events that have occurred better than the term “drowning.”

Injury estimates came from National Electronic Injury Surveillance System (NEISS) data extracted on April 1, 2010 for calendar year 2009. 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 fifteen 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 2007 and 2008 were also used from last year’s report to cover the 2007 – 2009 time frame. NEISS data is from a probability based sample. Sampling weights are used to project the cases from NEISS hospitals to national estimates. Since 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. Since 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 18, 2010 from NEISS, IPII, DTHS and INDP for pool or spa related submersion deaths involving children less than fifteen years of age for the years 2005 to 2007. This data was merged with data from last year’s report for 2005 and 2006 to cover the 2005 – 2007 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.

²² *Dorland’s Illustrated Medical Dictionary*, 30th Edition, Saunders, 2003.