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## Pool and Spa Submersion: Estimated Injuries and Reported Fatalities, 2008 Report

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This analysis was prepared by CPSC staff, has not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

## Executive Summary

This report contains information on pool and spa<sup>1</sup> submersion<sup>2</sup> injury and fatality incidents of children less than five years of age. In previous years, we reported numbers for pools only. This year we are reporting on both pools only and pools and spas. Pool numbers are reported separately where applicable to maintain linkage with previous memoranda. Please note that reported injuries and fatalities associated with circulation/suction entrapments in pools and spas are presented in a separate memorandum<sup>3</sup>.

Annual estimates and an average annual estimate of the number of emergency department-treated submersion injuries are presented for 2005 – 2007. This is followed by a count of fatalities reported to CPSC staff for submersions for 2003 – 2005. Injury and fatality years differ as a result of the lag in reporting fatalities. Appendix A discusses terminology and the methods used to extract the data.

### Highlighted findings include:

- There were, on average, 2,700 pool and spa related emergency department (ED)-treated submersion injuries each year for 2005 – 2007 and 283 pool and spa related fatalities per year for 2003 – 2005 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 2007 (2,200) is lower than the number estimated for 2006 (3,900). The difference is statistically significant. While the estimated number of injuries associated with pools only in 2007 is also lower than the number estimated in 2006, the difference is marginally non-significant.
- The overwhelming majority of estimated ED-treated submersion injuries for 2005 – 2007 and reported fatalities for 2003 – 2005 are associated with pools.
- Approximately 60 percent of estimated injuries for 2005 – 2007 and reported fatalities for 2003 – 2005 for children younger than five involve children ages one and two.
- For children younger than five, 58 percent of the victims of ED-treated pool and spa submersion injuries for 2005 – 2007 were admitted to the hospital or treated and transferred to another hospital compared to five percent for all ED-treated injuries for children younger than five for the same time period.
- 61 percent of the estimated injuries for 2005 – 2007 and 79 percent of the fatalities for 2003 – 2005 for children younger than five occurred at a residence.

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

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

<sup>3</sup> 1999 – 2007 Reported Circulation/Suction Entrapments Associated with Pools, Hot tubs, Spas, and Whirlpools, 2008 Memorandum, March 2008.

## Emergency Department-Treated Injuries

For 2005 – 2007, an estimated annual average of 2,700 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. There was an estimated annual average of 2,800 children less than five years of age treated for pool and spa submersion injuries in emergency departments for 2004 – 2006.

Table 1  
Estimated Number of Emergency Department-Treated Pool & Spa Submersion Injuries  
Children Less than Five Years of Age  
2005 – 2007

Year	Estimated Emergency Department-Treated Injuries <sup>4</sup>	
	Pools Only	Pools & Spas
<b>Average</b>	2,700	2,700
<b>2007</b>	2,100	2,200
<b>2006</b>	3,800 <sup>5</sup>	3,900
<b>2005</b>	2,100	2,100 <sup>6</sup>

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

The estimate for 2006 is larger than those for 2005 or 2007 and is statistically pairwise different for 2006 versus 2007 for pools and spas. For pools only, it is marginally non-significant for 2006 versus 2007<sup>7</sup>.

Table 2 shows frequencies of NEISS cases for 2005 – 2007 associated with pool and spa submersions that were weighted for the ED-treated national estimate. Notice that there are not many spa incidents compared to pool incidents.

<sup>4</sup> The estimates are rounded to the nearest hundred.

<sup>5</sup> The estimate in last year's pool memorandum was 3,703 for 2006. The new estimate for 2006 is due to the inclusion of additional pool submersion incidents.

<sup>6</sup> 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.

<sup>7</sup> For pools, the p-values for the pairwise comparisons are 0.13 for 2006 versus 2005 and 0.06 for 2006 versus 2007. For pools and spas, the p-values for the pairwise comparisons are 0.11 for 2006 versus 2005 and 0.05 for 2006 versus 2007.

Table 2  
NEISS Frequency of Emergency Department-Treated Pool & Spa Submersion Injuries  
Children Less than Five Years of Age  
2005 – 2007

Year	Emergency Department-Treated Injury Frequencies		
	Pools Only	Spas Only	Pools & Spas
<b>Average</b>	99	3	102
<b>2007</b>	84	1	85
<b>2006</b>	114	5	119
<b>2005</b>	99	2	101

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

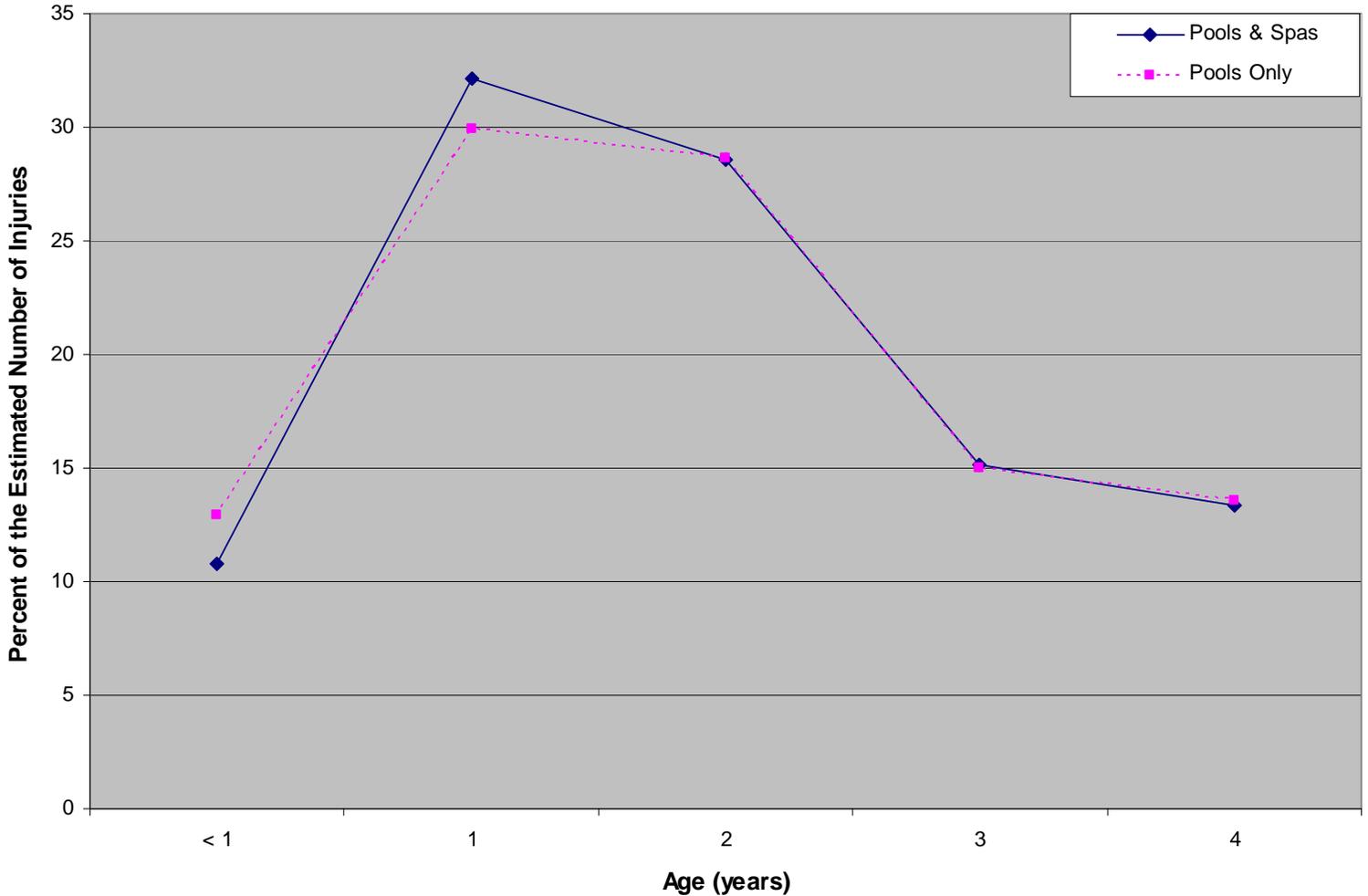
Table 3  
Percent of Emergency Department-Treated Pool & Spa Submersion Injuries  
Children Less than Five Years of Age by Gender within Product Category  
2005 – 2007

Gender	Estimated Emergency Department-Treated Injury Percentages	
	Pools Only	Pools & Spas
<b>Male</b>	53	52
<b>Female</b>	47	48

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. Notice that the one and two years of age categories together account for approximately 60 percent of submersion injuries.

Figure 1  
 Percent of Emergency Department-Treated Submersion Injuries by Age  
 Children Less than Five Years of Age  
 2005 – 2007



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

For injury disposition, the largest percent of the injuries (39%) were admitted to the hospital. This is followed by the treated and released, and treated and transferred disposition categories. Table 4 gives the estimated percentages by disposition. The deaths recorded in NEISS are also included in the fatality count in the next section.

Table 4  
 Percent of Emergency Department-Treated Pool & Spa Submersion Injuries  
 Children Less than Five Years of Age by Disposition  
 2005 – 2007

Disposition	Estimated Emergency Department-Treated Injury Percentages <sup>8</sup>	
	Pools Only	Pools & Spas
<b>Admitted to Hospital</b>	39	39
<b>Treated and Released</b>	29	29
<b>Treated and Transferred</b>	18	19
<b>DOA or Died in Emergency Department</b>	7	7
<b>Held for Observation</b>	6	6

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  
 2005 – 2007

Location	Estimated Emergency Department-Treated Injury Percentages <sup>8</sup>	
	Pools Only	Pools & Spas
<b>Residential</b>	61	61
<b>Undisclosed Location</b>	23	23
<b>Public</b>	17	17

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 percent due to rounding.

## Reported Fatalities

For 2003 – 2005, an annual average of 283 (270 for pools, 12 for spas)<sup>9</sup> 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. There was an annual average of 267 submersion fatalities associated with pools and spas reported to CPSC staff for 2002 – 2004 for children younger than five years of age. Cases in NEISS that were classified as DOA or died in the ED are also included in case counts for their respective years. Sixty-seven percent of the fatalities occurred on the same day as the submersion. Twenty-five percent of the victims succumbed days, weeks, and even years after the submersion, often after extensive medical treatment for both the pools and the pools and spas categories. The remaining eight percent is unknown.

Table 6  
Fatalities Reported to CPSC Staff Associated with Pool & Spa Submersion  
Children Less than Five Years of Age  
2003 – 2005

Year	Reported Fatality Frequencies		
	Pools Only	Spas Only	Pools & Spas
Average <sup>9</sup>	270	12	283
2005 <sup>10</sup>	302	17	319
2004 <sup>10</sup>	234	11	245
2003	275 <sup>11</sup>	9	284

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. The remaining fatalities were associated with spas.

Table 7 gives the estimated percentages of submersion fatalities by gender within product category. Notice that for pools only and the combined product category of pools and spas roughly two-thirds of the victims are males.

<sup>9</sup> Numbers may not add up to total due to rounding.

<sup>10</sup> Reporting is not considered complete for this year.

<sup>11</sup> The frequency count in last year's pool memorandum was 279 for 2003. The new count for 2003 is due to duplicate reports of the same fatality being consolidated.

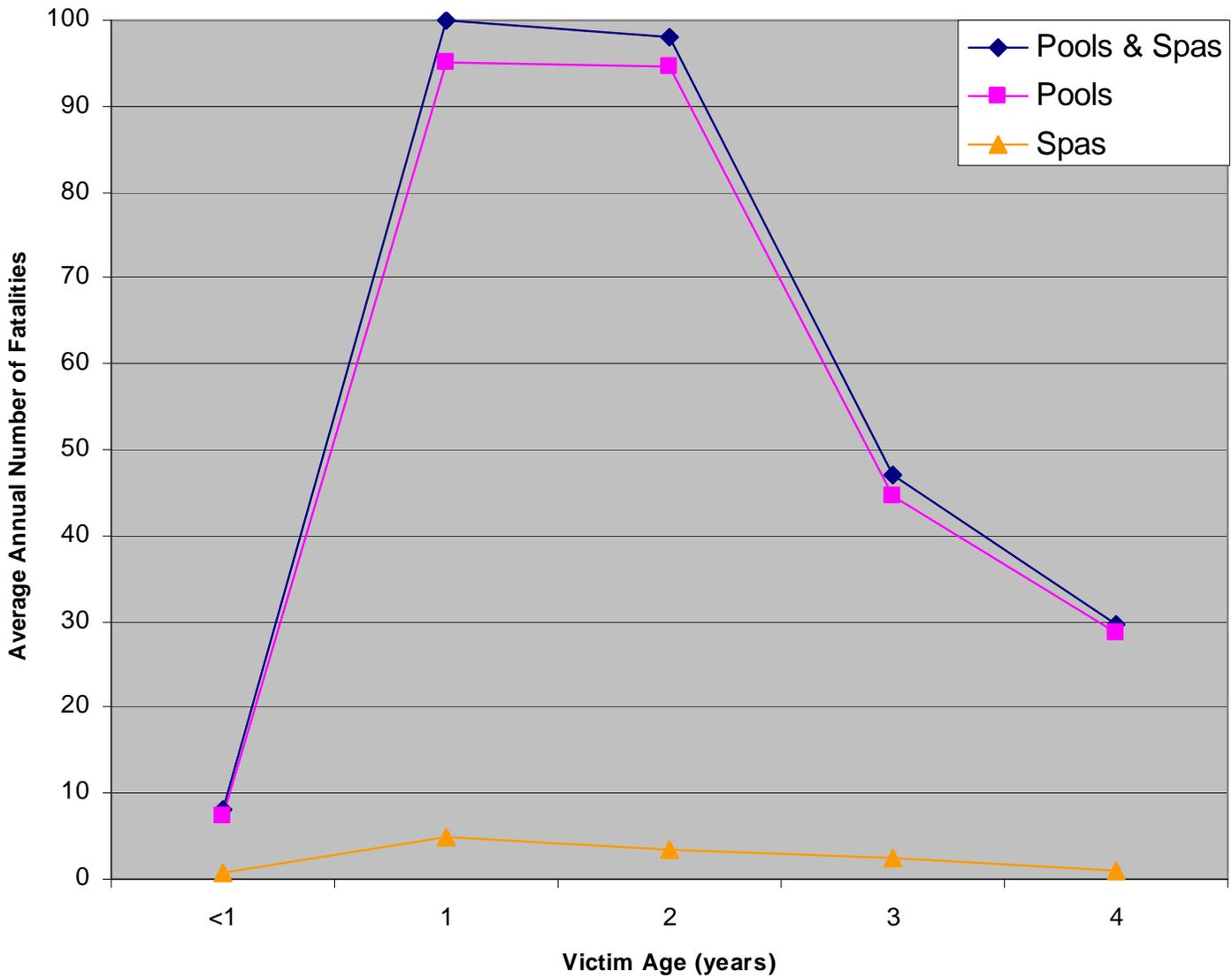
Table 7  
 Percentage of Fatalities Reported to CPSC Staff Associated with Pool & Spa Submersion  
 Children Less than Five Years of Age by Gender  
 2003 – 2005

Gender	Percentage of Reported Fatalities		
	Pools Only	Spas Only	Pools & Spas
Male	65	46	64
Female	35	54	36

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  
 2003 – 2005



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

Table 8 shows the average percentages of reported fatalities by location. The home location accounts for the largest overall percent (52% for pools and spas) of the fatalities.

Table 8  
 Percentage of Fatalities Reported to CPSC Staff Associated with Pool & Spa Submersion  
 Children Less than Five Years of Age by Location  
 2003 – 2005

Location	Percentage of Reported Fatalities		
	Pools Only	Spas Only	Pools & Spas
<b>Home Pool/Spa</b>	53	49	52
<b>Family/Friend Pool/Spa</b>	19	19	19
<b>Undisclosed Location</b>	12	5	12
<b>Public/Community/ Business Pool/Spa<sup>12</sup></b>	8	24	9
<b>Neighbor's Pool/Spa</b>	8	3	8

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 (35% 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.

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<sup>12</sup> 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  
 2003 – 2005

Pool/Spa Type	Percentage of Reported Fatalities		
	Pools Only	Spas Only	Pools & Spas
<b>Undisclosed Pool/Spa Type</b>	39	43	40
<b>In-Ground</b>	34	41	35
<b>Above-Ground (Pools Only)</b>	18	-	17
<b>Portable<sup>13</sup> (Pools Only)</b>	9	-	8
<b>Inside Home (Spa Only)</b>	-	11	0
<b>Outside Home (Spa Only)</b>	-	5	0

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 2003 – 2005 allowed classification of common scenarios for children younger than five years of age for pools and spas (848 reported submersion fatalities). The highest percentage of the reports (38%) 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. Fifteen percent of the reports indicated barrier compromise or circumvention, and 12 percent of the reports indicated that the incident occurred in or near the pool. In 34 percent of the reports, there was too little information available to determine the scenario. The scenarios are categorized in Table 10.

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<sup>13</sup> 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  
 2003 – 2005

<b>Scenario</b>	<b>Percentage of Reported Fatalities for Pools and Spas</b>
<b>Lost Contact or Knowledge of Whereabouts</b>	38
<b>Not Enough Information to Determine Scenario</b>	34
<b>Barrier Integrity or Circumvented Barrier</b>	15
<b>Near Pool/Spa or In Pool/Spa</b>	12
<b>Miscellaneous</b>	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.

## Appendix A

### Methodology for Pool and Spa Submersion Estimated Injuries and Reported Fatalities (2008)

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<sup>14</sup>. 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.”

The estimated numbers of emergency department-treated injuries are rounded to the nearest hundred. Percentages in this memorandum 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).

Injury estimates came from National Electronic Injury Surveillance System (NEISS) data extracted on April 4, 2008 for the time period 2005 to 2007. 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, Spas, and Whirlpools). 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 is a weighted sample and so all estimates from this data were weighted as well. Since incidents in NEISS are unique, there were no duplicates.

Data were extracted on February 14, 2008 from NEISS, IPII, DTHS and INDP for pool and spa related submersion deaths involving children less than five years of age for the years 2003 to 2005. 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, Spas, and Whirlpools) 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 that 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>14</sup> *Dorland’s Illustrated Medical Dictionary*, 30<sup>th</sup> Edition, Saunders, 2003.