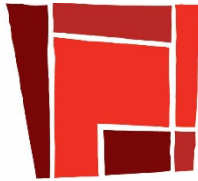


**DROWNING AND SUBMERSION-RELATED
HOSPITALIZATION IN ARIZONA AND
MARICOPA COUNTY, 2016-2020**

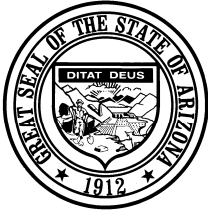
**Annual Report for the
Drowning Prevention Coalition of Arizona**



ARIZONA DEPARTMENT
OF HEALTH SERVICES

Bureau of Public Health Statistics

April 26, 2021



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**DROWNING AND SUBMERSION-RELATED HOSPITALIZATION IN ARIZONA
AND MARICOPA COUNTY, 2016-2020**

SUMMARY

This annual report provides statistical information about drownings and nonfatal drownings occurring in Arizona, with a focus on incidents occurring in Maricopa county. Starting with data for 2016 we analyze Arizona hospitalization data, called the Hospital Discharge Database (HDD). The national switch in late 2015 to ICD-10-CM diagnostic coding allows a robust analyses of admissions to emergency departments and to the in-patient setting.

In 2016, 2017, 2018, 2019, and 2020 the HDD recorded 419, 459, 431, 410, and 374 statewide admissions for water-related incidents among persons of all ages. Young children (0-4 years of age) comprised 1132 of these admissions statewide. For the 5-year period, admissions to hospitals in Maricopa county totaled 1386, of which 842 were young children. Among incidents involving young children, swimming pools and bathtubs were the water types most commonly identified in Maricopa county. Maricopa county hospitalizations from incidents during the 5 years in so-called “natural water” (such as rivers and lakes) totaled 232, mostly among persons 15 years of age and older. Hospital charges in Maricopa county for the 5 years exceeded \$38.5 million, and for the entire state they exceeded \$ 51.2 million.

A separate analysis looked at the death certificates of young children. The Maricopa count of 18 drownings in 2020, with the rate of 6.6 deaths per 100,000 children, indicates an increase compared to rates in recent years.

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INTRODUCTION

In the mid-1980's the drowning death rate of Arizona's preschoolers ranked first in the nation.¹ In the latest 6 years, data for the 50 states show that Arizona ranks 4th highest for drowning of children age 1-4 years.² And in recent years, among children 1-4 years of age in Arizona, drowning is the leading cause of death in that age group.³ Furthermore, in about 9% of nonfatal drowning incidents the child may be left with some degree of neurological impairment.⁴ Warm weather, long summers, and the presence of more than 300,000 residential swimming pools make Arizonans of all ages at risk for 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 was formed in 1988. This Coalition is comprised of municipal fire departments, hospitals, the state and county health departments, community organizations, pool builders and pool service providers, suppliers of pool safety equipment, parents of drowned children, concerned business leaders, and others.

The Coalition's website www.preventdrownings.org and a community partner's website <http://childrensafetyzone.com> provide stories about individual incidents. These stories convey the often tragic impact to a child and family. At a community level, the following report aggregates the individual events and uses data from hospital admissions to describe the larger patterns and trends. The information can be used in understanding the risk factors and in designing community approaches to reduce these incidents.

ADHS annual drowning reports prior to 2016 relied mainly upon incident reports from fire departments. However, since 2016 we have used a new data source, namely hospitalization data, which produces findings not directly comparable to those in previous years. But, as in previous years, much of the new reporting system focuses on children under five years of age, and specifically on incidents occurring in swimming pools. The current report looks at incidents in the combined period 2016-2020.

¹ Arizona Department of Health Services. Unintentional Drowning Deaths, Arizona, 1980-1989. Office of Planning & Health Status Monitoring, October 1990.

² CDC WONDER query for AZ deaths, 2010-2016, unintentional drowning, age 1-4 years, AZ crude rate of 4.6 deaths per 100,000 toddlers. Accessed June 14, 2018.

³ [Link to AZ data, 2010-2015, generated from CDC WISQARS.](#)

⁴ Beyda, D. and Masuello, J. Phoenix Children's Hospital. Oral communication, July 1999.

METHODS AND DATA SOURCE

Data Source: Hospitalization records

Effective on October 1, 2015 the U.S. Department of Health and Human Services required hospitals to implement the coding of injuries and diseases using the International Classification of Diseases, 10th edition, Clinical Modification (ICD-10-CM). The ADHS also requires Arizona hospitals to use this system in reporting patient admissions and discharges, the conditions diagnosed and treated, and the hospital's financial charges to the patient. This ICD-10-CM classification system allows for a more detailed epidemiologic analysis of hospital data from 2016 forward.

To create the dataset for the present analysis, ADHS generated a list of records of persons admitted and discharged using the following criteria.

Data item	Criteria or Code Description	Comment
Year of admission	2016, 2017, 2018, 2019, 2020	
Residence	Any state or country	
Age	Any age at time of admission	
Record type	Emergency record or In-patient record	If a case had both types of records, only the single incident record was analyzed
ICD-10-CM code group		Search of all diagnostic and e-code fields
T75.1	Unspecified effects of drowning and nonfatal drowning	
V90	Drowning and submersion due to accident to watercraft	e.g., watercraft overturns
V92	Drowning and submersion due to accident on board watercraft, without accident to watercraft	e.g., falling off the watercraft
W16	Fall, jump or diving into water	Only if the detailed code describes an associated drowning
W22.041	Strike wall of swimming pool causing drowning and submersion	
W65-W74	Accidental non-transport drowning and submersion	Includes bathtub, swimming pool, natural water, other, and unspecified water
X37-X38	Cataclysmic storm or flood	Only if another code implies an associated drowning
Y21	Drowning and submersion, undetermined intent	

Because the ICD-10-CM codes distinguish between an initial hospital encounter for an injury and subsequent admissions for continuing care we limited our analysis to admission for the initial event.⁵ This report calls them the “incident” event or “case”.

Information sources and records not included: Starting with the 2016 data year, our approach no longer includes information supplied by fire departments or gleaned

⁵ These records generally contain an “A” in the seventh position of the diagnostic and E codes.

from news clipping or TV coverage. Water-related incidents not admitted to a hospital emergency department ('ED') or not admitted for in-patient care are not counted either; so, cases pronounced dead on-scene are not counted as hospitalizations.⁶ Similarly, minor incidents that are not sent to a hospital are not a part of the dataset. Although the diagnostic code text description contains the word 'drowning', there were 61 hospitalized cases during 2016-2020 that we excluded from analysis where the manner of drowning or nonfatal submersion event was coded as "assault" or "self harm".

Data assumption: Because the hospital dataset is unable to provide the physical location of drownings and submersion events, for analysis purposes we assume that the county of the admitting hospital is the same as the county in which the incident occurred. For example, cases admitted to Phoenix Children's Hospital or Banner Desert/Cardon's Children's Hospital in Mesa are assumed to have occurred in Maricopa county. Thus, any case with an incident scene in one county who is transported directly to another county for admission would be misclassified as to the county of incidence.

Analysis: For incidents occurring since 2016, analysis of data is performed using SAS and Microsoft Excel.

FINDINGS

Analysis of the 2016, 2017, 2018, 2019, and 2020 Hospital Discharge Database (HDD) for persons of all ages revealed 419, 459, 431, 410, and 374 recorded admissions statewide for incidents of drowning or nonfatal submersion. Yearly admissions to Maricopa county facilities totaled 275, 313, 283, 270, and 245 respectively (see **Table 1**).

The distribution of the 2093 incidents statewide in 2016-2020 according to the facility county and age of the victim also is shown in **Table 1**. Maricopa county facilities admitted 1386 persons in 2016-2020, and Pima county facilities admitted 212 persons. Again, this report assumes that county of the facility for the admission reflects an occurrence of the incident in that same county. For the five combined years, admissions in Maricopa County only to Emergency Departments (EDs) totaled 1108, and admissions as in-patients totaled 278 (data not shown). If a person had multiple admissions, only the "incident" admission was considered. If a person was seen in the ED and then was admitted as an in-patient at the same facility, there is only one record (an inpatient record) which also includes the details of the ED admission (e.g., time of ED admission).

⁶ A later section of this report (see Figure 4) presents the counts derived from death certificates.

Table 1. Water-related incidents admitted 2016 - 2020 according to age group and the county in which the hospital facility was located.

County of the Facility	Year of Admission																													
	2016						2017						2018						2019						2020					
	Age Group						Age Group						Age Group						Age Group						Age Group					
	0-4	5-14	15-34	35-64	65+	Yr Total	0-4	5-14	15-34	35-64	65+	Yr Total	0-4	5-14	15-34	35-64	65+	Yr Total	0-4	5-14	15-34	35-64	65+	Yr Total	0-4	5-14	15-34	35-64	65+	Yr Total
Apache	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.	1	1	.	2
Cochise	4	.	.	.	.	4	3	.	.	.	.	3	.	.	.	1	.	1	.	.	.	.	.	.	2	.	2	.	4	
Coconino	4	2	3	3	1	13	2	5	4	4	.	15	2	1	2	3	.	8	1	1	6	3	.	11	3	.	4	9	1	17
Gila	.	.	.	.	.	.	.	2	1	3	.	6	1	.	1	1	1	4	.	.	.	.	.	.	.	1	.	.	1	
Graham	.	.	.	.	.	.	3	.	.	.	.	3	.	.	1	.	.	1	1	.	1	.	2	2	.	1	.	.	3	
La Paz	.	.	5	1	.	6	.	.	1	.	.	1	.	.	.	1	1	2	.	1	.	1	.	2	1	.	.	.	1	
Maricopa	174	27	34	32	8	275	203	40	28	34	8	313	181	36	34	25	7	283	148	38	44	26	14	270	136	24	39	31	15	245
Mohave	10	7	8	11	1	37	7	1	15	13	4	40	11	.	17	14	3	45	7	3	20	23	1	54	3	4	19	17	3	46
Navajo	1	1	.	.	.	2	1	1	1	.	.	3	.	.	1	2	1	4	.	.	.	2	1	3	.	.	.	.	.	.
Pima	29	7	1	5	2	44	28	7	3	4	4	46	39	7	3	4	.	53	24	6	3	4	2	39	16	6	3	1	4	30
Pinal	7	2	3	3	1	16	9	.	1	1	.	11	3	1	1	.	5	8	2	1	1	.	12	3	1	.	1	.	5	
Santa Cruz	.	.	.	.	.	.	2	.	1	.	.	3	.	.	1	.	1	2	.	.	.	.	.	.	.	.	.	.	.	.
Yavapai	2	1	1	.	1	5	3	.	2	.	1	6	2	2	.	2	2	8	4	.	.	2	.	6	1	1	1	3	.	6
Yuma	9	1	2	3	1	16	7	.	.	2	.	9	9	2	.	2	1	14	6	.	3	1	1	11	10	.	1	2	1	14
Total	240	48	57	59	15	419	268	56	57	61	17	459	248	49	61	55	18	431	199	51	77	64	19	410	177	36	72	65	24	374

Among the 1386 cases admitted to a hospital facility in Maricopa county, 1274 cases were Arizona residents (see **Table 2**) The most common city of residence was Phoenix (371 cases), followed by Mesa (179), Glendale (92), Gilbert (87), and Chandler (80). One hundred twelve of the incidents in Maricopa county involved out of state residents.

Table 2. Sum of incident cases presumed to have occurred in Maricopa County, 2016-2020 combined years, shown by the Residence City and age group.

Residence City	Age Group					Total
	0-4	5-14	15-34	35-64	65+	
PHOENIX	216	48	55	42	10	371
MESA	110	28	22	11	8	179
GLENDALE	57	10	13	11	1	92
GILBERT	63	7	8	8	1	87
CHANDLER	55	10	8	4	3	80
SCOTTSDALE	31	5	11	12	5	64
PEORIA	40	2	7	9	0	58
TEMPE	16	2	8	6	1	33
GOODYEAR	22	1	3	0	4	30
SURPRISE	20	2	2	3	3	30
BUCKEYE	15	6	1	1	0	23
AVONDALE	17	3	0	2	0	22
QUEEN CREEK	12	3	3	3	0	21
MARICOPA	8	6	2	1	1	18
EL MIRAGE	10	0	0	2	0	12
CASA GRANDE	9	1	1	0	0	11
LAVEEN	8	1	1	1	0	11
TOLLESON	8	2	0	1	0	11
ANTHEM	4	1	2	1	1	9
APACHE JUNCTION	5	3	0	1	0	9
SAN TAN VALLEY	4	1	3	0	1	9
SUN CITY	2	0	1	3	3	9
LITCHFIELD PARK	5	2	0	0	0	7
COOLIDGE	4	1	0	0	0	5
FLORENCE	4	0	1	0	0	5
FOUNTAIN HILLS	1	0	2	0	2	5
TUCSON	2	0	1	2	0	5
Remainder of AZ cities	31	8	9	8	2	58
Total for AZ residents	779	153	164	132	46	1274
Out of State Residents	63	12	15	16	6	112
TOTAL	842	165	179	148	52	1386

In Maricopa county, the four most frequent facilities to which cases were initially⁷ admitted were Banner Desert Medical Center, Phoenix Children’s Hospital, Banner Thunderbird Medical Center, and Honor Health Deer Valley (**Table 3**). The cases among young children (age 0-4) predominate among the age groups.

Table 3. Count of cases by facility in Maricopa county to which cases were initially admitted, 2016-2020. Hospitals with fewer than 10 admissions during the 5-year period are combined in the Table.

Name of Facility in Maricopa County	Age Group					Total
	0-4	5-14	15-34	35-64	65+	
BANNER DESERT MED CTR	240	52	14	9	3	318
PHOENIX CHILDRENS HOSPITAL	183	43	6	.	.	232
BANNER THUNDERBIRD MED CTR	130	13	4	6	2	155
HONORHEALTH DEER VALLEY MED CTR	42	6	13	11	2	74
HONORHEALTH SCOTTSDALE SHEA MED CTR	38	7	7	3	3	58
BANNER ESTRELLA MED CTR	24	5	9	7	1	46
DIGNITY HEALTH - MERCY GILBERT MED CTR	21	5	10	7	1	44
DIGNITY HEALTH - CHANDLER REGIONAL MED CTR	12	8	10	5	4	39
HONORHEALTH SCOTTSDALE OSBORN MED CTR	7	1	11	12	3	34
BANNER BAYWOOD MED CTR	2	.	12	11	5	30
VALLEYWISE HEALTH MED CTR	13	1	10	2	1	27
ABRAZO WEST CAMPUS	14	1	1	7	2	25
HONORHEALTH JOHN C LINCOLN MED CTR	3	2	3	9	4	21
BANNER DEL E WEBB MED CTR	10	1	.	6	3	20
STEWARD - MOUNTAIN VISTA MED CTR	7	2	8	2	1	20
DIGNITY HEALTH - ST JOSEPH'S HOSPITAL AND MED CTR (PHX)	2	.	6	10	1	19
ABRAZO PEORIA EMERGENCY CENTER	3	.	9	5	1	18
HONORHEALTH SONORAN CROSSING MED CTR	5	1	7	3	1	17
ABRAZO CENTRAL CAMPUS	7	.	5	2	.	14
ABRAZO SCOTTSDALE CAMPUS	1	1	7	3	2	14
HONORHEALTH SCOTTSDALE THOMPSON PEAK MED CTR	4	2	3	4	1	14
ABRAZO BUCKEYE EMERGENCY CENTER	8	3	2	.	.	13
BANNER GATEWAY MED CTR	5	.	6	2	.	13
DIGNITY HEALTH - ARIZONA GENERAL HOSPITAL	7	2	.	3	.	12
26 other Maricopa County facilities	54	9	16	19	11	109
TOTAL	842	165	179	148	52	1386

The water type in which the incident occurred in Maricopa county by age group and the coded activity of the patient is presented in **Table 4**. For 194 (14%) of the 1368 incidents we could not determine the water type from the diagnostic codes.

⁷ The Table does not show the counts of cases that were referred for ongoing or sequela care.

Among persons of all ages, most incidents (842 [61%] of the 1386) occurred in swimming pools. So-called 'natural water' (e.g., lakes, streams) involved 232 persons of all ages. Watercraft and water skiing was involved in 130 incidents. For 786 incidents (536 of them in swimming pools) an activity of the victim was not stated or not specified in the record.

Among young children, a swimming pool was involved in 597 (71%) of 842 incidents. A bathtub was the water type for 87 young child cases.

Table 4. Count by water type, activity, and age group of incidents occurring in Maricopa county, 2016-2020

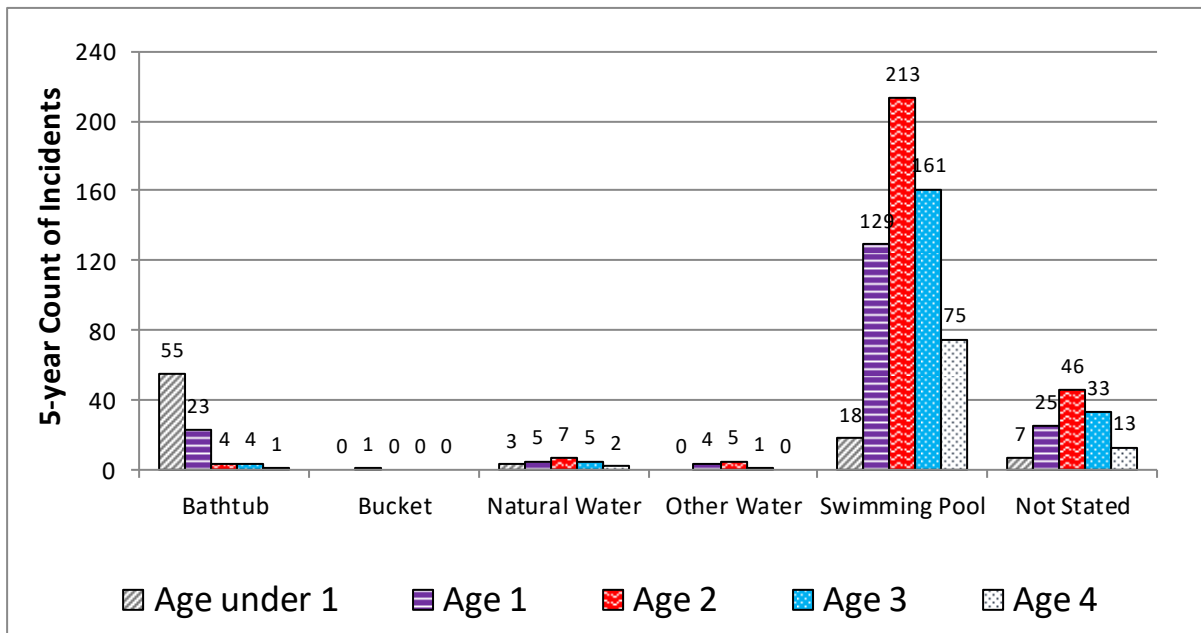
Water_Type	Activity_Victim	Age Group					All
		0-4	5-14	15-34	35-64	65+	
Not Stated	Not Stated	114	33	10	12	5	174
	Other Specified	7	1	2	1	1	12
	Swimming	4	.	1	2	1	8
Bathtub	Not Stated	13	.	2	3	1	19
	Bathing	73	2	4	1	2	82
	Other Specified	1	.	.	.	.	1
Bucket	Not Stated	1	.	.	.	.	1
Natural Water	Not Stated	15	4	16	5	3	43
	Golfing	.	.	.	.	1	1
	Involving Watercraft	1	5	45	50	5	106
	Other Specified	2	.	.	1	.	3
	Rafting/Tubing	.	2	21	5	1	29
	SCUBA	.	.	1	.	.	1
	Swimming	4	6	7	5	.	22
	Unspecified	.	.	1	.	.	1
	Walking/Hiking	.	.	1	1	.	2
	Water Skiing	.	1	16	7	.	24
Other Water	Not Stated	9	1	.	2	1	13
	Diving Board	.	.	1	.	.	1
	Other Specified	1	.	.	.	.	1
Swimming Pool	Not Stated	390	52	34	39	21	536
	Animal Care	1	.	.	.	.	1
	Climbing/Jumping	3	.	.	.	.	3
	Diving Board	.	1	.	.	.	1
	Maintenance	.	.	.	1	1	2
	Other Specified	32	.	.	4	4	40
	Rafting/Tubing	1	.	.	.	.	1
	Swimming	166	57	17	9	5	254
	Unspecified	3	.	.	.	.	3
	Walking/Hiking	1	.	.	.	.	1
All		842	165	179	148	52	1386

Young Children

Children, ages 0-4 years, comprised the largest group experiencing a water-related incident. The community generally feels a great sense of responsibility to prevent injury to persons in the youngest, highly vulnerable, age group. The next few graphs analyze the findings among the 0-4 year old age group. If the counts are sufficiently large to achieve statistical stability we include data for Pima and other counties.

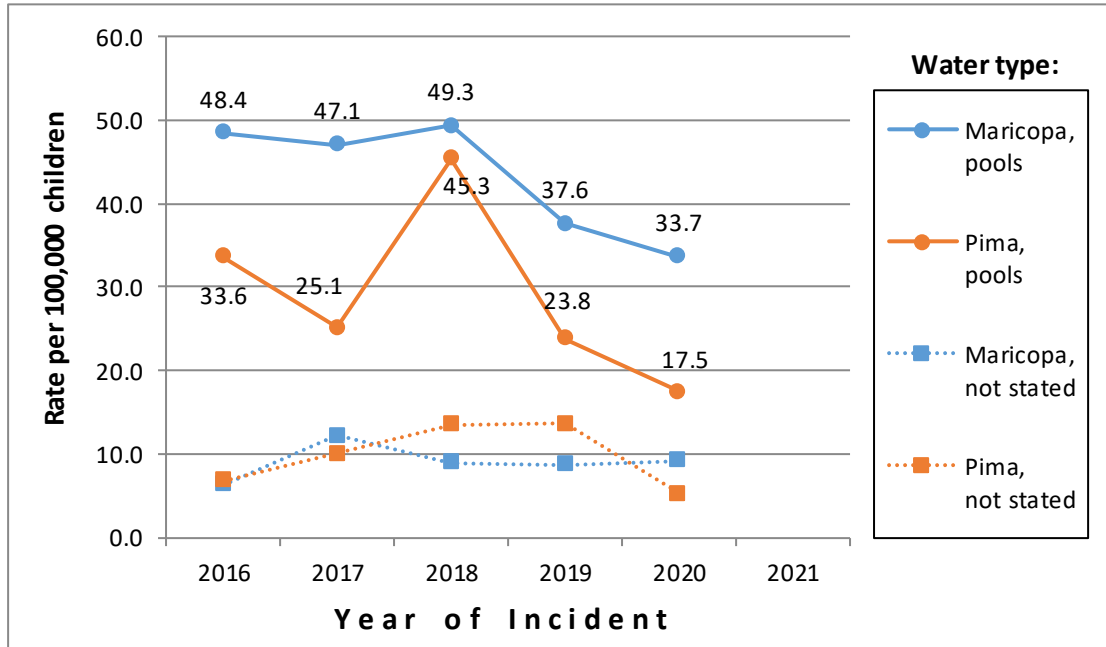
The distribution of cases among single ages of the 0-4 year old group is shown in **Figure 1**. Among children 1-4 years old, the count of incidents in swimming pools far overshadows the count in all other bodies of water combined. In contrast, among infants (i.e., under one year of age) the bathtub is the most common water body in which incidents occur.

Figure 1. Count of incidents according to the body of water in which incidents occurred, by single age category, reported in Maricopa County, 2016-2020



To consider the changes in the number of children residing in Maricopa County we calculate the rate of incidents expressed per 100,000 children. A rate adjusts for changes in the size of the population at risk. For example, in 2016 the incidence rate is calculated as: 131 incidents in pools ÷ 270,572 resident children = 48.4 incidents per 100,000 resident toddlers. Yearly calculated rates for 2016-2020 are shown in **Figure 2**). Additional years of observation may reveal a clearer trend of hospitalization for incidents among young children in swimming pools. The graph also shows the “not stated” water type because it likely contains some incidents in pools, and may affect the counts and rates attributed to swimming pools.

Figure 2. Rate of hospitalizations (per 100,000 children age 0-4 years) for Maricopa and Pima county incidents occurring in swimming pools and water type not stated.



The inverse of the 2020 rate for Maricopa ($100,000 / 33.7$) reveals that for every 2,967 resident children, at least one child experienced a pool incident requiring hospitalization in 2020 in Maricopa county. Rates for Pima county appear lower than for Maricopa County.

In 2016-2020 the incidents in Maricopa county swimming pools occurred among 256 young girls and 341 young boys (data not shown). The higher count among boys has been observed in many previous analyses of drowning data.

White Hispanic young children in Maricopa county accounted for 169 (28%) of 597 incidents, while white non-Hispanic accounted for 349 (58%) (data not shown). Thirty-nine (6.5%) young Black children were hospitalized because of incidents in pools. The remaining race categories together accounted for 40 (7 %) of the incidents.

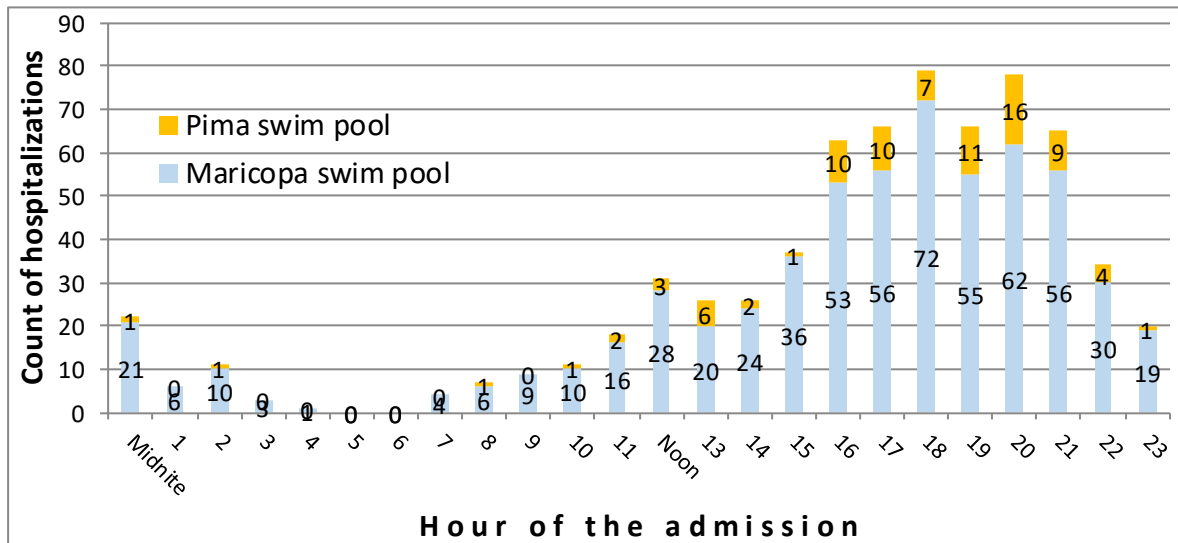
The hospitalization data for 0-4 year olds show a considerably higher risk for incidents in swimming pools on weekend days than on other days of the week (**Table 5**). Almost half (45%) of all pool incidents occurred on weekends.

Table 5. Sum of hospitalizations of children age 0-4 years, by Water Type and Hospitalization Day of the Week, for Maricopa facilities, 2016-2020

Water Type	Admission day of the Week							All
	Sun	Mon	Tues	Wed	Thur	Fri	Sat	
Not Stated	35	11	11	13	13	17	25	125
Bathtub	15	9	9	18	9	13	14	87
Bucket	.	.	1	.	.	.	.	1
Natural Water	9	3	2	.	2	1	5	22
Other Water	4	.	1	3	.	2	.	10
Swimming Pool	128	73	51	54	67	81	143	597

The hour of hospitalization as derived from incidents in Maricopa county swimming pools provides a rough sense when risk is highest. **Figure 3** indicates that late afternoon is considerably riskier than other times of the day. Few hours were free of risk.

Figure 3. Sum of hospital admissions for swimming pool-related incidents, by hour of the day, 2016-2020 data for Maricopa and Pima county facilities treating children age 0-4 years



The hospitalizations of young children by month are shown in **Table 6**. We note the typical pattern seen in previous years, with the count of pool-related incidents peaking during the summer months of June, July, and August in many counties. Averaged over the 5-years, 2016-2020, the count of incidents in Maricopa county pools from April through September exceeded the Coalition’s goal of reducing counts to fewer than 10 incidents in any month.

Table 6. Monthly sum of hospitalizations, 0-4 year olds, 2016-2020 (5-year totals by month)

County of Facility	Water_Type	Admission Month												All
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Cochise	<i>Not stated</i>	.	.	1	.	.	.	1	.	.	.	.	.	2
	Other Water	.	.	.	1	.	.	.	.	.	.	.	.	1
	Swimming Pool	1	.	1	.	.	1	1	2	.	.	.	.	6
Coconino	<i>Not stated</i>	.	.	.	.	.	.	.	.	.	.	.	1	1
	Natural Water	.	.	.	.	.	2	1	1	.	1	.	.	5
	Swimming Pool	2	.	.	.	.	1	1	.	.	1	1	.	6
Gila	<i>Not stated</i>	.	.	.	.	.	.	.	1	.	.	.	.	1
Graham	<i>Not stated</i>	.	.	.	.	.	.	.	.	.	1	.	.	1
	Bathtub	.	.	.	.	.	.	1	.	1	.	.	.	2
	Swimming Pool	.	.	.	.	.	2	1	.	.	.	.	.	3
La Paz	<i>Not stated</i>	.	.	.	.	.	1	.	.	.	.	.	.	1
Maricopa	<i>Not stated</i>	3	5	7	11	17	21	23	18	12	5	1	2	125
	Bathtub	8	4	7	9	6	9	12	9	6	7	5	5	87
	Bucket	.	.	.	1	.	.	.	.	.	.	.	.	1
	Natural Water	1	1	4	2	1	5	5	1	1	1	.	.	22
	Other Water	.	.	3	3	2	1	1	.	.	.	.	.	10
	Swimming Pool	8	20	31	53	67	115	125	85	54	16	16	7	597
Mohave	<i>Not stated</i>	1	.	.	.	.	1	.	.	.	.	1	.	3
	Bathtub	.	1	1	.	.	.	.	1	.	.	.	.	3
	Natural Water	.	.	.	.	1	4	.	1	1	.	.	.	7
	Swimming Pool	.	.	.	2	4	4	7	5	1	.	.	2	25
Navajo	Bathtub	.	.	.	.	.	.	.	.	1	.	.	.	1
	Natural Water	.	.	.	.	.	1	.	.	.	.	.	.	1
Pima	<i>Not stated</i>	.	1	2	3	5	7	9	1	.	1	.	.	29
	Bathtub	.	.	4	1	1	4	.	1	.	1	.	4	16
	Natural Water	.	.	.	1	1	.	1	.	.	.	.	.	3
	Other Water	.	.	.	.	1	.	.	.	1	.	.	.	2
	Swimming Pool	1	3	5	3	15	17	18	13	6	1	2	2	86
Pinal	<i>Not stated</i>	.	.	3	.	1	.	.	.	1	.	.	.	5
	Bathtub	1	.	.	.	1	.	.	.	.	.	.	.	2
	Natural Water	.	.	.	.	1	.	.	.	.	.	.	.	1
	Swimming Pool	.	1	1	.	2	7	5	4	.	1	.	1	22
Santa Cruz	<i>Not stated</i>	.	.	.	.	1	.	.	.	.	.	.	.	1
	Bathtub	.	.	.	.	.	1	.	.	.	.	.	.	1
Yavapai	<i>Not stated</i>	.	.	.	.	.	.	1	.	.	.	.	.	1
	Bathtub	.	1	.	.	1	.	.	.	1	.	.	.	3
	Natural Water	.	.	.	1	.	.	1	.	.	.	.	.	2
	Swimming Pool	.	1	.	.	.	1	3	.	1	.	.	.	6
Yuma	<i>Not stated</i>	1	.	.	.	1	2	.	1	.	.	.	.	5
	Bathtub	.	.	.	.	.	.	.	2	1	.	1	.	4
	Natural Water	.	.	1	.	.	1	.	.	1	.	.	.	3
	Swimming Pool	.	.	3	3	.	6	9	5	2	.	1	.	29
All		27	38	74	94	129	214	226	151	91	36	28	24	1132

Severity of Incident

As a surveillance source, the hospital discharge database provides no direct measure of the severity, outcome, or functional status of the patient upon discharge. Instead, we rely upon indirect measures to inform the Coalition as to the severity and impact of water-related incidents. These indirect measures include the length of stay in the hospital and the financial charges accrued. Patient outcome is assessed by counting deaths, survival with presumed impairment, and presumed normal status upon discharge.

Financial Impact

The financial impact of the incidents in all water types can be measured partially in terms of the hospital charges for the admissions. By county, the incurred charges at facilities in 2016-2020 are shown in **Table 7**. Hospitals in Maricopa county charged a total of \$38.5 million for care related to drowning and submersion in the five-year period. Statewide, the hospital charges exceeded \$51 million in the five-year period. For patients age 0-4 years, the statewide average charge was \$16,541 (18,723,963/ 1132) while the median charge was \$2,665. The average charge is highly skewed upward by charges in the tens of thousands of dollars for some admissions.

Table 7. Sum of hospital charges, 2016-2020, by the county in which the hospital is located. The row at the bottom of the table provides the statewide median of the charges by age group. The amounts show the charges among all water types.

County of the Facility						All
	0-4	5-14	15-34	35-64	65+	
Apache	.	.	\$2,521	\$19,984	\$6,579	\$29,084
Cochise	\$60,385	.	\$6,506	\$1,272	.	\$68,163
Coconino	\$61,598	\$36,419	\$173,936	\$530,242	\$23,962	\$826,157
Gila	\$1,040	\$9,897	\$5,126	\$21,980	\$8,012	\$46,055
Graham	\$6,208	.	\$8,128	\$1,151	.	\$15,487
La Paz	\$633	\$3,980	\$102,539	\$96,221	\$2,031	\$205,404
Maricopa	\$15,487,284	\$1,673,024	\$10,621,075	\$8,067,261	\$2,693,420	\$38,542,064
Mohave	\$1,039,720	\$155,644	\$1,614,189	\$2,432,334	\$194,421	\$5,436,308
Navajo	\$13,381	\$7,728	\$229,740	\$23,966	\$19,720	\$294,535
Pima	\$970,154	\$994,022	\$755,853	\$479,513	\$401,507	\$3,601,049
Pinal	\$362,358	\$15,042	\$16,868	\$237,788	\$3,002	\$635,058
Santa Cruz	\$147,177	.	\$8,980	.	\$6,570	\$162,727
Yavapai	\$43,871	\$10,561	\$40,026	\$108,215	\$195,995	\$398,668
Yuma	\$530,154	\$17,907	\$43,619	\$196,443	\$117,301	\$905,424
All	\$18,723,963	\$2,924,224	\$13,629,106	\$12,216,370	\$3,672,520	\$51,166,183
Median Charge	\$2,665	\$2,697	\$5,821	\$9,726	\$17,005	\$3,975

Length of Hospital Stay

The duration of admission can inform about the case severity. This analysis combines the admissions to emergency departments and the inpatient setting, and shows the range of days in the hospital. If the patient was transferred from one hospital facility to another facility we summed the admission days from all facilities for that case. The data for children age 0-4 years are shown in **Table 8**, according to the presumed outcome status.

Table 8. Duration of hospitalization for children age 0-4 years, by outcome status, for admissions to facilities in Maricopa County, 2016-2020.

Length of Stay (days)	Died	Did Not Die
0	26	453
1	10	274
2	9	31
3	4	5
4	.	3
5	2	0
6	3	1
7-13	7	2
14-27	1	7
28+	0	4

Outcome Status

For children 0-4 years of age we determined an outcome status at the time of discharge and present the findings in **Table 9**. The analysis looks at the combined years 2016-2020. Of the 842 children admitted, 62 (7%) died, with 46 of these deaths resulting from incidents in swimming pools. To count the “impaired” outcome status we conservatively assumed the child was impaired if they were discharged other than to home (e.g., to a care facility), or if they stayed 7 or more total days in hospital. Sixteen (1.9%) children were classified in the “impaired” outcome category. For the discharge status of “normal” outcome we assumed that children who stayed less than 7 total days in-hospital were discharged with status of “normal”. The vast majority of children (735 [87%] of the 842) would be considered to have a “normal” outcome under this definition.

Currently, we do not have resources to conduct a longer term assessment of the needs or functional outcome, such as educational achievement in school, of the surviving children. To our knowledge such a study has never been performed among children surviving a serious water-related incident.

Table 9. Outcome status of children 0-4 years of age hospitalized in Maricopa county for a drowning or submersion-related incident in 2016-2020.

WATER TYPE	Presumed outcome status				All
	Died	Impaired	Normal	Unknown	
Not stated	11	1	107	6	125
Bathtub	4	4	78	1	87
Bucket	.	.	1	.	1
Natural Water	1	.	21	.	22
Other Water	.	.	9	1	10
Swimming Pool	46	11	519	21	597
TOTAL	62	16	735	29	842

Limitations of Completeness and Accuracy of Incidence Data

A hospital record does not exist for a person who is declared dead on-scene and not transported for hospital care. Similarly, cases determined on-scene to have non serious findings might not be transported for hospital care.

All child deaths in Arizona from injury must be referred to the county medical examiner for assessment. Information from the 2017-2020 death certificates reveals that 16 of 60 child drowning deaths from incidents occurring in Maricopa county were not found in the hospitalization data because the record lacked an ICD-10-CM code indicating a water-related incident. For counting deaths by drowning, the match rate of 44/60 indicates a surprisingly low, 73% agreement of the hospitalization counts with the death certificate counts that listed drowning as a cause of death. The 73% match rate suggests possible inaccuracies related to coding of injury in the hospital records that requires further clarification. For the unmatched deaths there appears to be a number of cases where the hospital diagnosis listed 'cardiac arrest', but with no indication of its cause.

Nonetheless, there is a notable advantage of the use of hospital data. Previous years' reports often missed cases under the jurisdiction of the sheriffs' offices or a tribal governments because many rural jurisdictions did not participate in the reporting system. However, this current system records the cases at a hospital level and is not dependent on law enforcement reports.

DEATH CERTIFICATE DATA

Death certificates serve an independent data source to measure the counts, rates, and trends of child drownings. In addition, mortality data can provide insight as to the accuracy and completeness of the incidence surveillance system for the cases who die. However, it should be noted that case definitions used for vital statistics differ slightly compared to those used in the HDD incidence data.

Customarily, mortality data show resident deaths of the resident population during a given year. However, for this report we present an unconventional analysis that more precisely reflects the local, year-to-year findings. That is to say, we reviewed Arizona death statistics to find cases of young children who died in Arizona, regardless of where they resided, and we include only the cases whose incident occurred in Maricopa county. Thus, we present a crude Maricopa county rate of drowning deaths, regardless of residency. To calculate this mortality rate, we divided the count of deaths by the estimated number of children age 0-4 residing in Maricopa county in each year. The Coalition can use these surveillance data to provide yearly feedback about the effectiveness of local prevention programs.

Figure 4 (see next page) shows drowning death rates for children under five years of age.⁸ The data are shown for drownings in all bodies of water, and separately for drownings that occurred in swimming pools (including spas), and in bodies of water other than pools and spas.⁹ In 2020, the Maricopa drowning rate for all bodies of water increased to 6.6 deaths per 100,000 resident children. Similarly, the death rate for incidents in pools increased to 5.5 deaths per 100,000 young children. For comparison, the goal of *Healthy Arizona 2010* was to reduce drowning fatalities to no more than 0.9 deaths per 100,000 young children.^{10,11} Maricopa County's drowning rate in the 2010's remains about 4-5 times higher than the statewide goal. Although we see an overall decline in the pool death rate since the 1980's and 1990's, the rate since the early 2000's has trended upward. The current Arizona injury prevention plan continues to include a section dedicated to reducing drowning.¹²

⁸ To calculate this rate, the numerator includes non-residents and Arizona residents, age 0-4 years old, whose water related incident occurred in Maricopa County. The denominator, however, is the Maricopa County population of children 0-4 years old. We chose this unconventional method for calculating the rate because we occasionally encounter nonresident visitors whose incident and death occurred in Maricopa county. We count these cases because the Drowning Prevention Coalition is focused on reducing the number of local incidents regardless of whether the child is a county resident or a visitor.

⁹ Here we consider a hot tub or spa in the same category as swimming pool.

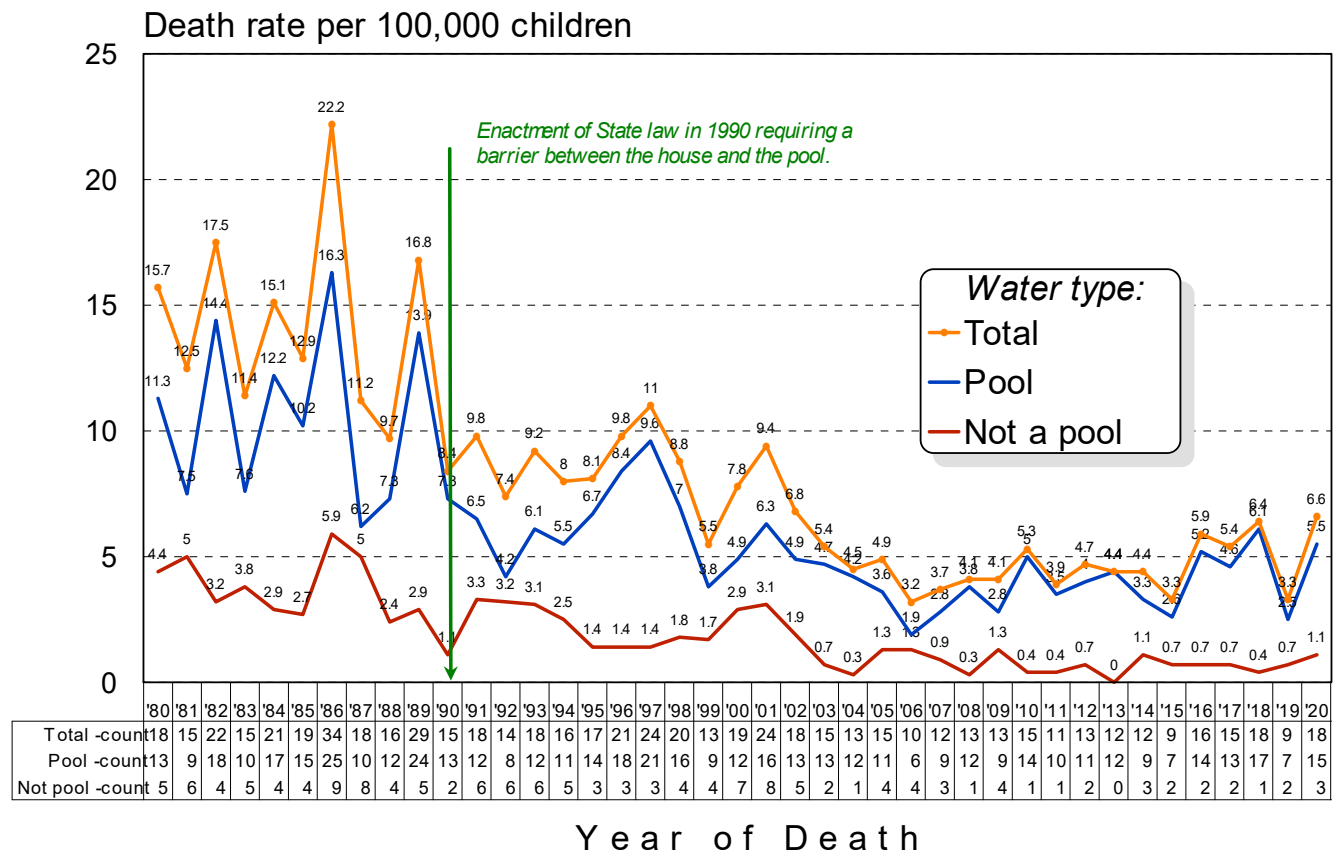
¹⁰ U.S. Department of Health and Human Services. *Healthy People 2010*, 2nd ed., Volume 2. Injury Prevention, Section 15-29: Reduce Drownings, page 15-40. U.S. Government Printing Office, November 2000.

¹¹ ADHS Injury Surveillance and Prevention Plan, 2002-2005. The plan was developed within the Bureau of Emergency Medical Services.

¹² ADHS. [Arizona Injury Prevention Plan, 2012-2016](#).

Figure 4. Drowning death rate for children, 0-4 years of age, where the occurrence of the death and the incident was in Maricopa County. [Data Source: ADHS, Vital Statistics, death certificates coded with underlying cause of death as: E830, E832, or E910 (prior to year 2000); or T75.1, W65-W74, V90-V92, or Y21 (year 2000 and later). Manner of death: accidental or undetermined].

Child drowning rate and count in Maricopa County, Arizona Deaths occurring in 1980-2020; 0-4 years of age



DISCUSSION

Monitoring drowning incidents using hospital discharge data allows analysis of many, but not all, of the data items previously reported to the DPCA from the system that relied on reports from fire departments. Significant differences include loss of specific water types (e.g., bucket, hot tub), and details such as the city in which the incident occurred, the type of dwelling, and whether the incident occurred at the victim's own home or a neighbor's home. The physical barriers and swim skills remain undocumented. Also, it is not possible to use the HDD dataset to assign an attributed cause of an incident as we have done in the past by reading the fire department personnel's brief narrative description.

Nonetheless, several advantages are noted using this approach. First, it expands drowning surveillance to a statewide level, rather than only in Maricopa or Pima counties. Second, the ICD-10-CM codes are robust and could allow the analysis of drowning and immersion incidents that are related to water transportation, such as boat crashes or falls off boats and inflatable craft. Previously these incidents were rarely included in our statistics. Third, the HDD is documenting 3 times as many incidents as were being reported by submission of the paper collection form.

Arizona's problem with drowning is not yet solved, and drowning rates remain unacceptably elevated. It may be time to hold discussion with the leadership of the Coalition concerning the use or development of supplemental data sources that can inform the direction of future strategies and prevention activities.