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2012–2016 Reported Circulation/Suction Entrapment Incidents Associated with Pools, Spas, and Whirlpool Bathtubs, 2017 Report

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Executive Summary

This report characterizes the information on circulation entrapment incidents associated with pools, spas,¹ and whirlpool bathtubs that were reported to U.S. Consumer Product Safety Commission (CPSC) staff. A “circulation entrapment” is defined as an entrapment involving the water circulation system of a product. A multidisciplinary team of CPSC staff collaboratively developed this definition and determined the types of products that are of interest regarding circulation entrapments.

CPSC staff is aware of 17 victims of circulation entrapments in incidents that reportedly occurred from 2012 through 2016. Highlighted findings include:

- Victims
 - Fatality (2 victims, 12 percent)
 - Injury (14 victims, 82 percent)
 - 12 victims were children, younger than 15 years old
 - 2 victims were between the age of 20 and 39 years old
 - No injury (1 victim, 6 percent)
 - 1 adult, age 20 to 29 years old
 - Majority of the entrapment victims (14 victims, 82 percent) were individuals younger than 15 years of age
 - Majority of the victims were females (12 victims, 71 percent)
- Product
 - 53 percent of the victims (9 victims) were associated with a spa incident
 - 35 percent (6 victims) were associated with a pool incident
 - 12 percent (2 victims) were associated with a whirlpool bathtub incident
- Location
 - 47 percent of the entrapments (8 victims) occurred in public settings
 - 47 percent (8 victims) occurred in residential settings
 - 6 percent (1 victim) occurred in an unknown location
- Entrapment Type
 - 47 percent (8 victims) experienced limb entrapment
 - 24 percent (4 victims) experienced hair entrapment
 - 12 percent (2 victims) experienced body entrapment
 - 12 percent (2 victims) experienced evisceration/disembowelment entrapment
 - 6 percent (1 victim) experienced mechanical entrapment
- Hazard Scenario²
 - 41 percent (7 victims) were trapped in suction incidents
 - 29 percent (5 victims) were involved in incidents related to being caught on an outlet cover
 - 29 percent (5 victims) were involved in incidents related to missing or removed outlet covers

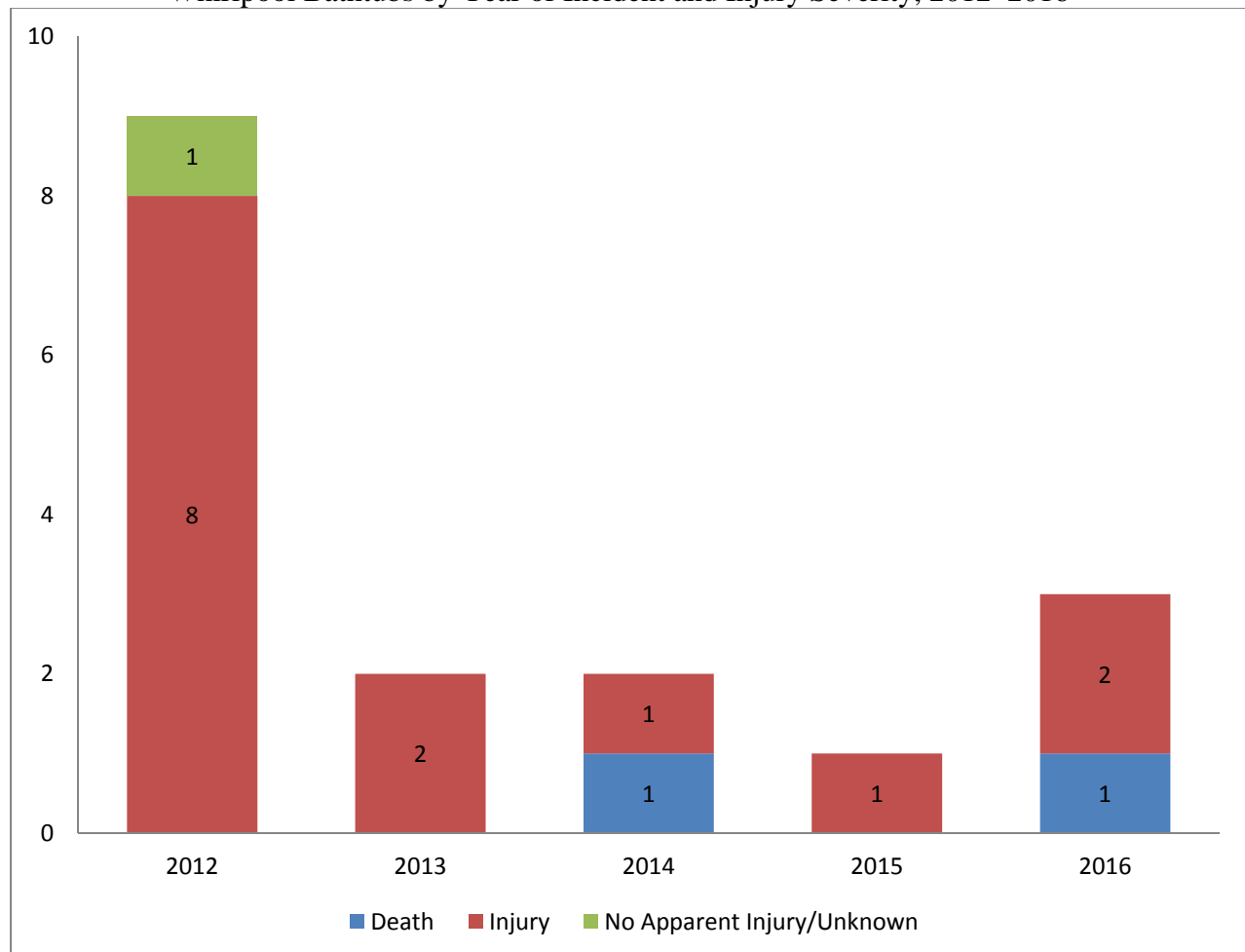
¹ The term “spa” is used to refer to spas and hot tubs.

² Since the Virginia Graeme Baker Pool & Spa Safety Act went into effect in December 2008, there have been no reported fatalities involving a child being entrapped on a suction outlet cover in a public pool or spa.

Circulation Entrapment

CPSC staff received reports of 16 incidents involving 17 victims of circulation entrapments from 2012 through 2016. One of the 16 incidents reported two victims. Appendix A provides the methodology for extracting the data and updating the database, and Appendix B provides the summary of the 16 reports. For this period, there were two fatalities (spa), 14 injuries (5 pool, 7 spa, 2 whirlpool bathtub), and one incident with no apparent injury or unknown injury (pool). Figure 1 displays the yearly counts of reported victims based on severity (fatality, injury, and no apparent/unknown injury). Reporting in CPSRMS is ongoing for the years 2014 through 2016.

Figure 1
Number of Victims of Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs by Year of Incident and Injury Severity, 2012–2016



Source: CPSC database, including the Consumer Product Safety Risk Management System (CPSRMS) and National Electronic Injury Surveillance System (NEISS). Reporting is ongoing for 2014–2016.

Among the 17 victims, six (35 percent) were associated with incidents in pools, nine (53 percent) were associated with spas, and two (12 percent) were associated with whirlpool bathtubs. Table 1 shows these counts by year.

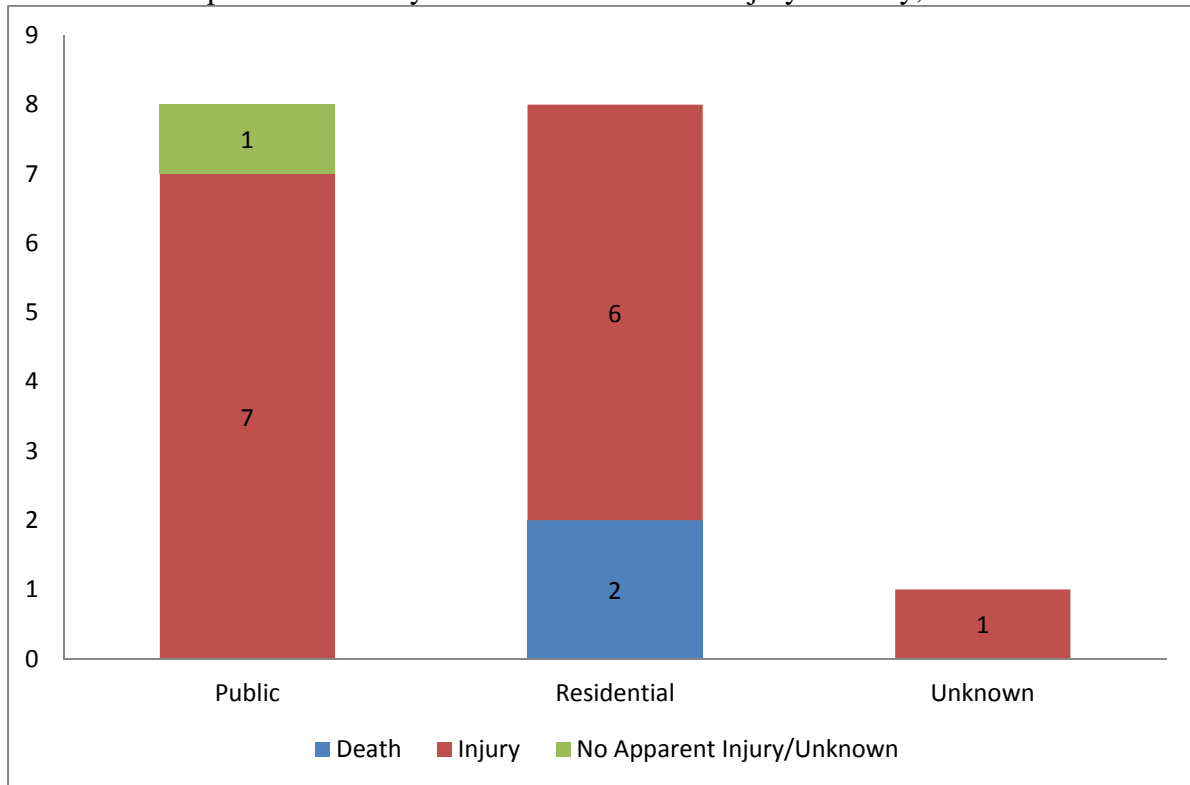
Table 1
Number of Victims of Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs by Year of Incident and Product Category, 2012–2016

Year	Pool	Spa	Whirlpool Bathtub	Total
2016	-	3	-	3
2015	-	1	-	1
2014	-	2	-	2
2013	2	-	-	2
2012	4	3	2	9
Total	6	9	2	17

Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014-2016.

An equal number of incidents occurred in public locations (8 victims, 47 percent) and residential locations (8 victims, 47 percent), with the remaining incident in an unknown location. Figure 2 presents the frequency of reported victims by location and severity.

Figure 2
Number of Victims of Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs by Incident Location and Injury Severity, 2012–2016



Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014-2016.

Among the six pool victims, 67 percent were in public pools. Among the nine spa victims, 44 percent occurred in residential locations and 44 percent occurred at nonresidential

locations, such as a hotel or motel. The two whirlpool bathtub incidents both occurred at a residential location. Table 2 shows the counts by incident location and product category.

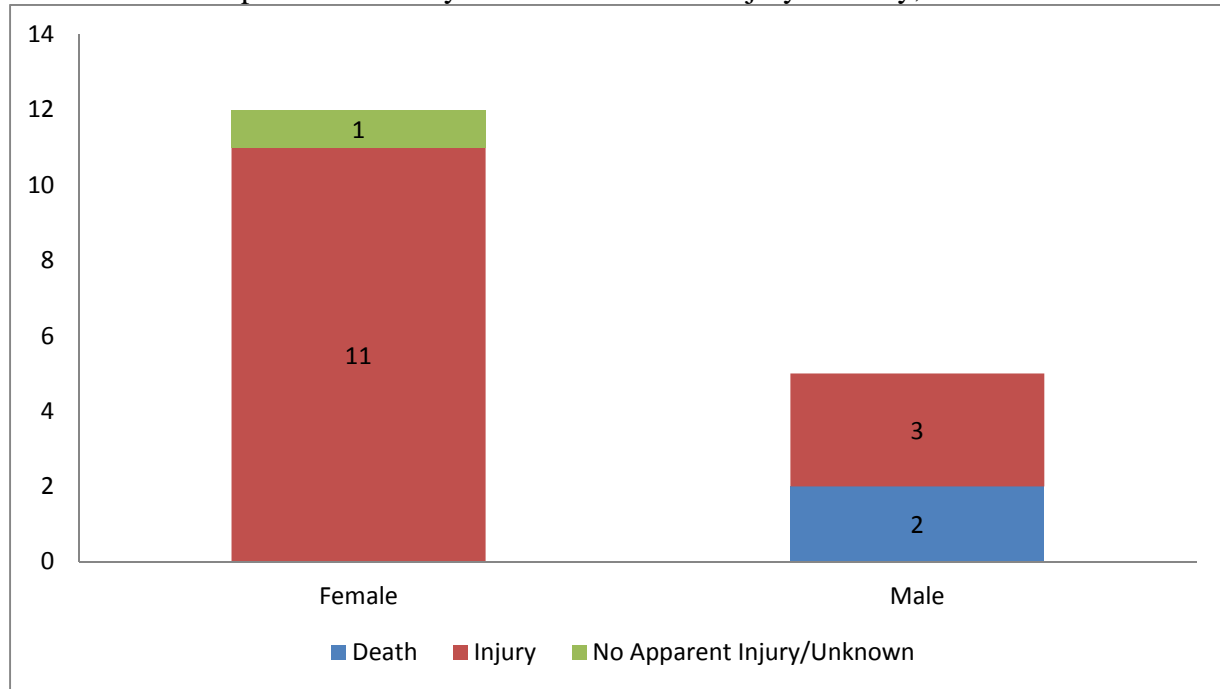
Table 2
Number of Victims of Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs by Incident Location and Product Category, 2012–2016

Location	Pool	Spa	Whirlpool Bathtub	Total
Public	4	4	-	8
Residential	2	4	2	8
Unknown	-	1	-	1
Total	6	9	2	17

Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014–2016.

More females (12 victims, 71 percent) were involved in these incidents than males (5 victims, 29 percent). Figure 3 displays circulation entrapment counts for reported entrapments by gender and severity.

Figure 3
Number of Victims of Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs by Victim Gender and Injury Severity, 2012–2016



Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014–2016.

Most of the victims (67 percent for pool, 67 percent for spa, 100 percent for whirlpool bathtub) for each product category were female. Table 3 illustrates these counts.

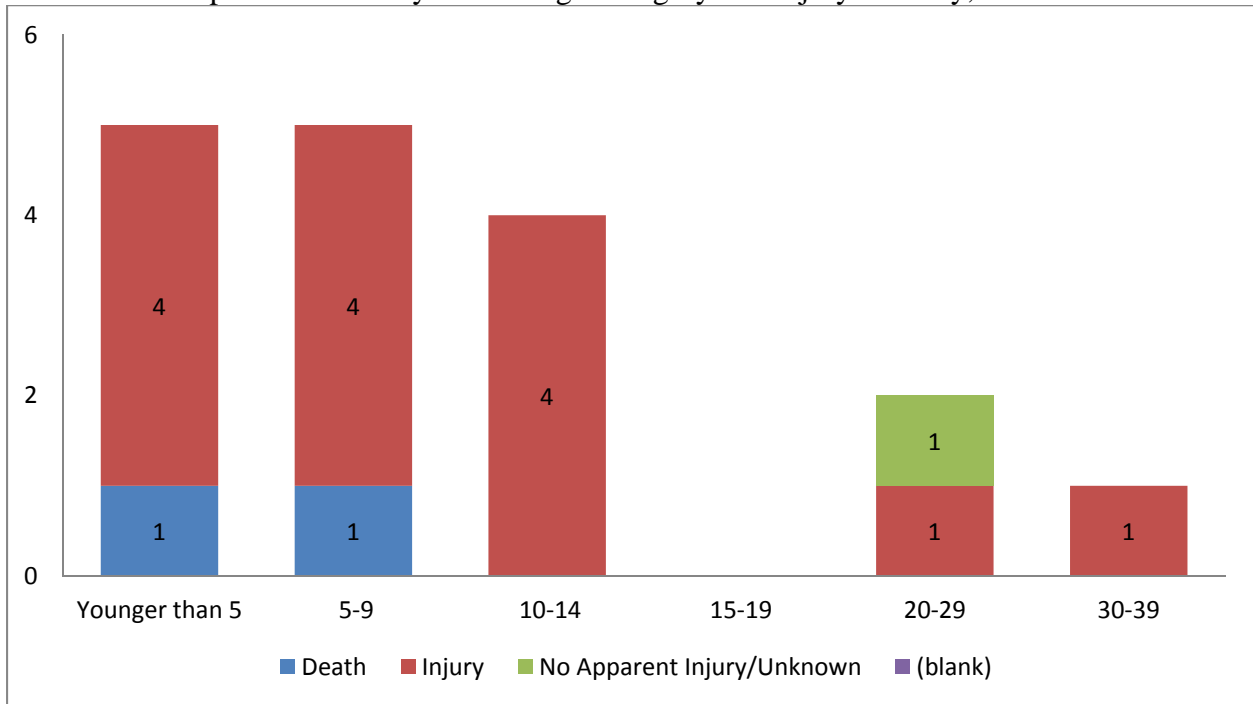
Table 3
Number of Victims of Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs by Victim Gender and Product Category, 2012–2016

Gender	Pool	Spa	Whirlpool Bathtub	Total
Female	4	6	2	12
Male	2	3	-	5
Total	6	9	2	17

Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014–2016.

Figure 4 shows the counts of reported victims by age category and injury severity. The majority of the victims (14 victims, 82 percent) were children and minors younger than 15 years of age; the rest were adults (3 victims, 18 percent). Children in the younger than 5 year (5 victims, 29 percent), 5 to 9 year (5 victims, 29 percent), and 10 to 14 year (4 victims, 24 percent) age categories had similar frequencies of circulation entrapments.

Figure 4
Number of Victims of Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs by Victim Age Category and Injury Severity, 2012–2016



Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014–2016. No victim falls in the 15 to 19 year, 40 to 49 year or the 50 and older age category.

Among children 14 years of age or younger, five (83 percent of pool victims) were associated with pools, seven (78 percent of spa victims) were associated with spas, and two (100 percent of the victims) were associated with whirlpool bathtubs. Table 4 lists these counts.

Table 4
Number of Victims of Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs by Victim Age Category and Product Category, 2012–2016

Victim Age Category (years)	Pool	Spa	Whirlpool Bathtub	Total
Younger than 5	3	2	-	5
5–9	1	2	2	5
10–14	1	3	-	4
15–19	-	-	-	-
20–29	1	1	-	2
30–39	-	1	-	1
40–49	-	-	-	-
50 and Older	-	-	-	-
Total	6	9	2	17

Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014–2016.

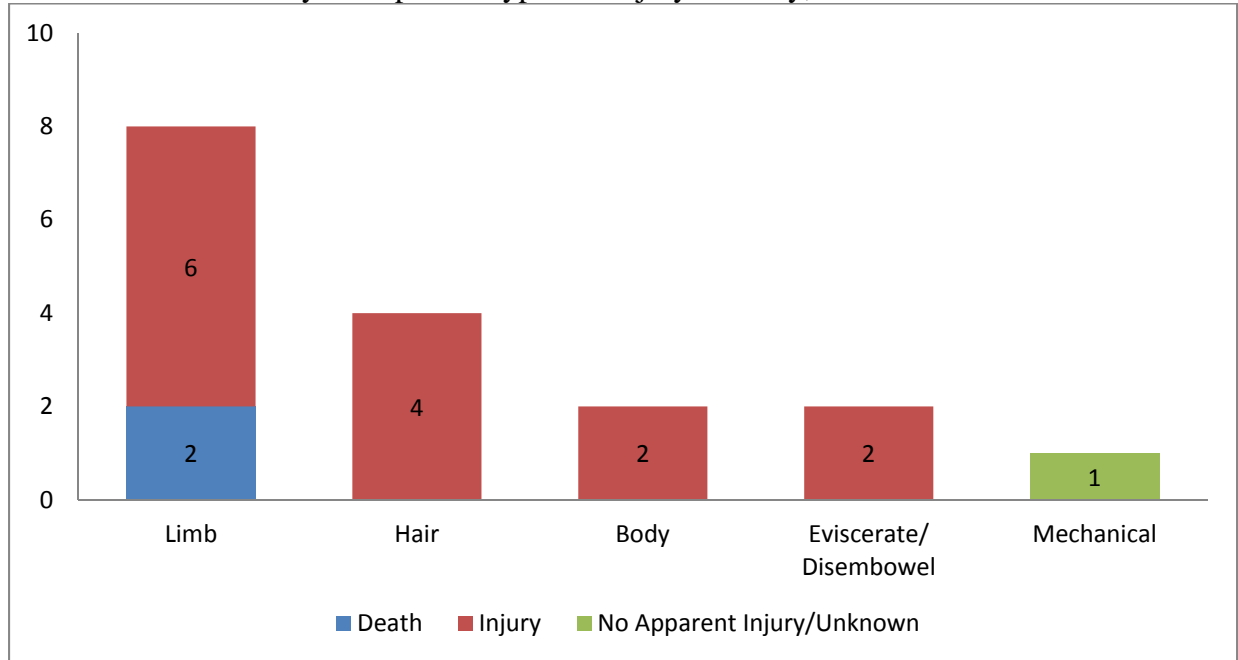
Using definitions developed by the Association of Pool and Spa Professionals (APSP), there are five types of circulation entrapment: (1) body, (2) limb, (3) evisceration/disembowelment, (4) hair, and (5) mechanical.³ “Limb entrapment” happens when a limb is sucked or inserted into an open sump or pipe. If only a limb was involved in the entrapment, then the incident was coded as “limb entrapment” (*i.e.*, arms, hands, legs, or feet). “Evisceration/disembowelment⁴” concerns suction applied directly to the intestines, such as when a child sits on an open sump. “Hair entrapment” occurs when hair becomes caught in an outlet cover. Incidents involving hair were coded as “hair entrapments.” “Mechanical entrapment” involves articles of clothing, jewelry, or appendages caught in an outlet cover. “Appendages” refer to digits (*i.e.*, fingers or toes). Incidents involving appendages only were coded as “mechanical entrapments.” Finally, “body entrapment” occurs when suction is applied to a large portion of the body or limbs. For purposes of this report, incidents were coded as a “body entrapment” if the entrapment involved a portion of the body not covered by the other types of entrapment. Examples of body entrapment include suction to areas such as: the shoulder and upper arm, abdomen, back, or hip.

The incidents reported to CPSC staff identified limb (8 victims, 47 percent) and hair (4 victims, 24 percent) as the most frequent types of entrapments. This is followed by body (2 victims, 12 percent), eviscerations/disembowelments (2 victims, 12 percent), and mechanical (1 victim, 6 percent) entrapments. Figure 5 displays the circulation entrapment victim data by entrapment type and injury severity.

³ ANSI/APSP-7 2006, *American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins*, p. viii.

⁴ Evisceration or disembowelment involves suction applied directly to the rectum with injuries ranging from prolapse of the rectum to small intestine removal. Incidents involving prolapsed rectums that retracted and required no further medical attention are now classified as eviscerations or disembowelments. They were previously counted as body entrapments.

Figure 5
Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs
by Entrapment Type and Injury Severity, 2012–2016



Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014–2016.

Among the six pool entrapment victims, half of them experienced limb (3 victims, 50 percent) entrapments, and the rest experienced body (1 victim, 17 percent) entrapments, evisceration/disembowelment (1 victim, 17 percent), and mechanical (1 victim, 17 percent) entrapments. The nine spa victims experienced more hair entrapments (4 victims, 44 percent) than other kinds of entrapments, and all of the hair entrapments for all products combined were associated with spas. The two whirlpool bathtub victims experienced only limb (2 victims, 100 percent) entrapments. Table 5 provides the counts by entrapment type and product category.

Table 5
Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs
by Entrapment Type and Product Category, 2012–2016

Circulation Entrapment Type	Pool	Spa	Whirlpool Bathtub	Total
Limb	3	3	2	8
Hair	-	4	-	4
Body	1	1	-	2
Eviscerate/Disembowel	1	1	-	2
Mechanical	1	-	-	1
Total	6	9	2	17

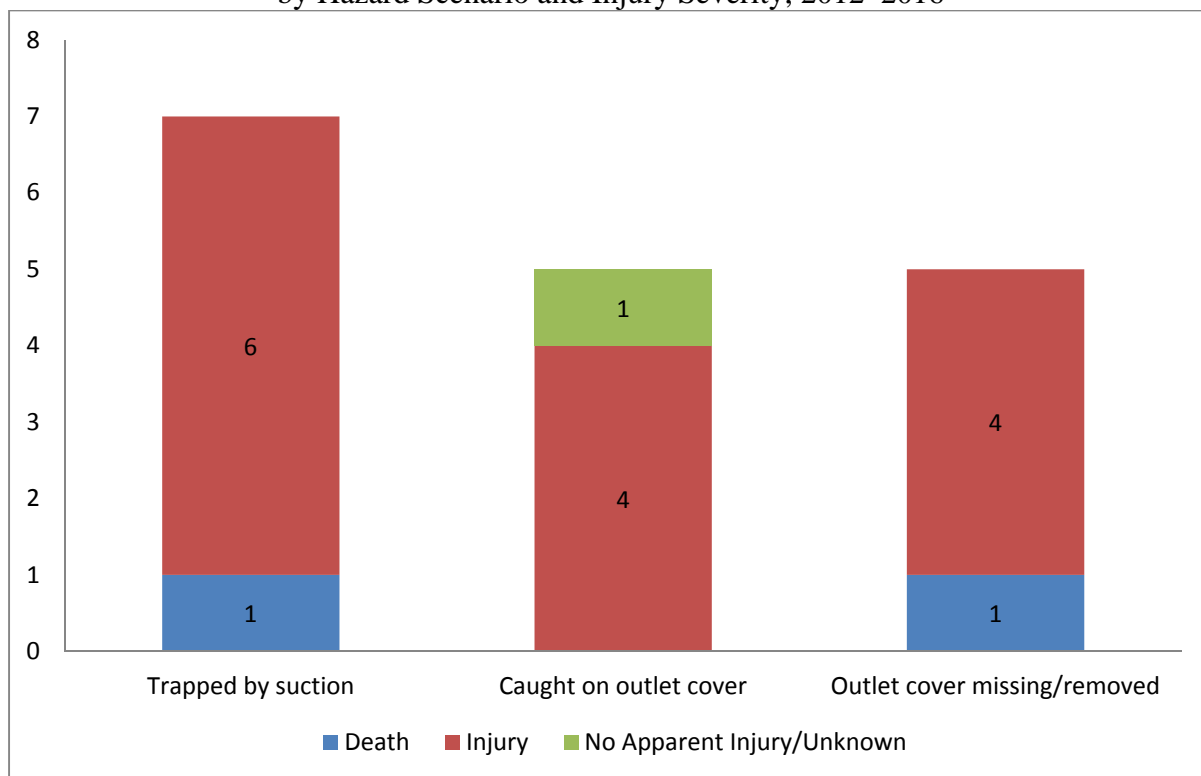
Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014–2016.

Hazard scenarios for the reported incidents fall into one of the following categories: trapped by suction; outlet cover missing/removed; caught on outlet cover; miscellaneous; and unknown. The incident scenarios were categorized by reviewing the report narratives and coding

the incidents based on the following hierarchical categories. If the report indicates that an outlet cover was missing or removed, then the incident was assigned to that respective category. If the report states that the individual was caught on the outlet cover, but there is no further description of the status of the cover, the incident was characterized as “caught on outlet cover.” If the report indicates that the suction was holding the individual down, but there is no further mention of the outlet, then the incident was classified as “trapped by suction.” An incident in which neither the outlet/outlet cover, nor suction was mentioned was categorized as “unknown.” An incident was classified as “miscellaneous” if the scenario was known but did not fit into the other categories.

Many of the incidents (7 victims, 41 percent) involved scenarios where the victim was being held to the drain by the suction force. It is followed by the category “caught on the outlet cover” (5 victims, 29 percent) and “missing or removed outlet covers” (5 victims, 29 percent). Figure 6 enumerates the results of the hazard scenario categorizations for circulation entrapments related to pools, spas, and whirlpool bathtubs.

Figure 6
Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs
by Hazard Scenario and Injury Severity, 2012–2016



Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014–2016.

Most of the pool victim scenarios (4 victims, 67 percent) were related to a missing or removed outlet cover. The spa victims were mainly trapped by suction (4 victims, 44 percent) or caught on an outlet cover (4 victims, 44 percent). All of the whirlpool bathtub victims were trapped by suction (2 victims, 100 percent). Table 6 shows these counts.

Table 6
 Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs
 By Hazard Scenario and Product Category, 2012–2016

Hazard Scenario	Pool	Spa	Whirlpool Bathtub	Total
Trapped by Suction	1	4	2	7
Caught on Outlet	1	4	-	5
Cover Outlet Cover Missing/Removed	4	1	-	5
Miscellaneous	-	-	-	-
Total	6	9	2	17

Source: CPSC databases, including CPSRMS and NEISS. Reporting is ongoing for 2014–2016.

Besides the incidents discussed in the preceding section, CPSC staff is also aware of another possible entrapment incident. According to the narrative from the hospital, “an 8 year old female was near drowning in a pool when she felt something pulled her down. Abrasions to the face and a chipped tooth were also noted.” Because the information is insufficient to determine this incident was definitely in scope, it is not included in the report, but it is listed in the Appendix B as a “possible” case.

Appendix A

Methodology for Extracting Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Bathtubs

This report covers the time frame from 2012 through 2016. Data were extracted on March 7, 2017⁵, from the Consumer Product Safety Risk Management System (CPSRMS) and the National Electronic Injury Surveillance System (NEISS) databases for the product codes enumerated in Table A for data entered in 2015-2016. These data were merged with the data from the 2016 report, which covered 2011-2015. The period was adjusted for the 2016 report to focus on recent incidents.

Table A–Product Codes Used in Extracting Circulation Entrapment Data

Product Code	Description
3221	Above-ground swimming pools
3251	Built-in swimming pools
3262	Swimming pool equipment
5043	Portable swimming pools
1246	Wading pools
1284	Swimming pools, not specified
3274	Swimming (activity)
698	Hot tubs or home spas
609	Glass bathtub or shower enclosures
610	Non-glass bathtub or shower enclosures
611	Bathtubs or showers
4030	Bathtub or shower enclosures, not specified

Within these product codes, suction/entrapment incidents were identified using the following keyword search terms: “SUCTION,” “SUCK,” “STUCK,” “TRAP,” “CAUGHT,” “HELD,” “TANGLE,” “UNDER,” “WEDGE,” “JAMM,” “DRAIN,” “PUMP,” “FILTER,” “PIPE,” “INTAKE,” “GRATE,” “COVER,” “HAIR,” “LIMB,” “ARM,” “HAND,” “FINGER,” “THUMB,” “LEG,” “FOOT,” “FEET,” “TOE,” “BRUISE,” “DROWN,” or “SUBMER.” Also, all NEISS cases were reviewed that had a diagnosis of “submersion (69).” NEISS data are from a probability-based sample. Sampling weights are used to project the cases from NEISS hospitals to national estimates, provided the sample counts are large enough. Due to the small number of suction/entrapment cases in NEISS, these cases were used in the case count and not projected nationally.

Reports were reviewed to eliminate cases that did not involve circulation entrapments. It should be noted that, for a given year, incidents are included on an ongoing basis for CPSRMS. CPSRMS combines death certificates (DTHS), In-Depth Investigations (INDP), and Injury and Potential Injury Incidents (IPII) from newspaper clippings, consumer complaints, state/local government referrals, and medical examiners/coroners. In addition, reports generally continue to

⁵ One record was revised after this date based on an investigation completed, while the report was under review.

be received for the most recent years. Information from these cases was extracted into an Excel spreadsheet and sorted by incident state and date. Source documents were checked to eliminate duplicate incident reports. Once the incident set was established, the incident reports were examined to code the additional characteristics of circulation entrapment type and hazard scenario.

Appendix B - Summary of 16 Reported (17 victims) Circulation/Suctions Entrapment Incidents for Pools, Spas, and Whirlpool Bathtubs, 2012–2016

Report #	Year	Product type	Severity	Age (yrs)	Sex	Entrapment type	Scenario	Narrative
1	2016	spa	Injury	6	F	hair	Caught on outlet cover	On February 19, 2016, a 6-year-old female nearly drowned in a non-swimming 2,500 gallon spa tub. The victim's hair unexpectedly became entrapped on one of the spa tub's six inch round suction outlet covers. The victim was immediately pulled out of the spa tub and was administered CPR by staff. The victim was able to regain consciousness and was taken to a local hospital by responding emergency medical services. No further information was available for the victim or her injuries. The facility was inspected and ordered closed by the new york city department of health & mental hygiene on February 29, 2016.
2	2016	spa	Injury	12	F	hair	Caught on outlet cover	A 12-year-old female was in an apartment community in-ground spa with friends when her hair became entangled in a drain cover on the wall of the spa. She was submerged under water for about two minutes, and was not able to free herself before her father pulled the drain cover off the spa wall with her hair still attached, and brought her to the surface. She had some difficulty breathing, and was vomiting blood and sputum, but was breathing normal when emergency personnel transported her to a local hospital for treatment related to the non-fatal drowning.
3	2016	spa	Death	7	M	limb	Outlet cover missing/removed	On November 5, 2016, a 7-year-old boy drowned in a residential in-ground spa when his hand and foot got caught in the spa's floor drain. The 3 HP pump was on that pulls water from the bottom of the spa and drains into the pool, creating suction pressure. There was no cover on the drain.
4	2015	Spa	Injury	13	M	Body	Trapped by suction	A 13-year-old male became entrapped on a skimmer in a newly constructed spa in the backyard of his residence. EMS responded and the victim was taken to the hospital and released the same day. The victim sustained a large bruise to his back and wrinkling of the skin.
5	2014	Spa	Death	4	M	Limb	Trapped by suction	On May 30, 2014, a four year-old boy drowned when his left hand became caught in a residential spa's uncovered single suction drain opening. The victim's great grandparents were close by, but they could not remove his hand from the drain. The spa's original flat grate cover had broken many years before and an anti-vortex cover was installed. This cover detached from the drain about two years before the incident and was never re-secured. The victim was a good swimmer and the water was fairly shallow, but the entrapment held the boy submerged at the bottom of the spa.

Report #	Year	Product type	Severity	Age (yrs)	Sex	Entrapment type	Scenario	Narrative
6	2014	Spa	Injury	12	F	Hair	Caught on outlet cover	On March 10, 2014, a 12 year old girl was playing in a hotel hot tub when her hair became caught in the hot tub's filter, while she was under water. The grandfather had to cut the girl's hair to pull her from under the water. The girl was taken to the hospital for further treatment but has made a full recovery after this incident.
7	2013	Pool	Injury	2	F	Body	Outlet cover missing/removed	The consumer stated that her 2-yo daughter (25 lbs) lifted up the lid of the pool skimmer, stepped into it and squatted down when it sucked her into the intake. The consumer stated that the child's front vaginal region had some tears, severe bruising and swelling.
8	2013	Pool	Injury	5	M	Limb	Outlet cover missing/removed	A five year old male spent several days in the hospital following a near drowning experience. The victim was being supervised by his aunt while swimming in a residential in-ground swimming pool. The victim attempted to retrieve a toy that was lodged in the pool's main drain and his arm became entrapped in the drain. It is suspected that the drain lacked a cover. After several attempts he was successfully extracted and resuscitative measures were taken. The victim was conscious and alert by the time emergency personnel arrived and transported him to the hospital.
9	2012	Spa	Injury	31	F	Limb	Trapped by suction	A 31-yr-old female was lounging in a hot tub/bathtub in her hotel bathroom where the hot tub/bathtub drain on the side of the bathtub pulled the right side of her leg into the drain. She had to have her husband help her pull her leg off the drain. She suffered a bruise that was red and purple and was the size of about two to three inches in diameter. She did not seek medical treatment. The injury took about a week to heal.
10	2012	Pool	Injury	3	F	Eviscerate/ Disembowel	Outlet cover missing/removed	A 3-year old female was entrapped on an uncovered single drain inside a wader pool. The drain cover came off the drain. It was determined that only two screws instead of four secured the drain cover to the drain. The safety vacuum release system (SVRS) did not activate. The owner of the pool shut off the SVRS and pump using a secondary on/off switch and the child was immediately released. The child was taken to a hospital where she was treated for a prolapsed rectum. She was released the next day.
11	2012	Pool	Injury	4	F	Limb	Outlet cover missing/removed	A four year old female stuck her arm and hand into the open vacuum port hole in the side of the swimming pool where she became stuck. She received only a couple of scratches to her lower left arm. The vacuum pump was not operating at the time of the incident.

Report #	Year	Product type	Severity	Age (yrs)	Sex	Entrapment type	Scenario	Narrative
12	2012	Pool	Injury	10	M	Limb	Trapped by suction	A 10-year-old boy suffered bruising on both thighs when he became trapped on a lily pad skimmer in a condominium pool. Bystanders broke the skimmer to release suction from the pump and release the victim's legs. The pool pump was on direct suction without a secondary anti-entrapment system.
13	2012	Pool	No App/Unk Injury	29	F	Mechanical	Caught on outlet cover	This incident involved an in-ground, pool, drain entrapment where body jewelry became stuck in a drain in the zero depth area of a public swimming pool. This indoor swimming pool is located inside a recreational center. This incident was not a suction type entrapment. The 29-year-old female, who became stuck in the drain, was uninjured as a result of this incident. The local fire department who responded to this incident, helped free the victim from the drain cover by removing the drain cover from the bottom of the pool. After the drain cover was removed, a fire fighter was able to manipulate the navel ring, so that it was released from the drain and the victim was freed.
14	2012	Spa	Injury	3	F	Eviscerate/ Disembowel	Trapped by suction	3 YOF Patient was home sitting in hot tub when she got stuck onto a vent. Mom pulled her out now w/ rectal prolapse. Diagnosis rectal prolapse.
15	2012	Spa	Injury	21	F	Hair	Caught on outlet cover	21 YOF got hair caught in hot tub drain and went under near drowning
16a	2012	Whirlpool bathtub	Injury	6	F	Limb	Trapped by suction	Two girls, ages 6 and 7, became suctioned to the intake grate cover in a whirlpool bathtub while taking a bath together. The children sustained bruises on their legs. No additional medical treatment was sought and the bruising subsequently healed without further complications or injuries.
16b	2012	Whirlpool bathtub	Injury	7	F	Limb	Trapped by suction	
Possible	2015	Pool	No App/Unk Injury	8	F	Unknown	Unknown	8 YOF near drowning in pool at camp when pt states felt something pulled down swimming, also noting abrasions to face and chipped tooth.