# Pool and Spa Submersion: Estimated Injuries and Reported Fatalities, 2009 Report

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Executive Summary

This report contains information on pool and spa[1] submersion[2] injury and fatality incidents of children less than five years of age. Pool numbers are reported separately where applicable to maintain linkage with previous memoranda. Please note that injuries and fatalities associated with circulation/suction entrapments in pools and 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 were not necessarily caused by the product.

Annual estimates and an average annual estimate of the number of emergency department-treated submersion injuries are presented for 2006 – 2008. This is followed by a count of fatalities reported to CPSC staff for submersions for 2004 – 2006. Injury and fatality years differ as a result of the lag in reporting fatalities.

Highlighted findings include:

- There were, on average, 3,100 pool and spa related emergency department (ED)-treated submersion injuries each year for 2006 – 2008 and 295 pool and spa related fatalities per year for 2004 – 2006 for children younger than five years of age.

- The estimated number of ED-treated submersion injuries to children younger than five associated with pools and spas in 2008 do not differ statistically from those estimated in 2007 or 2006.

- The overwhelming majority of estimated ED-treated submersion injuries for 2006 – 2008 and reported fatalities for 2004 – 2006 are associated with pools.

- Approximately 62 percent of estimated injuries for 2006 – 2008 and 70 percent of the reported fatalities for 2004 – 2006 for children younger than five involve children ages one and two.

- For children younger than five, 53 percent of the victims of ED-treated pool and spa submersion injuries for 2006 – 2008 were admitted to the hospital or treated and transferred to another hospital compared to four percent for all ED-treated injuries for children younger than five for the same time period.

- Approximately 64 percent of the estimated injuries for 2006 – 2008 and 79 percent of the fatalities for 2004 – 2006 for children younger than five 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 – 2008 Reported Circulation/Suction Entrapments Associated with Pools, Spas, and Whirlpool Tubs, 2009 Memorandum, May 2009.

**Emergency Department-Treated Injuries**

For 2006 – 2008, an estimated annual average of 3,100 children less than five years of age were treated in U.S. hospital emergency departments for injuries associated with pool and spa submersions. Estimates are shown in Table 1. 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. From last year's report, the corresponding annual average estimate for the years 2005 – 2007 is 2,700 children[4].

Table 1
Estimated Number of Emergency Department-Treated Pool & Spa Submersion Injuries
Children Less than Five Years of Age
2006 – 2008

| Year | Estimated Emergency Department-Treated Injuries[5] | |
|---|---|---|
| | Pools Only | Pools & Spas |
| **Average** | 3,000 | 3,100 |
| **2008** | 3,100 | 3,100[6] |
| **2007** | 2,100 | 2,200 |
| **2006** | 3,800 | 3,900 |

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

The 2008 estimate of children younger than five years of age that were treated in U.S. emergency departments for pool and spa related submersion injuries is not statistically different from either the 2007 or 2006 estimates. When just pool related submersion injuries are considered, the 2008 estimate is not statistically different from the other two years.

Table 2 shows the number of NEISS cases for 2006 – 2008 associated with pool and spa submersions that were weighted to produce the ED-treated national estimate. There are few spa incidents compared to pool incidents reported in NEISS.

[4] Pool and Spa Submersion: Estimated Injuries and Reported Fatalities, 2008 Report, May 2008.
[5] The estimates are rounded to the nearest hundred.
[6] There is no difference in the estimates for pools versus pools and spas due to rounding and the small contribution of spas to the injury estimate.

Table 2
NEISS Frequency of Emergency Department-Treated Pool & Spa Submersion Injuries
Children Less than Five Years of Age
2006 – 2008

| Year | Emergency Department-Treated Injury Frequencies | | |
|---|---|---|---|
| | Pools Only | Spas Only | Pools & Spas |
| **Average** | 101 | 2 | 103 |
| **2008** | 105 | 1 | 106 |
| **2007** | 83[7] | 1 | 84 |
| **2006** | 114 | 5 | 119 |

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 estimate by gender for pools only and for the combined product category of pools and spas. No gender differences are suggested.

Table 3
Percent of Emergency Department-Treated Pool & Spa Submersion Injuries
Children Less than Five Years of Age by Gender within Product Category
2006 – 2008

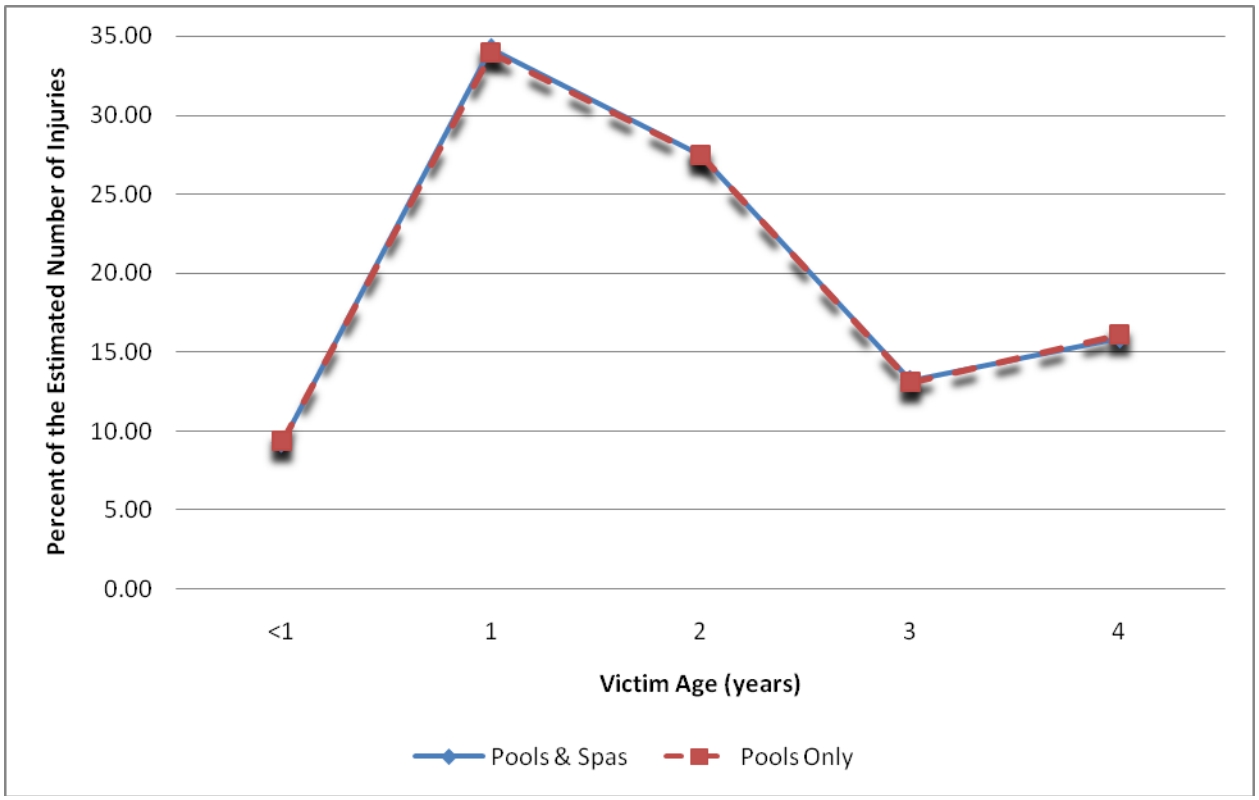
| Gender | Estimated Emergency Department-Treated Injury Percentages | |
|---|---|---|
| | Pools Only | Pools & Spas |
| **Male** | 56 | 56 |
| **Female** | 44 | 44 |

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 percentage of the estimated number of ED-treated submersion injuries attributed to each age category. Children in the one and two years of age categories together account for approximately 62 percent of submersion injuries.

[7] One 2007 NEISS incident was reclassified as out of scope. This resulted in a net loss of one incident compared to last year's report.

Figure 1
Percent of Emergency Department-Treated Submersion Injuries by Age
Children Less than Five Years of Age
2006 – 2008




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

For injury disposition, 37 percent of the injured children younger than five years of age were treated and released. However, 53 percent of the injured children were either admitted to the hospital, or transferred to another treatment facility. Across all consumer products in CPSC's jurisdiction, only four percent of children younger than five years of age that are treated in an emergency department for product related injuries are either admitted to the hospital or treated and transferred. Table 4 gives the estimated percentages by disposition. The deaths recorded in NEISS are also included in the fatality count in the section on reported fatalities.

Table 4
Percent of Emergency Department-Treated Pool & Spa Submersion Injuries
Children Less than Five Years of Age by Disposition
2006 – 2008

| Disposition | Estimated Emergency Department-Treated Injury Percentages | |
|---|---|---|
| | Pools Only | Pools & Spas |
| **Treated and Released** | 37 | 36 |
| **Admitted to Hospital** | 33 | 33 |
| **Treated and Transferred** | 19 | 20 |
| **DOA or Died in Emergency Department** | 6 | 6 |
| **Held for Observation** | 5 | 5 |

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

The majority of the incidents that led to these emergency department visits occurred at a residence. Table 5 shows the percentages of the estimated number of injuries by location type.

Table 5
Percent of Emergency Department-Treated Pool & Spa Submersion Injuries
Children Less than Five Years of Age by Location
2006 – 2008

| Location | Estimated Emergency Department-Treated Injury Percentages | |
|---|---|---|
| | Pools Only | Pools & Spas |
| **Residential** | 64 | 64 |
| **Undisclosed Location** | 23 | 23 |
| **Public** | 13 | 13 |

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

**Reported Fatalities**

For 2004 – 2006, an annual average of 295 (279 for pools, 17 for spas)[8] fatalities associated with pool and spa submersions were reported to CPSC staff for children less than five years of age. Reported frequencies are shown in Table 6. From last year's report, there was an annual average of 283 submersion fatalities associated with pools and spas reported to CPSC staff for 2003 – 2005 for children younger than five years of age[9]. Cases in NEISS that were classified as DOA or died in the ED are also included in case counts for their respective years. Seventy percent of the fatalities occurred on the same day as the submersion. Twenty-four percent of the victims succumbed days, weeks, and even years after the submersion, often after extensive medical treatment for both the pools only and the pools and spas categories. For the remaining six percent, it is unknown whether the fatalities occurred on the same day as the submersion.

Table 6
Fatalities Reported to CPSC Staff Associated with Pool & Spa Submersion
Children Less than Five Years of Age
2004 – 2006

| Year | Reported Fatality Frequencies | | |
|---|---|---|---|
| | Pools Only | Spas Only | Pools & Spas |
| **Average[9]** | 279 | 17 | 295 |
| **2006[10]** | 288 | 21 | 309 |
| **2005** | 305 | 17 | 322 |
| **2004** | 243 | 12 | 255 |

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.

Table 7 gives the estimated percentages of submersion fatalities by gender within product category. For pools only and the combined product category of pools and spas, roughly two-thirds of the victims were males.

[8] Numbers do not add up to total due to rounding.
[9] Pool and Spa Submersion: Estimated Injuries and Reported Fatalities, 2008 Report, May 2008.
[10] Reporting is not considered complete for this year.

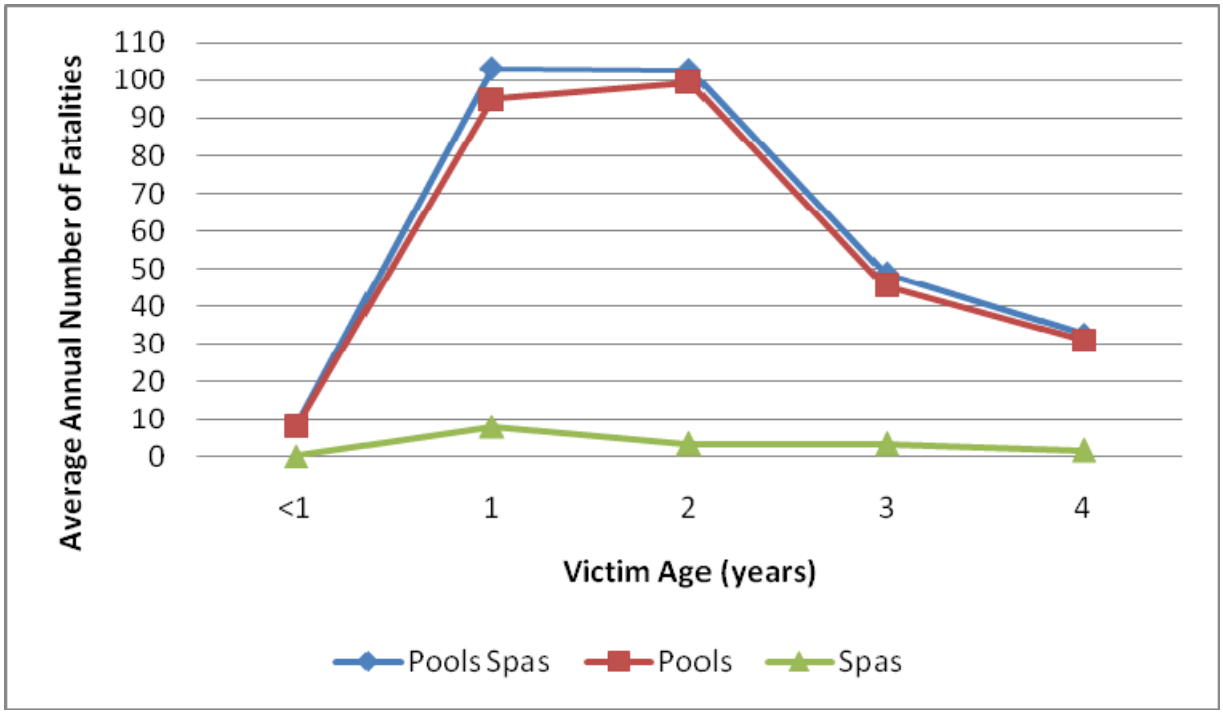
Table 7
Percentage of Fatalities Reported to CPSC Staff Associated with Pool & Spa Submersion
Children Less than Five Years of Age by Gender
2004 – 2006

| Gender | Percentage of Reported Fatalities | | |
|---|---|---|---|
| | Pools Only | Spas Only | Pools & Spas |
| **Male** | 64 | 50 | 63 |
| **Female** | 36 | 50 | 37 |

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 gives the annual average frequencies for each year of age for children less than five years old for pool and spa submersion fatalities. The graph shows a sharp decrease after age two.

Figure 2
Average Annual Fatalities Reported to CPSC Staff Associated with Pool & Spa Submersion
Children Less than Five Years of Age by Age Category
2004 – 2006




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

For the location of the pool or spa, the majority (79 percent for pools and 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 (51 percent for pools and spas) for all location categories. Table 8 shows the average percentages of reported fatalities by location.

Table 8
Percentage of Fatalities Reported to CPSC Staff Associated with Pool & Spa Submersion
Children Less than Five Years of Age by Location
2004 – 2006

| Location | Percentage of Reported Fatalities | | |
|---|---|---|---|
| | Pools Only | Spas Only | Pools & Spas |
| **Home** | 52 | 42 | 51 |
| **Family/Friend** | 22 | 16 | 22 |
| **Undisclosed Location** | 11 | 8 | 11 |
| **Public/Community/ Business**[11] | 8 | 32 | 10 |
| **Neighbor** | 7 | 2 | 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.

Table 9 shows percentages of reported fatalities by pool/spa type. The in-ground type accounts for the largest percentage (49 percent for pools and spas) of known pool/spa types in each category for children younger than five years of age. This is followed by the above-ground pool category and portable pool category.

[11] Condominium and apartment complex pools are included in this category.

Table 9
Percentage of Fatalities Reported to CPSC Staff Associated with Pool & Spa Submersion
Children Less than Five Years of Age by Pool/Spa Type within Product Category
2004 – 2006

| Pool/Spa Type | Percentage of Reported Fatalities[12] | | |
|---|---|---|---|
| | Pools Only | Spas Only | Pools & Spas |
| **In-Ground** | 48 | 52 | 49 |
| **Undisclosed Pool/Spa Type** | 23 | 32 | 24 |
| **Above-Ground (Pools Only)** | 18 | - | 17 |
| **Portable[13] (Pools Only)** | 10 | - | 10 |
| **Inside Home (Spa Only)** | - | 6 | 0 |
| **Outside Home (Spa Only)** | - | 10 | 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.

Analyzing the narratives of records for 2004 – 2006 allowed classification of common scenarios for children younger than five years of age for pools and spas (886 reported submersion fatalities). The highest percentage of the reports (46 percent) attributed the incident to 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, and 11 percent of the reports indicated that the incident occurred after the victim was last seen in the pool/spa or near the pool/spa. In 26 percent of the reports, there was too little information available to determine the scenario. The scenarios are categorized in Table 10.

[12] Percentages may not add up to 100 due to rounding.
[13] A portable pool is defined as any pool that can be set up/taken down or moved to another location with relative ease.

Table 10
Percentage of Fatalities Reported to CPSC Staff Associated with Pool & Spa Submersion
Children Less than Five Years of Age by Scenario
2004 – 2006

| Scenario | Percentage of Reported Fatalities for Pools and Spas |
|---|---|
| **Lost Contact or Knowledge of Whereabouts** | 46 |
| **Not Enough Information to Determine Scenario** | 26 |
| **Barrier Integrity or Circumvented Barrier** | 16 |
| **Near Pool/Spa or In Pool/Spa** | 11 |
| **Miscellaneous**[14] | 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.

[14] These eight incidents uniquely differ from the more common hazard scenarios.

## Appendix A

Methodology for Pool and Spa Submersion
Estimated Injuries and Reported Fatalities (2009)

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 liquid[15]. 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 4, 2009 for calendar year 2008. 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 five 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 2006 and 2007 were also used from last year's report to cover the 2006 – 2008 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 April 8, 2009 from NEISS, IPII, DTHS and INDP for pool and spa related submersion deaths involving children less than five years of age for the years 2004 to 2006. This data was merged with data from last year's report for 2004 and 2005 to cover the 2004 – 2006 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

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

that information on all the deaths has been received. Source documents were checked to eliminate duplicate incident reports.