Water-Related Incidents in Maricopa County, 2010

Abstract
This report describes water-related incidents that activated the 9-1-1 emergency systems. Data in this report are derived mainly from case reports submitted by fire departments in Maricopa County. During 2010 the ADHS surveillance system received reports concerning 64 serious water-related incidents that occurred in the metro area among person of all ages. Among the 38 incidents involving children less than 5 years of age, 38 incidents occurred in pools.
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Acknowledgements: The document acknowledges the University of Arizona College of Medicine students Christian J. Dameff and Jeff Tully for their contribution to data collection and coding of water-related incidents for 2010-2011 time-period. The report also acknowledges Dr. Timothy Flood, Christian J. Dameff and Jeff Tully for reviewing and providing feedback on this report.

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</tr>
</tbody>
</table>
Introduction

According to Center for Disease Control (CDC), approximately ten people die in the United States from unintentional drowning every day and drowning is the sixth leading cause of unintentional injury death for people of all ages. Unintentional drowning is the second leading cause of death for children ages 1 to 14 years in the U.S. [1]. Further, nonfatal drowning may result in brain damage with long-term disabilities that may include memory problems, learning disabilities, and permanent loss of basic functioning (e.g., permanent vegetative state). The most recent U.S. Vital Statistics report, available for 2007, indicates that males, children under five years of age (1 to 4 years), and persons of African American or Native American race are at increased risk for fatal unintentional drowning [1].

In the mid 1980’s the drowning death rate of Arizona’s preschoolers ranked first in the nation [6]. Warm weather, long summers, and the presence of more than 300,000 residential swimming pools make Arizona prone to water-related incidents. To address the problem of water-related incidents in the Phoenix metropolitan area (called “Maricopa County” in this report), the Drowning Prevention Coalition of Arizona (DPCA) was formed in 1988. This Coalition is comprised of municipal fire departments, hospitals, the state and county health departments, community organizations, pool builders, suppliers of pool safety equipment, parents of drowned victims, corporations, and others.

Unlike reports in previous years this incidence report serves as a supplement to the child death report for 2007-2010 compiled using Child Fatality Review (CFR) data. This report describes water-related incidents (WRI) that activated the 9-1-1 emergency system during 2010, compares the 2010 findings to those in previous years, and analyzes for risk factors. Much of the report focuses on children less than five years of age, and specifically on incidents occurring in swimming pools.

Background

Since 1988, the Arizona Department of Health Services (ADHS) has monitored water-related incidents as reported by local fire departments and EMS agencies. These agencies usually are first on the scene after 9-1-1 calls and are generally able to provide information gathered on scene. We assume that very few serious incidents occur without activation of 9-1-1. The agencies voluntarily submit case reports on a Standard Incident Report Form (see appendix) developed in conjunction with the Drowning Prevention Coalition of Arizona (DPCA). The fire departments do not submit reports of calls to 9-1-1 that are canceled. This data surveillance system relies heavily upon these agencies to self-report all the serious cases occurring within their jurisdictions, but participation is not mandated.

Incidents in the surrounding lakes and/or nearby Salt or Verde Rivers that are popular recreational areas adjacent to Phoenix metropolitan areas are investigated by the Maricopa County Sheriff’s Office. However, these incidents have not been consistently reported to ADHS and therefore have not been systematically incorporated into the analyzable data set.

The reported data items include the age and gender of the victim, the location and approximate time of the incident, and the apparent circumstances surrounding the event. The ADHS Bureau of Public Health
Statistics (BPHS) has traditionally received and analyzed the case incident forms. Starting 2010 these forms were received by the Bureau of Emergency Medical Services & Trauma System (BEMS).

This report serves as a supplement to the child death report for 2007-2010 compiled using Child Fatality Review (CFR) data by the Office of Assessment and Evaluation (OA&E) within the Bureau of Women’s and Children’s Health (BWCH) at ADHS. This supplement preserves most of the core elements from the previous years for continuity and sheds more details on some potential ‘causes.’

**Methodology**

3.1 Incident terms

During 1992-2010 there were a total of 2,413 incidents reported during the 19-year span. These incidents are divided into 2 categories: minor “dunkings” and serious “water related incidents.”

**Case definition** - A water-related incident (WRI) in this report is defined as an incident in which a fire department (FD) responded to a 9-1-1 emergency call. We include in the analysis any incident in which the victim was given CPR, was not breathing, and was submerged or not struggling when retrieved from the water. The victim may die the same day or at a later time, and in some cases the victim may fully recover. Out of the 2,413 incidents, 76.1% (n = 1,837) were determined to be a water-related incident (see figure 1).

Excluded from the analysis are incidents that did not appear to be life-threatening, (e.g. an incident in which a victim was struggling and did not require CPR) and those that are ‘minor incidents,’ ‘near misses,’ or ‘close-calls.’ All such cases are referred to as ‘dunkings.’ During 1992-2010 there were a total 576 ‘dunkings’ that were excluded from further analysis.

3.2 Data, sample, design and measures – The study design is observational and data were obtained from the BPHS and BEMS bureaus which collected and validated the incident case reports. Historically, data have been validated in conjunction with the coalition. In addition, the surveillance system searches the local newspaper (the Arizona Republic) and television daily for reports of water-related incidents. When found, articles are downloaded or clipped,¹ and attached to the agency submitted reports. Sometimes there is no report from the agency. If a report from the fire department is missing, then ADHS contacts the fire department to request a submission. When an agency does not submit a case report and the case appears to be serious, the information from the news clipping is used to create a case report, although specific data elements obtainable from new clippings are limited [7-9].

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¹ The Children’s Safety Zone collaborates with local fire departments, hospitals and media to gather statistics and stories on water related incidents and fatalities in Arizona. See [http://childrensafetyzone.com/gp/](http://childrensafetyzone.com/gp/)
Because no identifying information is collected in most agency submitted reports, matching the records to administrative databases is difficult. Hence, outcomes, specifically those that relate to severe impairment and/or death are not reported here.

As outlined in the sample flow chart (see Figure 1) there were 1,837 water-related incidents reported during 1992-2010 of which three-quarters (n = 1,369; 75%) were related to pool incidents. This makes a compelling case to assess the factors associated with water-related incidents in pools.

The incident case report obtained from fire departments provides some information on water-related incidents and the circumstances surrounding the event. The data and measures discussed in this supplemental report rely mostly on the incident case report.
3.3 Statistical Measures

In this supplemental report the primary variable of interest (in statistical terms called the “outcome” variable) is type of water-related incident. Water-types on the incident form are recorded as ‘bath-tub,’ ‘pool-in ground,’ ‘Spa,’ ‘pool-above ground,’ ‘canal or irrigation ditch,’ ‘bucket,’ ‘lake’ and ‘other.’ A dichotomous variable for water-type was created to indicate water-type (1 = pool; 0 = other than a pool).

Two predictor variables of interest also were created from breach conditions that indicate whether or not the incident could have been prevented and these conditions are relevant to pool incidents and children less than 5 years of age. These conditions are recorded as:

- no barrier at all: “incident would have been prevented if there were a barrier;”
- fence inadequate: “the fence (either inner fence or yard fence) was inadequate; too low, had a hole, broken bars, climbable, etc.;”
- gate failed: “the gate or latch to the gate failed or was propped open;”
- lapse in supervision: “there was a lapse in supervision when child was in the water or inside the inner fence;”
- supervisor left area: “supervisor left the area, child was in or near the water and inside a protected area;”
- back door inadequate: “the back door self-closer or latcher was inadequate or propped open;”
- pool cover inadequate: “pool cover was inadequate or left open;”
- child let into secure area: “child was let into an otherwise secure area/then supervisor left;”
- unknown.

The first predictor variable was created from two breach conditions “lapse in supervision” and “supervisor left the area” as described above as a dichotomous predictor variable called inadequate supervision (1 = inadequate; 0 = other). The second predictor variable was created from five breach conditions “no barrier at all,” “inadequate fence,” “gate failed,” “back door inadequate,” and “pool cover inadequate” as a dichotomous predictor variable called inadequate barrier (1 = inadequate; 0 = other).

Other variables such as whether the incident occurred in the victim’s home or other place (1 = victim’s home; 0 = other), and a series of dummy variables for caregiver/supervisor at the time of incident (1 = mother or father and 0 = other; 1 = grandparent and 0 = other; 1 = both parents and 0 = other; 1 = other child and 0 = other; 1 = other adult and 0 = other) were created. Time variables such as hour of incident was included in the analysis as continuous variable. Also assessed were day of the week (1 = weekend; 0 = weekday) and season of the incident as summer (May through September) and winter months.

Demographic variables such as age, gender, race and ethnicity reported in the incident form were also utilized and appropriate dummy variables were created.

3.4 Analytic procedures – Bivariate and multivariate methods were utilized to compare the risks for a water-related incident. Chi-Square tests and logistic regression analyses was conducted using SAS v9.2 (SAS Institute, Inc., Cary, NC). Three-year moving average for water-related incidents was utilized apart from incident rates and Cochran-Armitage test was utilized to test for any significant monotonic trend.
Results and Conclusion

During the 19-year span of 1992-2010 there were a total of 1,837 water-related incidents reported in Maricopa County. Three quarters (n = 1,369; 74.5%) of these incidents were pool related and the remainder one quarter (n = 468; 25.5%) related to other water-types. Because a large percentage of water-related incidents involved pools the majority of this analysis is focused on describing the nuances of pool incidents and an explanatory model assessing factors contributing to this type of water-related incident is presented.

4.1 1992-2010 results - Figure 1A presents the distribution of water-related incidents during the 1992-2010 time-periods. In 1992 there were a total of 102 incidents reported of which 81 (79.4%) related to pool and the remainder 21 (20.6%) to other water-types. Similarly, in 2010 there were a total of 64 incidents reported of which 53 (82.8%) related to pool and the remainder 11 (17.2%) related to other water-types. While the total counts of reported incidents have declined the proportion of pool and non-pool incidents remain similar.

Figure 1A.

Figure 1B on the following page outlines the distribution of water-related incidents by two major age-categories: children less than 5 years of age; and victims 5 years or older. It is evident from the figure that the percentage of water-related incidents in general has been higher for children less than five years of age. Because a large percentage of water-related incidents are pool incidents it implies that a
disproportionate burden of these incidents involve children less than five years of age. Figure 2 tests the proposition that age (‘< 5 years’ or ‘5 and older’) relates to the body of water (pool vs not a pool) in which an incident occurs. Figure 2 shows a greater proportion of pool incidents (67%) involving children under 5 years of age than non-pool incidents (51%) involving children under 5 years of age.

Figure 1B.

Figure 2.

Proportion of water-related incidents by water-type and age-group during 1992-2010

Notes: Non-pool includes bathtub, bucket, river/lake, canal/irrigation, SPA, toilet, and other

***Chisquare indicates statistically significant difference at p < 0.05. Odd ratios suggest that the risk of pool incidents increases by 2 times for children 0 to 4 years than other age-groups.
It is evident from figure 2 that the percentage of pool incidents is higher (67%) in children less than 5 years of age compared to those who are older (33%) during 1992-2010. This difference in percentage was statistically significant. Although we find a similar pattern in 2010 (63% in children less than five years of age versus 37%) with regards to pool incidents the difference was not significant. This finding is consistent with literature that reports that the majority of the drowning incidents among one to four year olds occur in residential swimming pools.

Table 1 gives an overview percentage of incidents in major cities in Maricopa County by major age-group during 1992-2010. During 1992-2010, Phoenix recorded a total of 924 incidents, followed by Mesa (n = 295), Glendale (n = 110), Gilbert (n = 80), Scottsdale (n = 78), Chandler (n = 66), Peoria and Tempe (n = 62), rural area in Maricopa (n = 48), and Avondale (n = 24).

Table 1. Percentage of water-related incidents in pools, by city and by major age-group

<table>
<thead>
<tr>
<th>City name</th>
<th>Percentage of incidents during 1992-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 years or older</td>
</tr>
<tr>
<td>Apache Junction (n=7)</td>
<td>29%</td>
</tr>
<tr>
<td>Avondale (n=24)</td>
<td>33%</td>
</tr>
<tr>
<td>Buckeye (n=6)</td>
<td>0%</td>
</tr>
<tr>
<td>Cave Creek (n=2)</td>
<td>50%</td>
</tr>
<tr>
<td>Chandler (n=66)</td>
<td>24%</td>
</tr>
<tr>
<td>El Mirage (n=4)</td>
<td>25%</td>
</tr>
<tr>
<td>Gilbert (n=80)</td>
<td>28%</td>
</tr>
<tr>
<td>Glendale (n=110)</td>
<td>26%</td>
</tr>
<tr>
<td>Goodyear (n=6)</td>
<td>60%</td>
</tr>
<tr>
<td>Litchfield Park (n=2)</td>
<td>100%</td>
</tr>
<tr>
<td>Mesa (n=295)</td>
<td>33%</td>
</tr>
<tr>
<td>New River (n=1)</td>
<td>100%</td>
</tr>
<tr>
<td>Other &amp; Unknown Maricopa Co (n=21)</td>
<td>90%</td>
</tr>
<tr>
<td>Paradise Valley (n=11)</td>
<td>18%</td>
</tr>
<tr>
<td>Peoria (n=62)</td>
<td>53%</td>
</tr>
<tr>
<td>Phoenix (n=924)</td>
<td>37%</td>
</tr>
<tr>
<td>Queen Creek (n=4)</td>
<td>50%</td>
</tr>
<tr>
<td>Rural Area Maricopa Co (n=48)</td>
<td>60%</td>
</tr>
<tr>
<td>Salt River (n=6)</td>
<td>33%</td>
</tr>
<tr>
<td>Scottsdale (n=78)</td>
<td>39%</td>
</tr>
<tr>
<td>Sun City (n=1)</td>
<td>0%</td>
</tr>
<tr>
<td>Sun Lakes (n=2)</td>
<td>100%</td>
</tr>
<tr>
<td>Surprise (n=15)</td>
<td>40%</td>
</tr>
<tr>
<td>Tempe (n=62)</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Total (n=1837)</strong></td>
<td><strong>37%</strong></td>
</tr>
</tbody>
</table>
It is evident that the percentage of pool incidents in these cities was generally higher in children less than 5 years of age. Table 2 gives an overview of the incidents in all water types by cities and different age categories for 2010. Out of the total 64 incidents reported in 2010, 70 percent (n = 45) were in Phoenix.

Table 2. Water-related incidents (all water types) in 2010 by city and age categories

<table>
<thead>
<tr>
<th>City of Incident</th>
<th>0-4</th>
<th>5-14</th>
<th>15-34</th>
<th>35-64</th>
<th>65+</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avondale</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Buckeye</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chandler</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>El Mirage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gilbert</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Glendale</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Goodyear</td>
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<td>0</td>
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<td>0</td>
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<tr>
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<td>0</td>
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<td>4</td>
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<tr>
<td>Paradise Valley</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Peoria</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Phoenix</td>
<td>28</td>
<td>3</td>
<td>3</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>45</td>
</tr>
<tr>
<td>Maricopa Co, rural</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Scottsdale</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
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<td>8</td>
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<td>Sun Lakes</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>Surprise</td>
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<td>0</td>
</tr>
<tr>
<td>Tempe</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other &amp; Unknown</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38</strong></td>
<td><strong>6</strong></td>
<td><strong>5</strong></td>
<td><strong>11</strong></td>
<td><strong>1</strong></td>
<td><strong>3</strong></td>
<td><strong>64</strong></td>
</tr>
</tbody>
</table>

Table 3. Water-related incidents in 2010 by water-type and age categories

<table>
<thead>
<tr>
<th>Water type</th>
<th>0-4</th>
<th>5-14</th>
<th>15-34</th>
<th>35-64</th>
<th>65+</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathtub</td>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Bucket</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Canal/Irrigation Ditch</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fish/Decorative Pond</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>Other</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pool, in ground</td>
<td>31</td>
<td>5</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>51</td>
</tr>
<tr>
<td>Pool, above ground</td>
<td>1</td>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>River/Lake</td>
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<td>0</td>
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<td>4</td>
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<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38</strong></td>
<td><strong>6</strong></td>
<td><strong>5</strong></td>
<td><strong>11</strong></td>
<td><strong>1</strong></td>
<td><strong>3</strong></td>
<td><strong>64</strong></td>
</tr>
</tbody>
</table>
Table 3 gives an overview of the incidents in 2010 by water-type and age categories. It is evident that 53 (51 + 2) out of the 64 water-related incidents were pool incidents.

Because the majority of the water-related incidents are pool incidents involving children less than five years of age, the subsequent results presented here pertains to this ‘early childhood’ population.

Table 4 gives an overview of the demographics of the population that ‘experienced’ a water-related incident during 1992-2010 time periods.

**Table 4. Distribution of water-related incidents in pools by age, gender, and race/ethnicity in children less than 5 years of age.**

<table>
<thead>
<tr>
<th>Demographic variables</th>
<th>2010 (N =38)</th>
<th></th>
<th>1992-2010 (N =1,145)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percent</td>
<td>Count</td>
<td>Percent</td>
</tr>
<tr>
<td>Age Less than one year</td>
<td>2</td>
<td>5.3%</td>
<td>97</td>
<td>8.5%</td>
</tr>
<tr>
<td>Age One year</td>
<td>5</td>
<td>13.2%</td>
<td>373</td>
<td>32.6%</td>
</tr>
<tr>
<td>Age Two years</td>
<td>17</td>
<td>44.7%</td>
<td>324</td>
<td>28.3%</td>
</tr>
<tr>
<td>Age Three years</td>
<td>7</td>
<td>18.4%</td>
<td>242</td>
<td>21.1%</td>
</tr>
<tr>
<td>Age Four years</td>
<td>7</td>
<td>18.4%</td>
<td>109</td>
<td>9.5%</td>
</tr>
<tr>
<td>Females</td>
<td>14</td>
<td>36.8%</td>
<td>464</td>
<td>40.5%</td>
</tr>
<tr>
<td>Males</td>
<td>24</td>
<td>63.2%</td>
<td>679</td>
<td>59.3%</td>
</tr>
<tr>
<td>Gender unknown</td>
<td>2</td>
<td>0.0%</td>
<td>2</td>
<td>0.2%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>17</td>
<td>44.7%</td>
<td>304</td>
<td>26.6%</td>
</tr>
<tr>
<td>Non-Hispanic African American</td>
<td>1</td>
<td>2.6%</td>
<td>48</td>
<td>4.2%</td>
</tr>
<tr>
<td>Non-Hispanic Asian or Pacific Islander</td>
<td>1</td>
<td>2.6%</td>
<td>14</td>
<td>1.2%</td>
</tr>
<tr>
<td>Non-Hispanic Native American</td>
<td>0</td>
<td>0.0%</td>
<td>15</td>
<td>1.3%</td>
</tr>
<tr>
<td>Non-Hispanic Other Race</td>
<td>0</td>
<td>0.0%</td>
<td>14</td>
<td>1.2%</td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>16</td>
<td>42.1%</td>
<td>603</td>
<td>52.7%</td>
</tr>
<tr>
<td>Unknown race and ethnicity</td>
<td>3</td>
<td>7.9%</td>
<td>147</td>
<td>12.8%</td>
</tr>
</tbody>
</table>

It is evident that males and non-Hispanic Whites shared a disproportionate burden of water-related incidents in zero through four age category. During 1992-2010 there were 679 (59.3%) water-related incidents among males out of a total of 1,145 incidents. Similarly, in 2010, there were 24 (63.2%) water-related incidents among males out of a total of 38 incidents. This finding is consistent with the literature that reports male children less than five years of age have an increased the risk of fatal and non-fatal drowning. However, with regards to race and ethnicity the percentage of incidents was higher among non-Hispanic Whites compared to other race and ethnic minorities, while the national data available suggests that being African American and/or Native American increases the risk of fatal and/or non-fatal drowning.

Table 5 presented in the next page gives an overview of water-related incidents by type of water body. As noted earlier, the majority of the water-related incidents during 1992-2010 and 2010 specifically involved pools. For instance, 32 (31 + 1) out of a total of 38 incidents were in pools in 2010 and 914 incidents (870 + 40) out of a total of 1,145 incidents occurred in pools during 1992-2010.
Table 5. Water-related incidents by water-type in children less than 5 years of age by water-type

<table>
<thead>
<tr>
<th>Water-type</th>
<th>2010</th>
<th>Percent</th>
<th>1992-2010</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathtub</td>
<td>3</td>
<td>7.9%</td>
<td>105</td>
<td>9.2%</td>
</tr>
<tr>
<td>Bucket</td>
<td>0</td>
<td>0.0%</td>
<td>38</td>
<td>3.3%</td>
</tr>
<tr>
<td>Canal/Irrigation Ditch</td>
<td>0</td>
<td>0.0%</td>
<td>21</td>
<td>1.8%</td>
</tr>
<tr>
<td>Fish/Decorative Pond</td>
<td>0</td>
<td>0.0%</td>
<td>13</td>
<td>1.1%</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0.0%</td>
<td>4</td>
<td>0.3%</td>
</tr>
<tr>
<td>Pool, Above Ground</td>
<td>1</td>
<td>2.6%</td>
<td>40</td>
<td>3.5%</td>
</tr>
<tr>
<td>Pool, In Ground</td>
<td>31</td>
<td>81.6%</td>
<td>874</td>
<td>76.3%</td>
</tr>
<tr>
<td>River/Lake</td>
<td>0</td>
<td>0.0%</td>
<td>14</td>
<td>1.2%</td>
</tr>
<tr>
<td>Spa</td>
<td>3</td>
<td>7.9%</td>
<td>30</td>
<td>2.6%</td>
</tr>
<tr>
<td>Toilet</td>
<td>0</td>
<td>0.0%</td>
<td>3</td>
<td>0.3%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
<td>0.0%</td>
<td>3</td>
<td>0.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>1145</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Figure 3A gives an overview of the count of reported pool incidents involving children less than five years of age during 1992-2010. It is evident that there is variation from year to year on the reported incidents, with year 1993 having the highest count (n = 66) and year 2008 having the least (n = 30).

Figure 3A.
While there are inherent merits in examining the counts, rates provide a better overview of the trends in water-related incidents. Figure 3B provides an overview of the pool incident rate\(^2\) and a three-year moving average rate for children less than five years of age. The trend indicates that in general the pool incident rates have been declining. However, a formal test of monotonic trend\(^3\) indicated non-significant decline.

**Figure 3B.**

Seasonality is an important factor when assessing water-related incidents as it is expected that there would be more ‘water-related activities’ such as swimming, boating etcetera in summer than in winter. Consequently, the proportion of water-related incidents should also “rise and fall” depending on the time of the year.

Figure 4A displays the count of pool incidents during 1992-2010 in children less than five years of age by month. There were a total of 914 pool incidents involving children less than five years of age during this time-frame. Incidents peak during the summer months (May through September) and lessen during winter months. In general, June (\(n = 176\)) and July (\(n = 161\)) have the highest number of incidents accounting for slightly over one-third of the total pool incidents during 1992-2010 time periods followed by May (\(n = 114\)) and August (\(n = 113\)) which account for one fourth of the total pool incidents.

\(^2\) Pool incident rate is calculated as the number of pool incidents in a particular year divided by the estimated population for that age-group in that year.

\(^3\) Test for monotonic trend was assessed using Cochran-Armitage trend with \(p = 0.10\).
Figure 4A.

Water-related incidents in pool during 1992-2010 in children less than 5 years of age by month

Figure 4B.

Water-related incidents by water-type and season during 1992-2010 in children less than 5 years of age

Notes: Summer months are May through September and non-pool includes bathtub, bucket, river/lake, canal/irrigation, SPA, toilet, and other

***Chi-square statistic indicated significant differences at p < 0.01. Odds-ratio suggests that the risk of pool incidents increases by 2 times in summer than in winter
Figure 4B displays an association between summer months and the type of water-related incident (i.e. whether a pool incident or a non-pool incident). The percentage of pool incidents involving children less than five years of age is higher during summer (85%) compared to non-pool incidents (15%) and the risk of pool incidents increases by two times during summer compared to winter months. There is little and/or no literature on seasonality and its association with water-related incidents and therefore, this finding suggests that public health messages surrounding pool incidents should be initiated early during summer months to provide a warning to parents and/or caregivers about the risk of fatal and/or non-fatal drowning.

Figure 5A displays the total count of pool incidents by day of the week and the pattern suggests that weekends (i.e. Saturday and Sunday) in general have higher frequency of pool incidents ($314 = 165 + 164$) accounting for over one-third of the total number of pool incidents involving children less than five years of age. A minor peak is noted on Wednesdays ($n = 139$).

**Figure 5A.**

![Water-related incidents in pool during 1992-2010 by days of week in children less than 5 years of age](image)

Figure 5B compares days of the week (i.e. weekends) and a water-related incident in children less than five years of age. There is no association between a water-related incident (pool versus non-pool) and whether it is weekend (Saturday and Sunday versus other weekdays). Relative to the number of incidents in all types of water the proportion in pools and non pools is not affected by the day of the week. That is, about 80% of all WRI occur in pools on the weekdays and on the weekends.
Figure 5B.

Water-related incidents by water-type and day of week during 1992-2010 in children less than 5 years age

![Bar chart showing water-related incidents by water-type and day of week during 1992-2010 in children less than 5 years age.](image)

Notes: Non-pool includes bathtub, bucket, river/lake, canal/irrigation, SPA, toilet, and other.

Figure 6.

Water-related incidents by water-type and time of day during 1992-2010 in children less than 5 years of age

![Line chart showing water-related incidents by water-type and time of day during 1992-2010 in children less than 5 years of age.](image)

Notes: Non-pool includes bathtub, bucket, river/lake, canal/irrigation, SPA, toilet, and other.
Figure 6 displays the time (hour) of incident in six-hour blocks. It is evident that number of incidents "rise and fall" with time with a large number of incidents between 12 pm to 5 pm. For instance, in children less than five years of age the total number of pool incidents between 12 pm to 5 pm is 495, which accounts for more than fifty percent of the total pool incidents. Similarly, the total number of non-pool incidents between 12 pm to 5 pm is 118, which also accounts for slightly more than 50 percent of the incidents.

In any epidemiological analysis time and place characteristics are important factors. Earlier we found that pool incidents are higher in summer months and we also found that a large percentage of water-related incidents (pool and non-pool) occur between 12 pm to 5 pm.

The standard incident form also records the place of incidents. Table 6 presents the place of water-related incident as recorded on the incident form. It is evident that majority (n = 768) of the water-related incidents during 1992-2010 and 2010 in children less than five years of age occurred at victim's home followed by a relative's home consistent with the fact that the proportion of pool incidents is generally higher in this population.

Table 6. Water-related incidents in any water type in children less than 5 years of age by site of incident

<table>
<thead>
<tr>
<th>Site of incident</th>
<th>2010</th>
<th>1992-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percent</td>
</tr>
<tr>
<td>Friend's home</td>
<td>2</td>
<td>5.3%</td>
</tr>
<tr>
<td>Neighbor's home</td>
<td>1</td>
<td>2.6%</td>
</tr>
<tr>
<td>Public and Semi-public</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Relative's home</td>
<td>5</td>
<td>13.2%</td>
</tr>
<tr>
<td>Victim's home</td>
<td>26</td>
<td>68.4%</td>
</tr>
<tr>
<td>Other unknown</td>
<td>4</td>
<td>10.5%</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

There is very little literature available that examines the relationship between location and water-related incidents. Out of the total pool incidents during 1992-2010 (n = 914), 68 percent (n = 593) of the incidents occurred at victim's home compared to 32 percent (n = 276) at other places (away from home). In 45 cases there was missing information. Similarly, out of the total non-pool incidents during 1992-2010 (n = 231), 82 percent (n = 175) of the incidents occurred at victim’s home compared to 18 percent (n = 39) at other places. In 17 cases this information was missing information.

Figure 7 examines whether there is an association between location and water-type during 1992-2010 involving children less than five years of age. During 1992-2010, a higher proportion of the pool incidents occurred away from home (88%) when compared to a victim’s home (77%). This difference was found to be statistically significant. The risk of pool versus a non-pool incident was 53 percent lower in victim’s home compared to other places. However in 2010, this pattern is reversed in that approximately 90 percent of the water-related incidents occurred in a victim’s home compared to 75 percent in other places. Although the
The relative risk of a pool incident at a victim’s home is lower when compared to another location, in general, the proportion of pool incidents at victim’s homes is higher.

**Figure 7.**

Another important element of surveillance is to identify the ‘apparent circumstances’ surrounding each event. In gathering the incident data, a firefighter or paramedic asks about supervision at the time of the incident and looks for breaches in layers of protection that likely allowed a young child to access the pool. The ADHS data coder interprets the listed circumstances and attempts to assign a single “breached condition code” to the incident. This information helps in evaluating what likely factors contributed to water-related incidents and can facilitate prevention messages.

Table 7 presents the breach condition for pool incidents involving children less than five years of age. During 1992-2010 as well as in 2010, in approximately one third of the pool incidents ‘no barrier’ or ‘fence inadequate’ was the attributed breach condition. During 1992-2010 a ‘lapse in supervision’ was interpreted as the major breach condition for 37% of the incidents. Another important breach condition in pool incidents was ‘gate failed or propped’ (16.1%). Over ten percent of the data also had an ‘unknown/other’ as a
category of breach and this lack of information limits the inference about the circumstances surrounding the event.

Table 7. Pool-related incidents among children less than 5 years of age and breach condition

<table>
<thead>
<tr>
<th>Breach conditions</th>
<th>2010</th>
<th>1992-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percent</td>
</tr>
<tr>
<td>No barrier at all</td>
<td>9</td>
<td>28.1%</td>
</tr>
<tr>
<td>Supervision problem when child in water or on deck</td>
<td>12</td>
<td>37.5%</td>
</tr>
<tr>
<td>Fence inadequate</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Gate/latch failed or propped</td>
<td>4</td>
<td>12.5%</td>
</tr>
<tr>
<td>Safety back door failure or propped</td>
<td>1</td>
<td>3.1%</td>
</tr>
<tr>
<td>Unknown or other</td>
<td>6</td>
<td>18.8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Figure 8 displays the association between breach conditions in pool incidents and place of incident. The risk of inadequate supervision was higher (71%) in other places compared to victim's home (63%).

**Figure 8.**

*Notes:* Percentages are based on 834 cases and for about 80 cases there was missing data. Inadequate supervision includes lapse in supervision, caregiver/supervisor left the area. **Chi-square statistic indicated significant differences at p < 0.05. Odd ratio suggested that the risk of inadequate supervision was 32 percent lower in victim's home than at other places.*
This percentage difference was found to be statistically significant. The odds of ‘inadequate supervision’ were 32 percent lower in victim’s own home compared to other places. An important implication for prevention effort therefore is to have designated supervisors or to ensure adequate supervision when children are ‘away from home.’

Table 8 gives an overview of the type of supervisor/caregiver for all water-types as noted in the standard incident form. In one-third of the cases the supervisor was a mother, followed by father, and in some cases both parents.

Table 8. Water-related incidents in children less than 5 years of age by type of supervisor or caregiver

<table>
<thead>
<tr>
<th>Type of Supervisor/Caregiver</th>
<th>2010</th>
<th>1992-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Count</td>
<td>Percent</td>
</tr>
<tr>
<td>Mother</td>
<td>14</td>
<td>37%</td>
</tr>
<tr>
<td>Father</td>
<td>6</td>
<td>16%</td>
</tr>
<tr>
<td>Grandfather</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Grandmother</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Grandparents</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Both parents (Mom and Dad)</td>
<td>4</td>
<td>11%</td>
</tr>
<tr>
<td>Other child</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Other adult</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>One parent</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Unknown</td>
<td>6</td>
<td>16%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

While there are several factors associated with risk of water-related incidents, it is possible that one could develop a ‘risk model’ for water-related incidents in children less than five years of age in Arizona based on the data available. Such a risk model would examine the risk of having a pool incident versus a non-pool incident although both pool and non-pool incidents are unfavorable. This type of analysis would provide us with factors associated with increased ‘risk’ for a pool incident compared to a non-pool incident. The sheer numbers of pool incidents in children less than five years of age makes it compelling to examine the relative risk of pool versus non-pool incidents; thus, help us target and refine the prevention messages for all water-related incidents. This analysis was conducted, however is not presented here.

4.2 Discussion and conclusion – During 1992-2010 there were a total of 1,145 water-related incidents involving children less than five years of age. In general, the majority of the incidents were pool incidents irrespective of age category. While the overall trend for water-related incidents has been declining, there was no statistically significant monotonic decline in the trend. Based on the data reported in the incident form, it was found that the risk of pool incidents increased during summer, increased due to inadequate supervision and barriers, and increased for males and these findings are consistent with published literature. Major implications for public health practice is to target prevention messages during summer to
parents and caregivers of children less than five years encouraging better supervision and utilization of adequate barriers. The variability in the quality and reporting of data from year to year also may limit the extent to which inferences can be drawn as this is not mandatory but voluntary reporting. Missing and unknown information for other breach conditions also limits the inferences.

The strengths of the findings outweigh the limitations as there is rich information surrounding the event collected through standardized incident form. Further, wherever feasible specific associations were tested for statistical significance and the findings were consistent with the literature.

References


APPENDIX 1.

REPORT OF DROWNING OR NEAR-DROWNING IN ARIZONA – 2010

DATE OF INCIDENT: (MM/DD/YR) ____________
HOUR: (24:00) ____________
AGE: (yrs) ____________
SEX: ____________
INCIDENT #: ____________
PLAT or ZIP CODE: ____________

FIRE DEPT.: ____________________________

CITY OF INCIDENT: ____________________________
()- Chandler () Mesa () Rural area
()- Gilbert () Peoria () Scottsdale
()- Glendale () Phoenix () Tempe
()- Other: ____________

RACE/ETHN: ____________________________
()- Hispanic () White () Amer. Indian
()- Black () Asian/PI () Unknown
()- Other: ____________

WATER TYPE: ____________________________
()- Pool–in ground () Spa
()- Pool–above ground () Bathtub
()- Canal or Irrigation Ditch () Bucket
()- Lake () Other: ____________

LIKELY METHOD OF ACCESS TO POOL OR SPA: ____________________________
()- Supervisor allowed child into pool or deck area
()- No barrier – child wandered in
()- Climbed (specify): ____________
()- Child entered unsecured or propped gate
()- Other: ____________

BARRIER: ____________________________
()- Fence between house and pool () Yes () No
()- Gates Self-Close with Latch () Yes () No
()- Gates Work Properly () Yes () No
()- House Doors Self-Close with Latch () Yes () No
()- Doors Work Properly () Yes () No
()- Pool Cover, Type: ____________ () Yes () No
()- Door or Window Alarm () Yes () No

IS IT PRESENT?: ____________________________

CHILD SUPERVISION AT TIME OF INCIDENT: ____________________________
()- Mother () Father () N/A
()- Other (Specify): ____________

SUPERVISOR’S ACTIVITY PRIOR TO INCIDENT: ____________________________
()- Sleeping () Watching TV () On phone
()- Yard work () Housework () Other: ____________

STATUS OF PATIENT WHEN FOUND IN WATER: ____________________________
()- Submerged () Floating
()- Struggling () Unknown
()- Other: ____________

RESPIRATORY EFFORT WHEN PULLED FROM WATER: ____________________________
()- Present () Absent

DISPOSITION (if known): ____________________________
()- D.O.A.
()- Transported to: ____________ () Died in E.D.
()- Treated as outpatient and released () Admitted
()- P.O.V. transport to: ____________ () Evaluated and left on-scene

AT WHOM HOME DID INCIDENT OCCUR: ____________________________
()- Victim’s Home () Neighbor’s
()- Relative’s () Friend’s
()- Not at a home: ____________

TYPE OF DWELLING OR FACILITY: ____________________________
()- Single Home () Apt/Condo
()- Hotel/Motel () Other: ____________

ATTIRE OF VICTIM: ____________________________
()- Swimwear () None
()- Other Clothes () Other Clothes

RESCUER(S) ACTIONS PRIOR TO FD ARRIVAL: ____________________________
()- Chest compressions AND breaths (CPR)
()- Chest compressions only
()- Rescue breaths only
()- None attempted () Unknown

ESTIMATED DURATION OF ANOXIA: ____________________________

FOLLOW-UP & DATE PATIENT WAS LAST SEEN: ____________________________
()- Died _________/_______/_______
()- No Impairment _________/_______/_______
()- Impairment _________/_______/_______

DESCRIBE THE APPARENT CIRCUMSTANCES (how/why it happened; how child was found & revived): ____________________________ (Initials)

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“(Initials)”

“(Today’s Date)”