

Childhood Immersion Incidents & Deaths In Orange County

**Based on Emergency Department and
Hospitalization Data (2005 – 2007)**



Orange County Health Care Agency
David L. Riley, Interim Director

June 2009



*Excellence
Integrity
Service*

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Dear Reader,

With the summer swimming season upon us, children will be spending countless hours in and around pools and beaches, putting them at an increased risk of drowning. The effects of an immersion incident occur quickly and can be catastrophic, especially to young children who lose consciousness within two minutes and can experience irreversible brain damage within four minutes. Drowning consistently remains the leading cause of death among children 1-4 years of age and among the top five leading causes for those under the age of 18, both in California and Orange County.

The 2009 "Childhood Immersion Incidents & Deaths in Orange County" report provides a detailed description of immersion incidents that resulted in emergency room visits and in severe cases hospitalization, among children 0-17 in Orange County. The goal of this study is to better guide prevention efforts aimed at reducing the number of childhood immersions and drowning deaths.

Between 2005 and 2007, there were a total of 204 immersion related incidents among 0-17 year olds, 25 of which resulted in death. Children 0-4 years of age represented 69% of all immersion related incidents, including 72% of drowning deaths. The majority of incidents (61%) occurred among males and non-Hispanic whites (64%). Most immersion incidents occurred in pools/spas (64%) or open bodies of water (18%).

Anaheim (16%) and Santa Ana (13%), the two most populous cities in Orange County, had the highest number of immersion related incidents. The south regions of the County had the fewest number of incidents. More than half (51%) of all immersion incidents occurred between June and August, with 44% occurring during the weekends. Among all immersion related incidents, 12% of children died. The majority (81%) of children were discharged home, while another 7% required additional treatment at a long-term facility.

The focus of this report was to both illustrate the magnitude and severity of immersion incidents and drowning in Orange County. These findings may be used to raise awareness and help guide educational efforts aimed at reducing the occurrence of a preventable tragedy.

Thank you for your interest and we encourage you to read and share this special report with your colleagues.

Sincerely,

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Childhood Immersion Incidents & Deaths In Orange County

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Background

This report relies on data from emergency departments and hospitals to assess the incidence and location of immersion incidents involving Orange County children 0 to 17 years of age from 2005 through 2007. As part of a larger effort to prevent drowning in Orange County, it is our hope that these data help guide future prevention efforts to reduce/eliminate childhood immersion incidents and drowning deaths in Orange County.

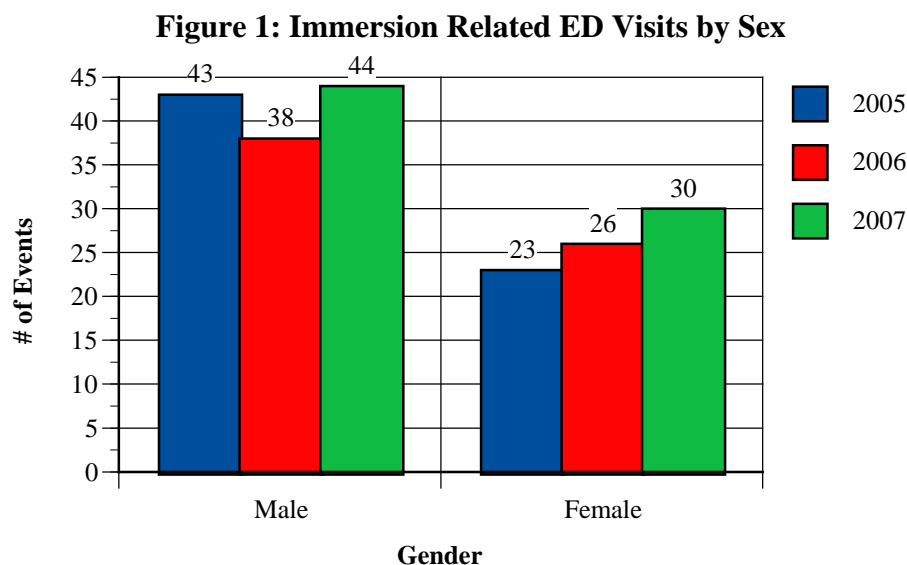
Overview

Data for this report was provided by the Office of Statewide Health Planning and Development (OSHPD) which collects patient information from health care facilities within California. The 2005-2007 Emergency Department (ED) and Patient Discharge (PD) data were utilized for this report. Where possible, incidence rates are presented based on the 2006 population estimates for Orange County.¹ Between 2005 and 2007, there were 204 immersion incidents in Orange County involving children 0-17 years of age, which resulted in an emergency department visit. Among these cases, 117 (57.4%) were admitted to an acute care hospital for further treatment. The first section of this report covers ED visits, the second section hospitalizations, and the final section immersion-related fatalities (drowning deaths).

Emergency Department Visits

Demographics of Emergency Department Visits

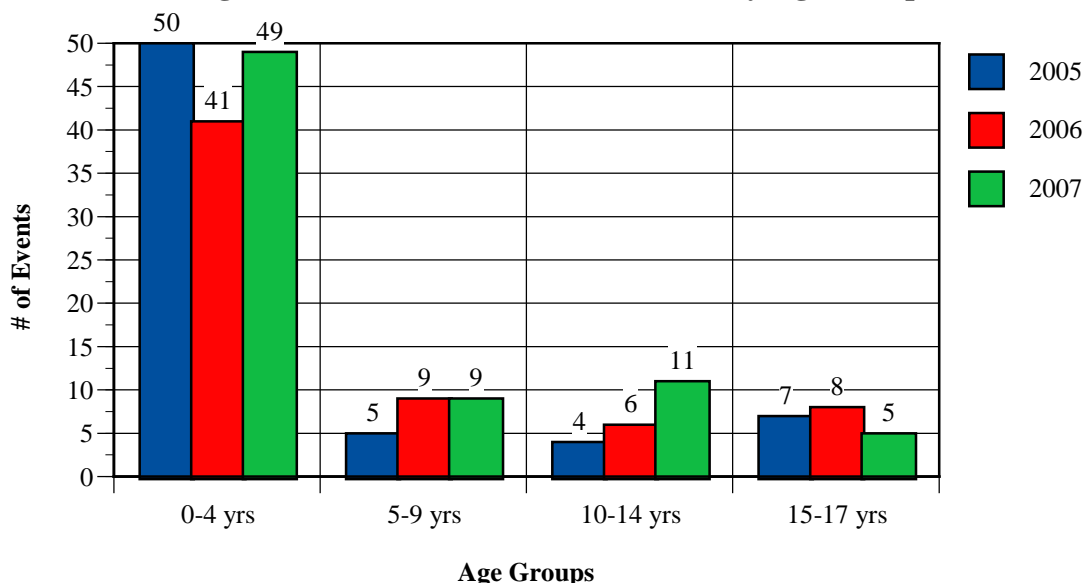
Gender: Among the 204 immersion incidents that resulted in an ED visit, 61.3% (n=125) were males and the remaining 38.7% were females (n=79; Figure 1).



¹ Estimates were provided by California Department of Finance: Population Estimates

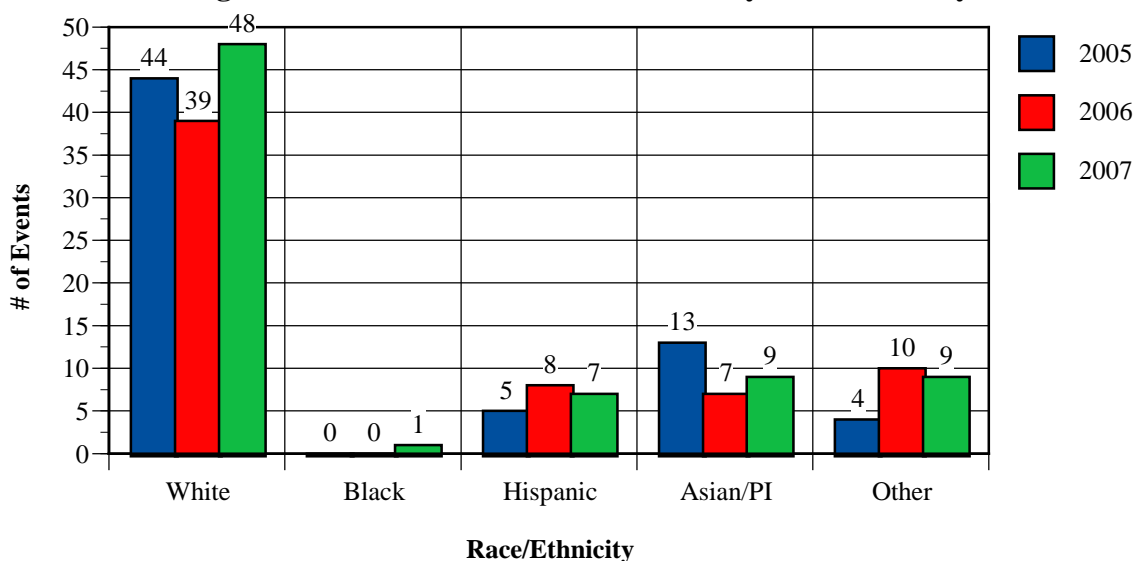
Age: More than two-thirds of all ED visits (68.6%) occurred among children under 5 years of age (n=140), with children 1-3 years of age (n=113) accounting for 55.4% of all cases (Figure 2). The mean age for males was 5.2 years, with approximately 60% (n=75) of males between the ages of 1 and 4 years. Females had a mean age of 4.4 years, with more than three-fourths (n=55) of females between the ages of 1 and 4 years.

Figure 2: Immersion Related ED Visits by Age Group



Race/Ethnicity: Whites accounted for 64.2% (n=131) of all immersion related ED visits. Asians made up the second highest group, with 14.2% (n=29). Hispanics were the third highest group, with 9.3% (n=19). African Americans (n=1) and other/unknown (n=23) together made up the remaining 11.8% of all immersion related cases that resulted in an ED visit (Figure 3).

Figure 3: Immersion Related ED Visits by Race/Ethnicity

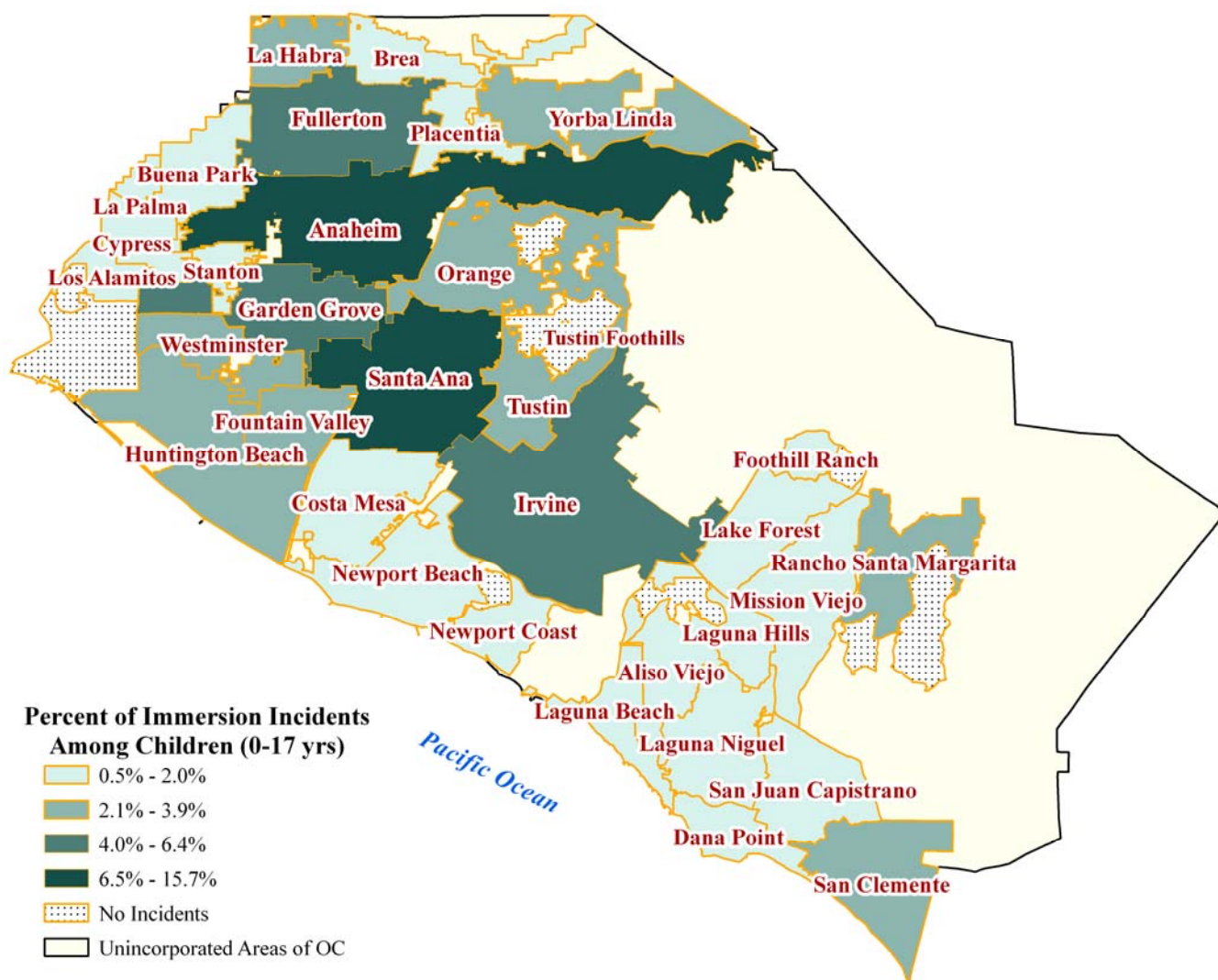


Place of Residence: All Incidents (Children: 0-17 years old)

Victim's City of Residence (Map & Table): The following maps and Table 1 represent the distribution of the 204 immersion incidents that resulted in a visit to the ED among Orange County residents 0-17 years of age, by the percentage of all incidents (Figure 4) and by rates per 100,000 city population (Figure 5).

The highest percentage of immersion related ED visits occurred among residents of Anaheim (15.7%), Santa Ana (12.7%), and Garden Grove (6.4%), accounting for more than one-third (n=71) of all immersion incidents for children reported by Orange County EDs (Figure 4 & Table 1). Southern and coastal areas of the County saw the lowest percentage of immersion related ED visits.

Figure 4: Immersion Related Emergency Department Visits Among Children (0-17 yrs)
Percentage by City/Community of Residence (2005-2007)

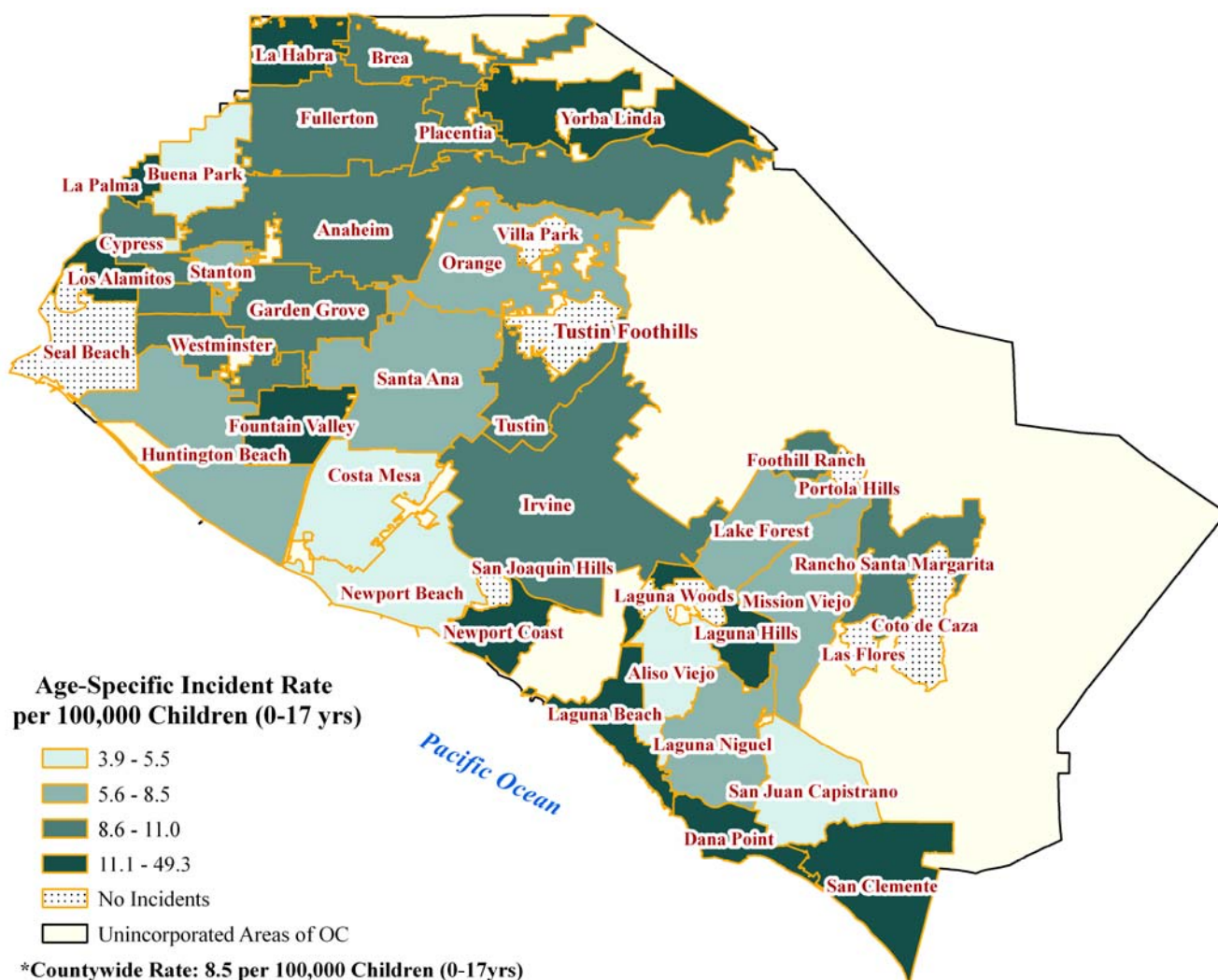


Source: OSHPD Emergency Department & Patient Discharge Data (2005-2007)

Note: Due to mapping software limitations, percentages/rates for the unincorporated areas of the county could not be mapped. As a result, the three immersion incidents for children residing in the unincorporated area of Trabuco Canyon are not shown.

When the distribution of immersion related ED visits was analyzed by incidence rate (i.e., per 100,000 children in each city/community) a different pattern emerged (Figure 5). Specifically, the highest rates were seen among children residing in the cities/communities of Newport Coast (49.3 per 100,000), Fountain Valley (21.2 per 100,000), and Laguna Beach (18.8 per 100,000; Table 1). However, among those communities with five or more incidents, Fountain Valley, San Clemente (18.2 per 100,000), and Yorba Linda (15.5 per 100,000) had the highest rates, averaging about 18 ED visits per 100,000 children 0-17 years of age. About 40% of the cities/communities mapped were above the countywide rate of 8.5 per 100,000.

Figure 5: Immersion Related Emergency Department Visits Among Children (0-17 yrs)
Incident Rate by City/Community of Residence (2005-2007)



Source: OSHPD Emergency Department & Patient Discharge Data (2005-2007)

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Note: Due to mapping software limitations, percentages/rates for the unincorporated areas of the county could not be mapped. As a result, the three immersion incidents for children residing in the unincorporated area of Trabuco Canyon are not shown.

Table 1: Immersion Related ED Visits by City/Community of Residence (Ages 0-17)

	Year			Total ¹	Population (0-17 yrs) ²	% Total Events	3yr Avg. Rate per 100,000
	2005	2006	2007				
Anaheim	10	13	9	32	97,775	15.7%	10.9
Santa Ana	8	10	8	26	108,458	12.7%	8.0
Garden Grove	3	1	9	13	46,017	6.4%	9.4
Fullerton	6	4	1	11	33,691	5.4%	10.9
Irvine	3	3	5	11	40,809	5.4%	9.0
San Clemente	2	2	4	8	14,616	3.9%	18.2
Yorba Linda	2	2	4	8	17,161	3.9%	15.5
Fountain Valley	2	3	2	7	11,027	3.4%	21.2
Huntington Beach	3	2	2	7	40,584	3.4%	5.7
Tustin	3	1	3	7	25,778	3.4%	9.1
La Habra	2	2	2	6	16,940	2.9%	11.8
Orange	0	0	6	6	36,010	2.9%	5.6
Westminster	1	1	4	6	21,929	2.9%	9.1
Rancho Santa Margarita	0	2	3	5	15,869	2.5%	10.5
Costa Mesa	3	1	0	4	24,298	2.0%	5.5*
Cypress	0	2	2	4	12,459	2.0%	10.7*
Lake Forest	2	2	0	4	20,164	2.0%	6.6*
Mission Viejo	2	2	0	4	24,091	2.0%	5.5*
Placentia	2	1	1	4	12,998	2.0%	10.3*
Brea	0	0	3	3	9,357	1.5%	10.7*
Buena Park	2	1	0	3	23,306	1.5%	4.3*
Laguna Hills	1	1	1	3	6,961	1.5%	14.4*
Laguna Niguel	1	2	0	3	15,729	1.5%	6.4*
Trabuco Canyon	1	1	1	3	11,559	1.5%	8.7*
Aliso Viejo	0	2	0	2	12,420	1.0%	5.4*
Dana Point	0	0	2	2	5,486	1.0%	12.2*
Laguna Beach	2	0	0	2	3,551	1.0%	18.8*
La Palma	1	1	0	2	3,771	1.0%	17.7*
Newport Beach	1	0	1	2	16,880	1.0%	3.9*
Stanton	1	0	1	2	11,097	1.0%	3.0*
Foothill Ranch	0	1	0	1	3,538	0.5%	9.4*
Los Alamitos	1	0	0	1	2,996	0.5%	11.1*
Newport Coast	1	0	0	1	676	0.5%	49.3*
San Juan Capistrano	0	1	0	1	8,376	0.5%	4.0*
Coto de Caza	0	0	0	0	4,720	0.0%	0.0
Laguna Woods	0	0	0	0	96	0.0%	0.0
Las Flores	0	0	0	0	1,874	0.0%	0.0
Portola Hills	0	0	0	0	2,162	0.0%	0.0
Rossmoor	0	0	0	0	2,831	0.0%	0.0
San Joaquin Hills	0	0	0	0	662	0.0%	0.0
Seal Beach	0	0	0	0	2,847	0.0%	0.0
Tustin Foothills	0	0	0	0	6,182	0.0%	0.0
Villa Park	0	0	0	0	1,522	0.0%	0.0
Unknown/Other	0	0	0	0	19,279	0.0%	0.0
Total:	66	64	74	204	798,551	100.0%	8.5

¹OSHPD Emergency Department Data (2005-2007). ²California Department of Finance Population Projections (2006).

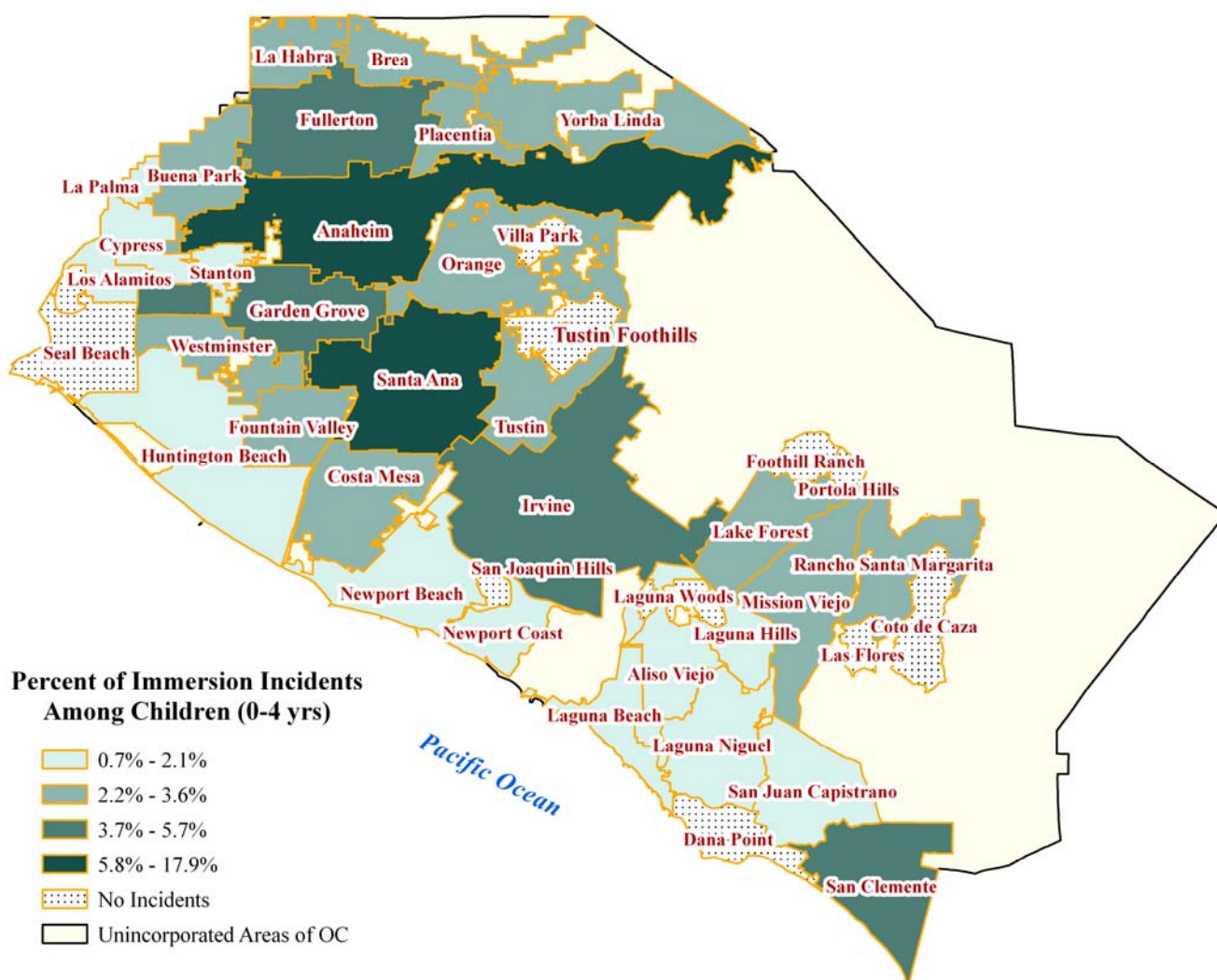
*Those rates based on fewer than 5 cases are statistically unreliable.

Place of Residence: High Risk Group (Children: 0-4 years old)

Victim's City of Residence (Map & Table): The maps and Table 2 shown below present the distribution of immersion incidents that resulted in a visit to the ED among Orange County residents 0-4 years of age, by the percentage of all incidents (Figure 6) and by rates per 100,000 city population (Figure 7).

The highest percentage of immersion related ED visits for young children (0-4 yrs) occurred among residents of Anaheim (17.9%), Santa Ana (12.1%), and Garden Grove (5.7%). These three cities accounted for more than one-third (n=50) of all immersion related ED visits among Orange County children 0-4 years (see also Table 2). Southern and coastal areas of the County, with the exception of San Clemente, had the lowest percentage of immersion related ED visits among children under age five (Figure 6).

Figure 6: Immersion Related Emergency Department Visits Among Children (0-4 yrs)
Percentage by City/Community of Residence (Orange County, 2005-2007)



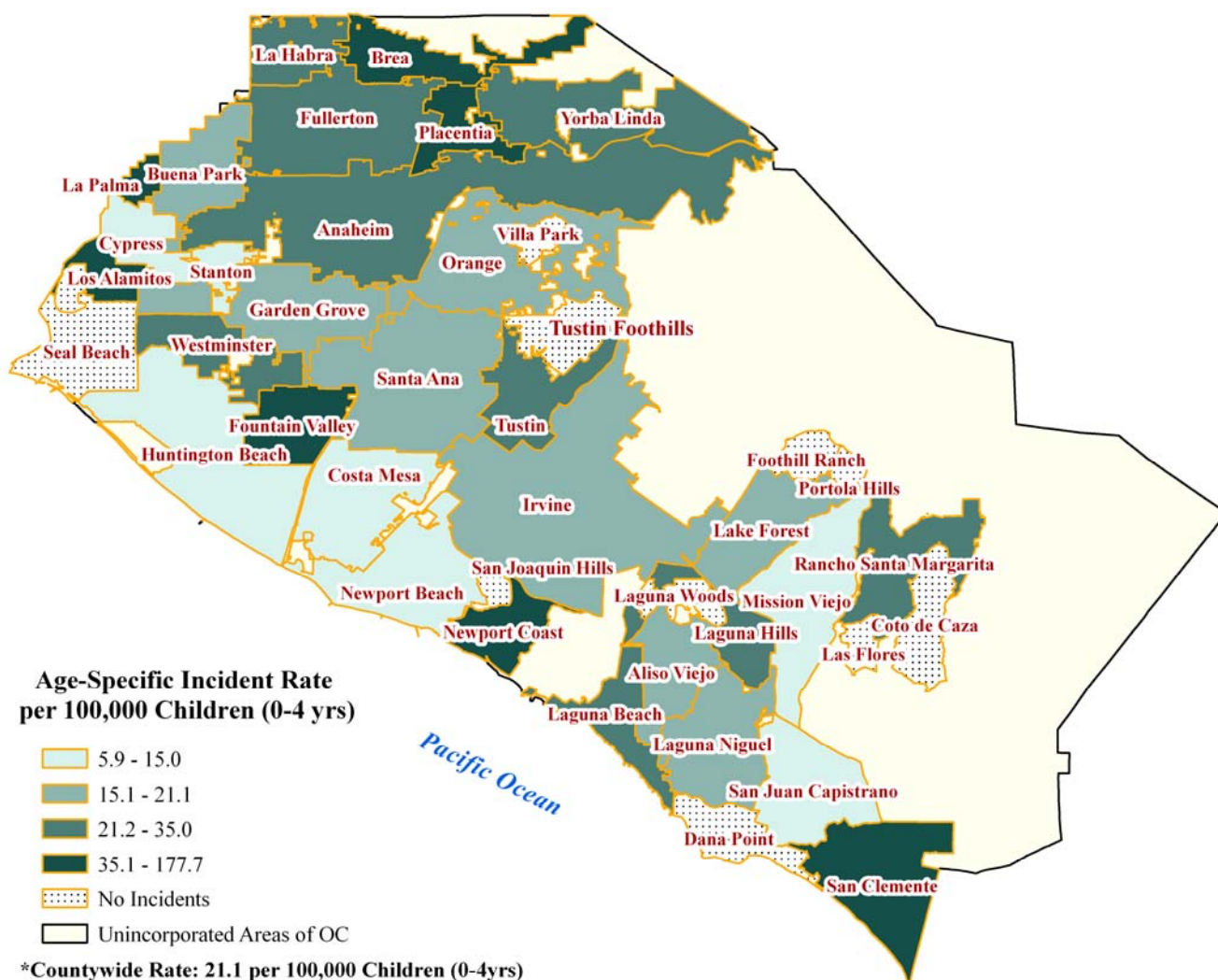
Source: OSHPD Emergency Department & Patient Discharge Data (2005-2007)

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Note: Due to mapping software limitations, percentages/rates for the unincorporated areas of the county could not be mapped. As a result, the two immersion incidents for children 0-4 years residing in the unincorporated area of Trabuco Canyon are not shown.

When the distribution of immersion related ED visits was analyzed by incidence rate (i.e., per 100,000 children 0-4 years in each city/community) a different pattern emerged (Figure 7). Specifically, the highest rates were seen among children residing in the cities/communities of Newport Coast (177.7 per 100,000), La Palma (63.7 per 100,000), and San Clemente (49.3 per 100,000; Table 2). However, among those with five or more incidents, San Clemente, Yorba Linda (35 per 100,000), and Anaheim (30.7 per 100,000) had the highest rates, averaging about 38 ED visits per 100,000 children 0-4 years of age. As shown in Table 2, 37% (n=16) of the cities/communities mapped had an incident rate that was above the countywide rate of 21.1 per 100,000.

Figure 7: Immersion Related Emergency Department Visits Among Children (0-4 yrs)
Incident Rate by City/Community of Residence (Orange County, 2005-2007)



Source: OSHPD Emergency Department & Patient Discharge Data (2005-2007)

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Note: Due to mapping software limitations, percentages/rates for the unincorporated areas of the county could not be mapped. As a result, the two immersion incidents for children 0-4 years residing in the unincorporated area of Trabuco Canyon are not shown.

Table 2: Immersion Related ED Visits by City/Community of Residence (Ages 0-4)

	Year			Total ¹	Population (0-4 yrs) ²	% Total Events	3yr Avg. Rate per 100,000
	2005	2006	2007				
Anaheim	7	10	8	25	27,135	17.9%	30.7
Santa Ana	7	7	3	17	30,100	12.1%	18.8
Garden Grove	2	0	6	8	12,771	5.7%	20.9
Irvine	3	2	2	7	11,326	5.0%	20.6
Fullerton	4	1	1	6	9,350	4.3%	21.4
San Clemente	2	2	2	6	4,056	4.3%	49.3
Orange	0	0	5	5	9,994	3.6%	16.7
Tustin	3	0	2	5	7,154	3.6%	23.3
Westminster	1	0	4	5	6,086	3.6%	27.4
Yorba Linda	1	0	4	5	4,763	3.6%	35.0
Fountain Valley	2	2	0	4	3,060	2.9%	43.6*
La Habra	2	2	0	4	4,701	2.9%	28.4*
Placentia	2	1	1	4	3,607	2.9%	37.0*
Rancho Santa Margarita	0	2	2	4	4,404	2.9%	30.3*
Brea	0	0	3	3	2,597	2.1%	38.5*
Buena Park	2	1	0	3	6,468	2.1%	15.5*
Costa Mesa	2	1	0	3	6,743	2.1%	14.8*
Lake Forest	2	1	0	3	5,596	2.1%	17.9*
Mission Viejo	2	1	0	3	6,686	2.1%	15.0*
Aliso Viejo	0	2	0	2	3,447	1.4%	19.3*
Huntington Beach	0	0	2	2	11,263	1.4%	5.9*
Laguna Hills	1	1	0	2	1,932	1.4%	34.5*
Laguna Niguel	0	2	0	2	4,365	1.4%	15.3*
La Palma	1	1	0	2	1,047	1.4%	63.7*
Newport Beach	1	0	1	2	4,685	1.4%	14.2*
Trabuco Canyon	0	1	1	2	3,208	1.4%	20.8*
Cypress	0	0	1	1	3,458	0.7%	9.6*
Laguna Beach	1	0	0	1	985	0.7%	33.8*
Los Alamitos	1	0	0	1	831	0.7%	40.1*
Newport Coast	1	0	0	1	188	0.7%	177.7*
San Juan Capistrano	0	1	0	1	2,325	0.7%	14.3*
Stanton	0	0	1	1	3,080	0.7%	10.8*
Coto de Caza	0	0	0	0	1,310	0.0%	0.0
Dana Point	0	0	0	0	1,523	0.0%	0.0
Foothill Ranch	0	0	0	0	982	0.0%	0.0
Laguna Woods	0	0	0	0	27	0.0%	0.0
Las Flores	0	0	0	0	520	0.0%	0.0
Portola Hills	0	0	0	0	600	0.0%	0.0
Rossmoor	0	0	0	0	786	0.0%	0.0
San Joaquin Hills	0	0	0	0	184	0.0%	0.0
Seal Beach	0	0	0	0	790	0.0%	0.0
Tustin Foothills	0	0	0	0	1,716	0.0%	0.0
Villa Park	0	0	0	0	422	0.0%	0.0
Unknown/Other	0	0	0	0	5,350	0.0%	0.0
Total:	50	41	49	140	221,618	100.0%	21.1

¹OSHPD Emergency Department Data (2005-2007). *Those rates based on fewer than 5 cases are statistically unreliable.

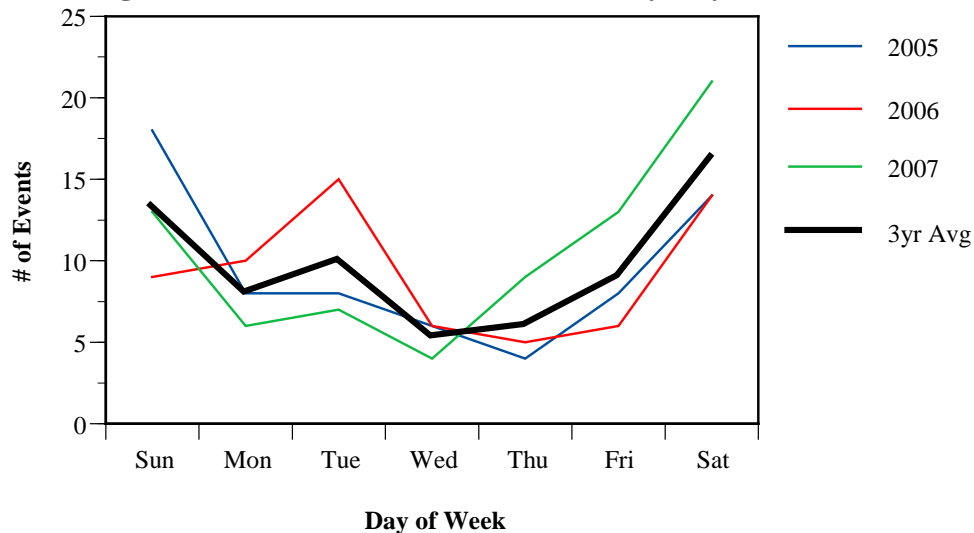
²California Department of Finance Population Projections (2006).

Emergency Department Findings

Time of Encounter: Over the three-year period of 2005-07 there was an average of 68 immersion-related ED visits and an average of 3 deaths in the ED per year. Approximately 5% of all immersion related ED cases resulted in death while being treated in the ED.

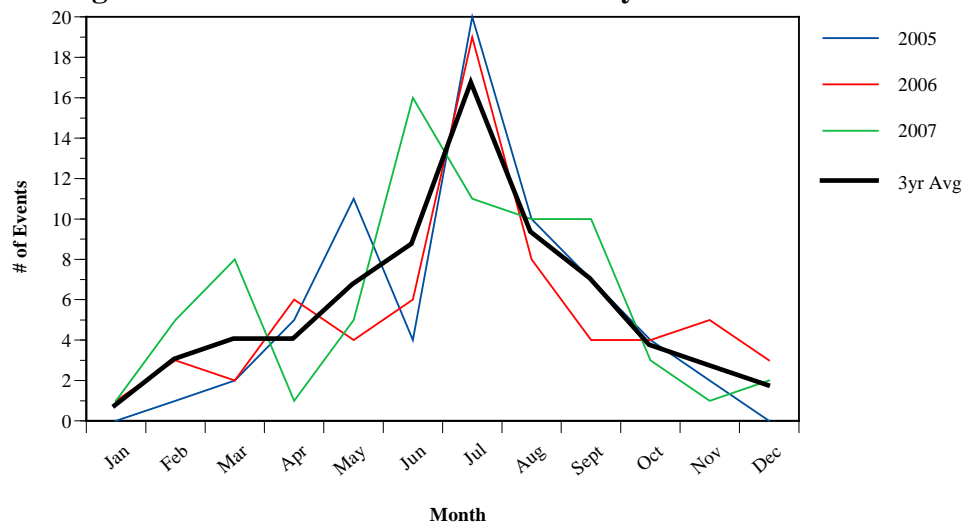
Approximately 43.6% (n=89) of all immersion related ED visits occurred during the weekend (Figure 8). While there was an anomolous spike in the number of incidents on Tuesdays in 2006, weekends averaged almost twice as many incidents (15 weekend vs. 8 weekday incidents per year).

Figure 8: Immersion Related ED Visits by Day of Admission



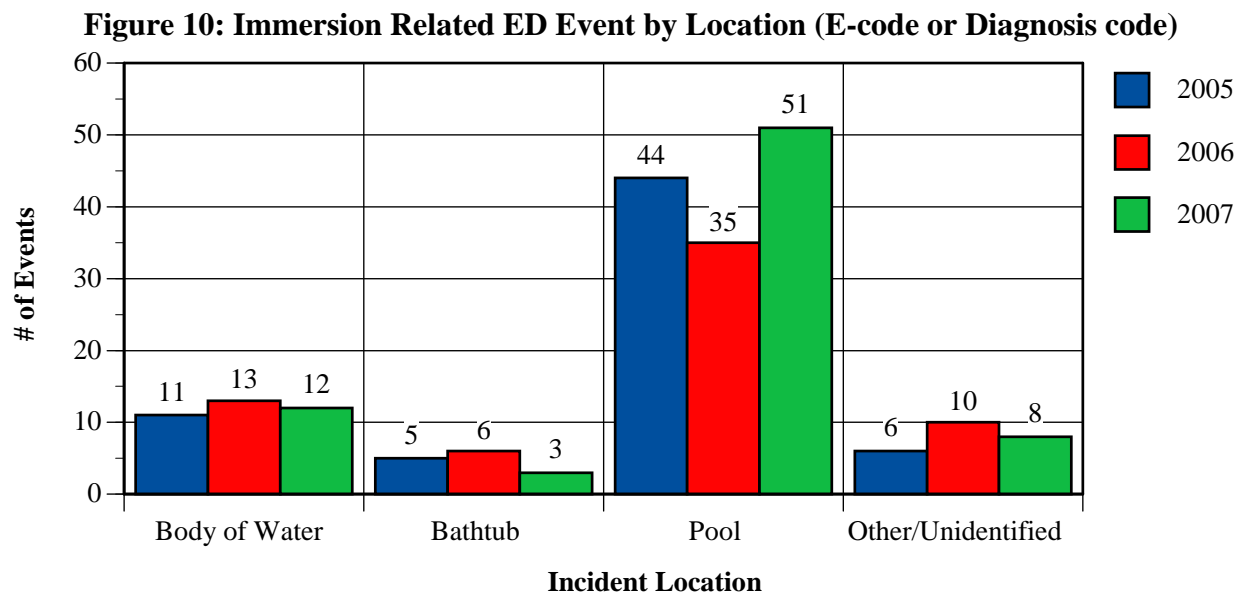
Over the three-year period, more than half (50.9%) of all immersion related ED visits occurred during the three-month period of June to August (n=104; Figure 9). With a slight variation in 2007, this trend held constant across the three-year period. Nearly one-in-four (24.5%) immersion incidents occurred during the month of July.

Figure 9: Immersion Related ED Visits by Month of Admission



Source of Payment: Among those who were treated in the emergency department for immersion related incidents, 59.8% had private insurance. More than one in every four patients seen in the ED had some form of government insurance; of these patients 84.9% (n=45) were covered by Medi-Cal.

Location of Immersion Incidents: The majority (63.7%) of immersion related incidents occurred in a pool (n=130), either residential or commercial (Figure 10). Children are 3.6 times more likely to drown in a pool than they are in a natural body of water. An additional 17.6% involved incidents that occurred in natural bodies of water (n=36). Immersion incidents in bathtubs (n=14) accounted for 6.9% of cases. The remaining 11.8% of cases occurred in undetermined or unidentified locations (n=24).



The greatest number of immersion related ED visits occurred among children 0-4 years of age (n=140), representing 68.6% of all cases (Table 3). Three-quarters (75%; n=105) of all immersion incidents, among 0-4 year olds, occurred in pools and accounted for nearly 70% (n=16) of incidents among 5-9 year olds.

Table 3: Injury Code (E-code) for Immersion Related ED Visits by Age Group

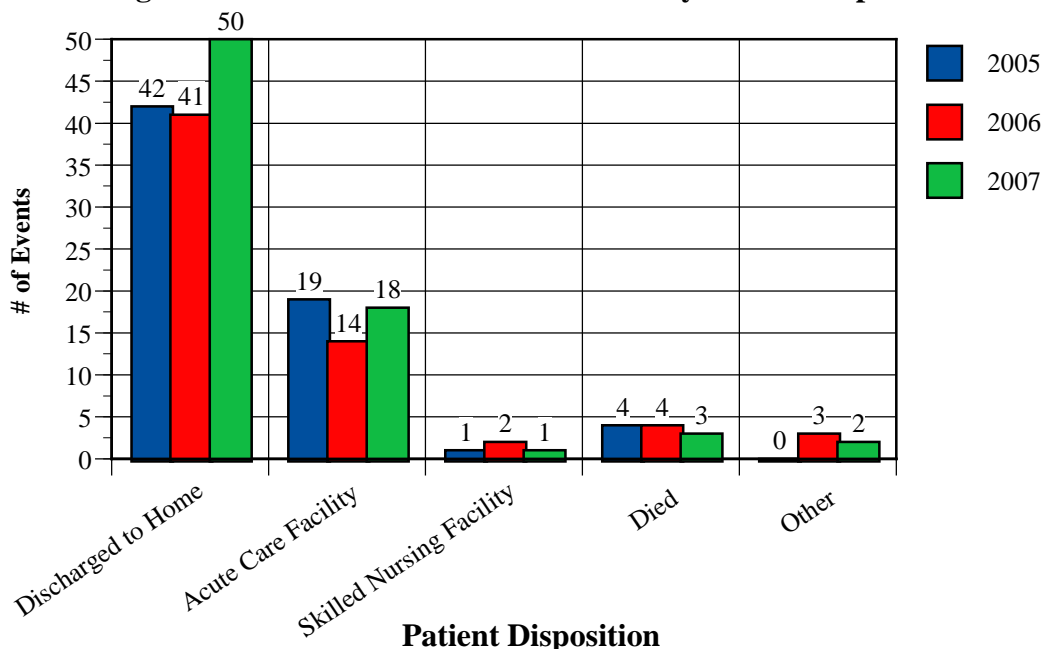
E-code Description ¹	Age Groups				Total
	0-4yrs	5-9yrs	10-14yrs	15-17yrs	
Accidental drowning in natural body of water (E910.0-910.3)	12	1	11	12	36
Accidental drowning in bathtub (E910.4)	12	1	1	0	14
Accidental drowning in Pool (E910.8)	105	16	5	4	130
Other or Unidentified Location:					
Accidental drowning in Other/Unspecified Location (E910.4)	9	3	3	3	18
Drowning undetermined accidental or intentional (E984)	0	0	1	1	2
Drowning Diagnosis (Dx Code: 994.1)	2	2	0	0	4
Total:	140	23	21	20	204

¹OSHPD Emergency Department Data (2005-2007).

The present report primarily uses the *International Classification of Disease 9th Edition* external cause of injury codes (E-codes) to identify immersion incidents. Additionally, there were four cases where there was no E-code provided. However, the primary diagnosis was listed as a "drowning and non-fatal submersion" (ICD-9 code: 994.1). For this analysis, these cases were identified as a distinct group referenced as "Drowning Diagnosis." Those cases identified with an E-Code of E910.4 & E984 and those with a diagnosis code of 994.1 were grouped into the "Other or Unidentified Location" group.

Patient Disposition: Among all immersion incidents, 5.4% (n=11) resulted in the death of the child in the ED, with an average of 3 drownings per year over the 3-year period (Figure 11). The remaining 94.6% of these events were near-drownings, with 65.2% (n=133) of these patients being discharged home and more than one out of every four patients were admitted or transferred to an acute care facility (n=51).

Figure 11: Immersion Related ED Visits by Patient Disposition



Children 0-4 years of age made up the majority of immersion related ED visits (68.6%, n=140). Among those, 64% (n=89) were discharged home, 25.9% (n=36) were transferred to an acute care facility, and 6.5% (n=9) expired in the ED (Table 4). Older children 5-14 years made up significantly fewer cases and were typically able to go home from the ED (about a third were hospitalized). Among teens 15-17 years old, most (90%, n=18 of 20) were discharged home.

Table 4: Immersion Related ED Visits: Disposition of Patient by Age Group

Patient Disposition	Age Groups				Total ¹
	0-4yrs	5-9yrs	10-14yrs	15-17yrs	
Discharged to Home	89	13	13	18	133
Discharged to Acute Care Facility	36	7	7	1	51
Discharged to Skilled Nursing Facility (SNF)	3	0	1	0	4
Died	9	2	0	0	11
Other	3	1	0	1	5
Total:	140	23	21	20	204

¹OSHPD Emergency Department Data (2005-2007).

Emergency Department Incident Rates: The age-specific incident rate for immersion related ED visits among Orange County children 0-17 years of age was 8.5 per 100,000 of this population (Table 5).

Table 5: Age-Specific Incident Rates per 100,000 children 0-17 years of age

All Incidents	Year			Total¹	Population (0-17 yrs)²	3yr Avg. Rate per 100,000
	2005	2006	2007			
Drowning	4	4	3	11	798,551	0.5
Near-Drowning	62	60	71	193	798,551	8.1
Sex						
Male	43	38	44	125	408,638	10.2
Female	23	26	30	79	389,913	6.8
Age Group						
0-4 yrs	50	41	49	140	221,618	21.1
5-9 yrs	5	9	9	23	213,547	3.6
10-14 yrs	4	6	11	21	227,034	3.1
15-17 yrs	7	8	5	20	136,352	4.9
Race/Ethnicity						
White	44	39	48	131	286,007	15.3
Black	0	0	1	1	9,955	3.3
Hispanic	5	8	7	20	365,726	1.8
Asian/PI	13	7	9	29	105,146	9.2
Other	4	10	9	23	31,717	24.2
Total (Ages 0-17):	66	64	74	204	798,551	8.5

¹OSHDP Emergency Department Data (2005-2007).

²California Department of Finance Population Projections (2006).

The three-year average mortality rate for ED visits was 0.5 per 100,000 for drowning, compared to 8.1 per 100,000 for near-drowning (Table 5). Children 0-4 years of age had an incident rate of 21.1 per 100,000, which was 4.3 times higher than any other group. The immersion incident rate for males was 10.2 per 100,000 compared to that of females at 6.8 per 100,000. Among those with a known race/ethnicity, whites had the highest immersion incident rate with 15.4 per 100,000 children. Asians had the second highest rate with 9.2 immersion incidents per 100,000.

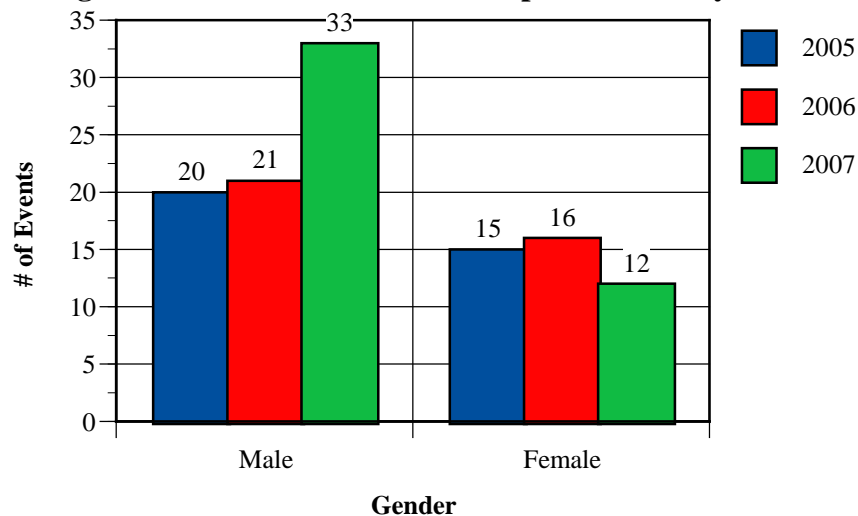
Hospitalizations

Demographics of Hospitalized Patients

Among the 204 immersion related ED visits, 117 (57.4%) were injured seriously enough to be admitted to an acute care hospital for further treatment and/or observation. The following results are based on the 2005-2007 OSHPD Patient Discharge datasets.

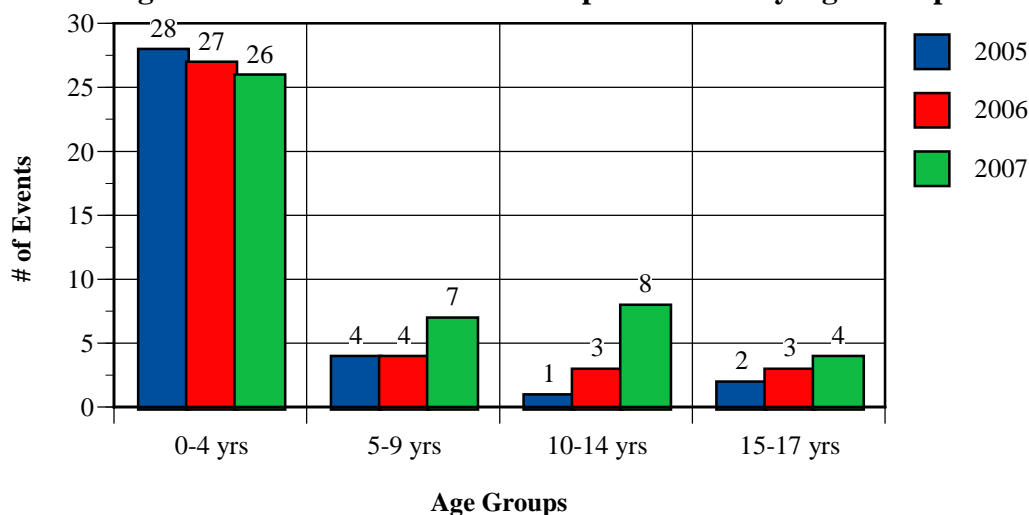
Gender: Among the 117 immersion incidents that resulted in hospitalization, 63.2% (n=74) were males and the remaining 36.8% were females (n=43; Figure 12).

Figure 12: Immersion Related Hospitalizations by Gender

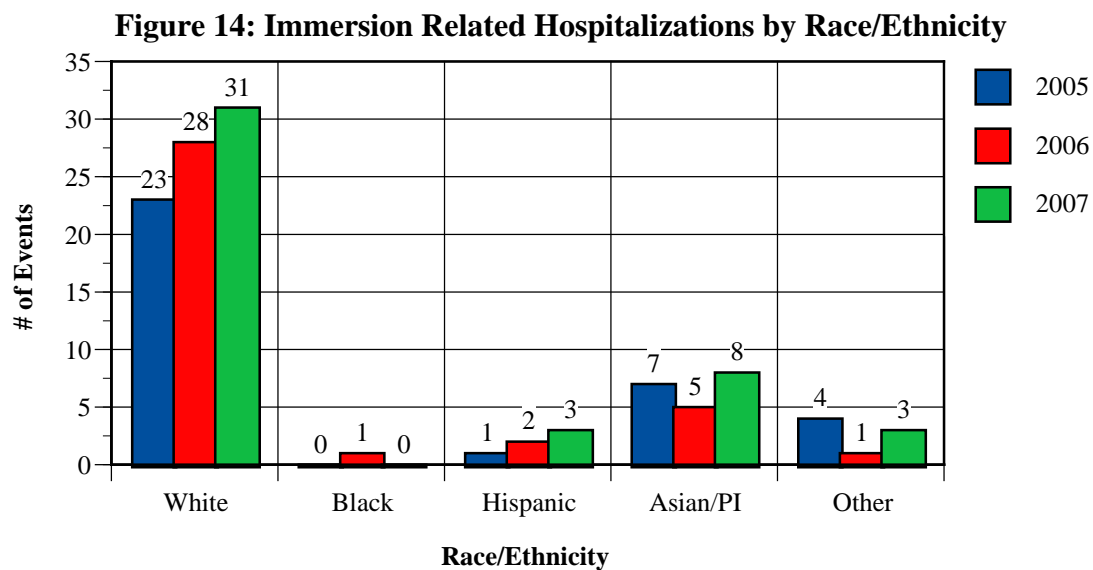


Age: More than two-thirds of all cases resulting in hospitalization (69.2%) occurred among children under age five (n=81). Children 5-9 years of age accounted for 13% of immersion related hospitalizations followed by 10% for 10-14 year olds and 8% for teens 15-17 years (Figure 13).

Figure 13: Immersion Related Hospitalizations by Age Group



Race/Ethnicity: The majority (70.1%) of immersion related hospitalizations occurred among whites (n=82). Asians made up the second highest group, with 17.1% (n=20). Hispanics were the third highest group with 5.1% (n=6) requiring admission to the hospital. African Americans (n=1) and other/unknown (n=8) made up the remaining 7.7% of admissions (Figure 14).



Place of Residence: All Incidents (Children: 0-17 years old)

Victim's City of Residence (Map & Table): The maps and Table 6 below present the distribution of the 117 immersion related hospitalizations among Orange County residents 0-17 years of age, by the percentage of all incidents (Figure 15) and by rates per 100,000 city population (Figure 16).

The highest percentage of immersion related hospitalizations occurred among residents of Anaheim (15.4%), Santa Ana (12.0%), and Garden Grove (8.5%). These cities accounted for 36% (n=42) of all immersion related hospitalizations for children reported by Orange County EDs (Table 6). Southern and coastal areas of the County saw the lowest proportions of immersion related hospitalizations, with the highest number of cases occurring in the more populous central Orange County (Figure 15).

**Figure 15: Immersion Related Hospitalizations Among Children (0-17 yrs)
Percentage by City/Community of Residence (Orange County, 2005-2007)**



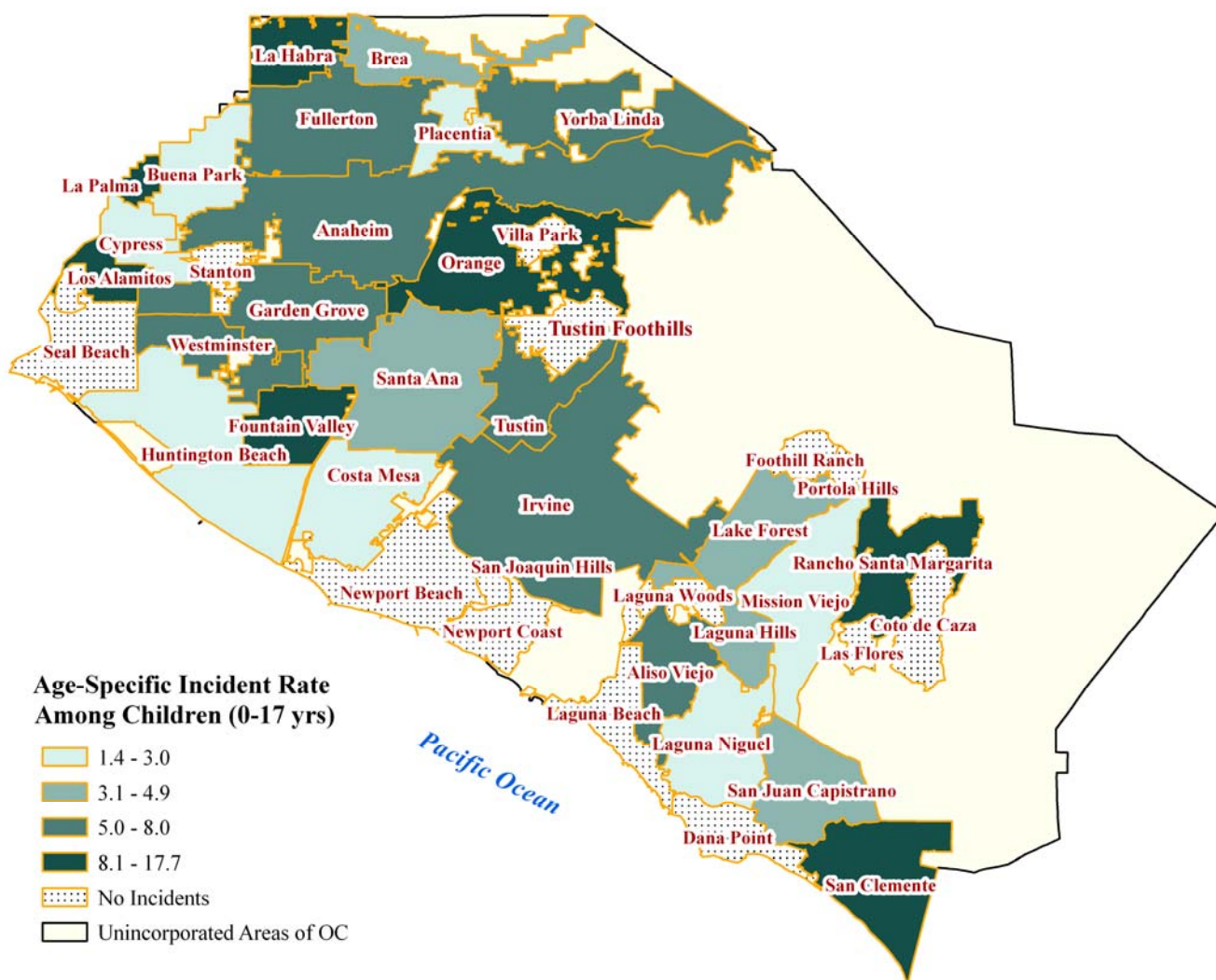
Source: OSHPD Emergency Department & Patient Discharge Data (2005-2007)

HCA/Planning & Research February 2009

Note: Due to mapping software limitations, percentages/rates for the unincorporated areas of the county could not be mapped. As a result, the two immersion incidents for children residing in the unincorporated area of Trabuco Canyon are not shown.

When the distribution of immersion related hospitalizations was analyzed by incidence rate (i.e., per 100,000 children in each city/community) a different pattern emerged (Figure 16, Table 6). Specifically, the highest rates were seen among children residing in the cities/communities of La Palma (17.7 per 100,000), San Clemente (16.0 per 100,000), and Fountain Valley (15.1 per 100,000) – where the average rate of hospitalizations for these three cities was 16.3 per 100,000 children. However, among those with five or more incidents, San Clemente, Fountain Valley, and La Habra with a rate of 9.8 per 100,000 had the highest rates, averaging just over 13 hospitalizations per 100,000 children 0-17 years of age. As shown in the map below, 36% of the cities/communities mapped had an incident rate that was above the countywide rate of 4.9 per 100,000.

Figure 16: Immersion Related Hospitalizations Among Children (0-17 yrs)
Incident Rate by City/Community of Residence (Orange County, 2005-2007)



Source: OSHPD Emergency Department & Patient Discharge Data (2005-2007)

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Note: Due to mapping software limitations, percentages/rates for the unincorporated areas of the county could not be mapped. As a result, the two immersion incidents for children residing in the unincorporated area of Trabuco Canyon are not shown.

Table 6: Immersion Related Hospitalizations by Child's City of Residence (Ages 0-17)

	Year			Total ¹	Population (0-17 yrs) ²	% Total Events	3yr Avg. Rate per 100,000
	2005	2006	2007				
Anaheim	5	7	6	18	97,775	15.4%	6.1
Santa Ana	5	5	4	14	108,458	12.0%	4.3
Garden Grove	2	1	7	10	46,017	8.5%	7.2
Orange	0	3	6	9	36,010	7.7%	8.3
San Clemente	2	2	3	7	14,616	6.0%	16.0
Irvine	2	1	3	6	40,809	5.1%	4.9
Fountain Valley	1	3	1	5	11,027	4.3%	15.1
Fullerton	4	1	0	5	33,691	4.3%	4.9
La Habra	1	1	3	5	16,940	4.3%	9.8
Westminster	1	1	3	5	21,929	4.3%	7.6
Rancho Santa Margarita	0	0	4	4	15,869	3.4%	8.4*
Tustin	2	1	1	4	25,778	3.4%	5.2*
Yorba Linda	1	1	1	3	17,161	2.6%	5.8*
Aliso Viejo	0	1	1	2	12,420	1.7%	5.4*
Buena Park	1	1	0	2	23,306	1.7%	2.9*
Costa Mesa	1	1	0	2	24,298	1.7%	2.7*
Huntington Beach	1	1	0	2	40,584	1.7%	1.6*
Lake Forest	1	1	0	2	20,164	1.7%	3.3*
La Palma	1	1	0	2	3,771	1.7%	17.7*
Trabuco Canyon	0	1	1	2	11,559	1.7%	5.8*
Brea	0	0	1	1	9,357	0.9%	3.6*
Cypress	0	1	0	1	12,459	0.9%	2.7*
Laguna Hills	0	1	0	1	6,961	0.9%	4.8*
Laguna Niguel	1	0	0	1	15,729	0.9%	2.1*
Los Alamitos	1	0	0	1	2,996	0.9%	11.1*
Mission Viejo	1	0	0	1	24,091	0.9%	1.4*
Placentia	1	0	0	1	12,998	0.9%	2.6*
San Juan Capistrano	0	1	0	1	8,376	0.9%	4.0*
Coto de Caza	0	0	0	0	4,720	0.0%	0.0
Dana Point	0	0	0	0	5,486	0.0%	0.0
Foothill Ranch	0	0	0	0	3,538	0.0%	0.0
Laguna Beach	0	0	0	0	3,551	0.0%	0.0
Laguna Woods	0	0	0	0	96	0.0%	0.0
Las Flores	0	0	0	0	1,874	0.0%	0.0
Newport Beach	0	0	0	0	16,880	0.0%	0.0
Newport Coast	0	0	0	0	676	0.0%	0.0
Portola Hills	0	0	0	0	2,162	0.0%	0.0
Rossmoor	0	0	0	0	2,831	0.0%	0.0
San Joaquin Hills	0	0	0	0	662	0.0%	0.0
Seal Beach	0	0	0	0	2,847	0.0%	0.0
Stanton	0	0	0	0	11,097	0.0%	0.0
Tustin Foothills	0	0	0	0	6,182	0.0%	0.0
Villa Park	0	0	0	0	1,522	0.0%	0.0
Unknown/Other	0	0	0	0	19,279	0.0%	0.0
Total:	35	37	45	117	798,551	100.0%	4.9

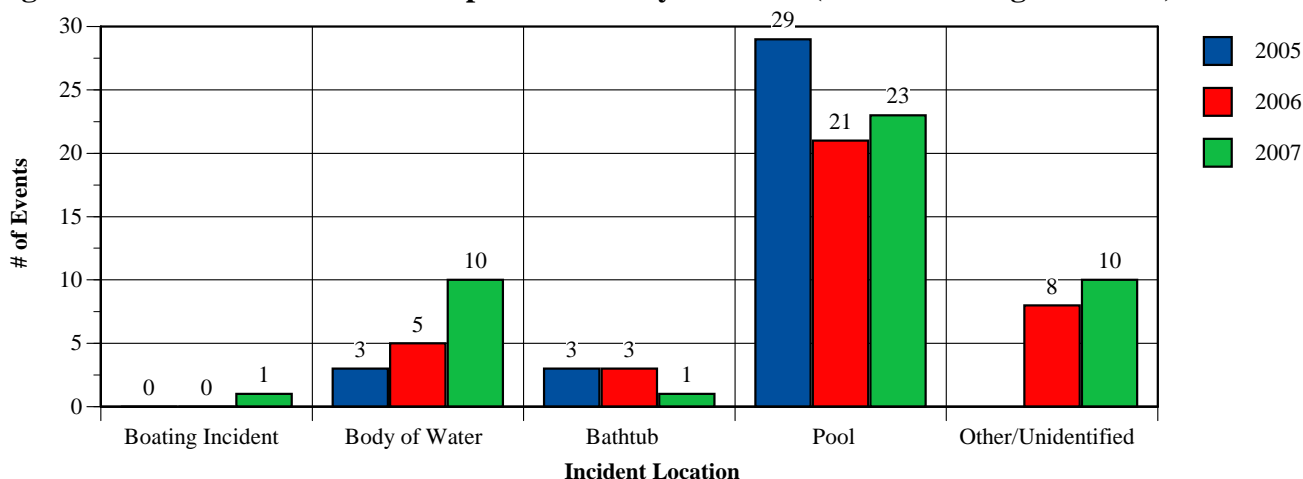
¹OSHPD Emergency Department Data (2005-2007).²California Department of Finance Population Projections (2006).

*Those rates based on fewer than 5 cases are statistically unreliable.

Source of Payment: Among those children admitted to the hospital for immersion related incidents, 58.1% had private insurance and about 35% had some form of government insurance.

Location of Immersion Incidents: The majority (62.4%) of immersion related incidents resulting in hospitalization occurred in a pool (n=73), either residential or commercial (Figure 17). Another 15.4% involved incidents in natural bodies of water (n=18). Immersion incidents in bathtubs (n=7) accounted for an additional 6% of cases. There was one boating related incident in the hospitalization data. The remaining 15.4% of cases were the result of other causes (n=18). Pools and natural bodies of water remained the most common location of all immersion related hospitalizations across the three-year period. In 2005, 82.9% (n=29) of immersion related incidents occurred in pools, compared to the three-year average of 62.4%.

Figure 17: Immersion Related Hospitalizations by Location (E-code or Diagnosis code)



As in the ED data, the greatest number of cases requiring hospitalization occurred among children 0-4 years of age (n=82), representing 70.1% of all hospitalizations. Almost three-quarters (74%) of all immersion related hospitalizations, among 0-4 year olds, occurred in pools (Table 7).

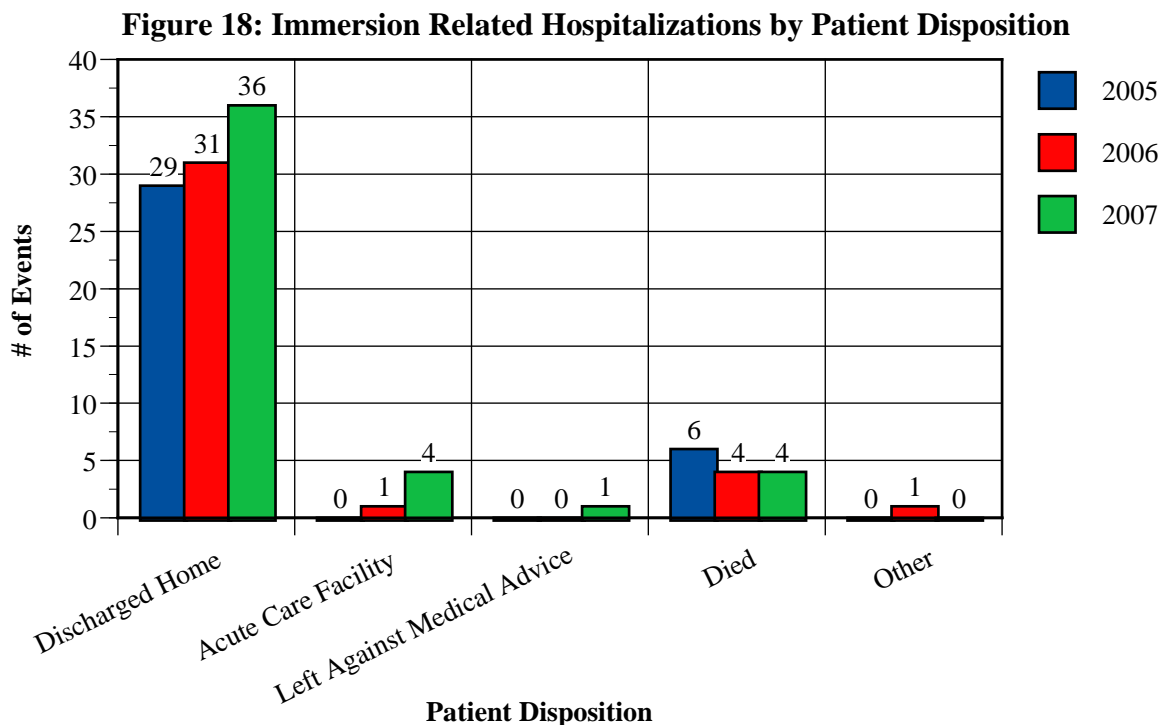
Table 7: Injury Code (E-code) for Immersion Related Hospitalizations by Age Group

E-code Description ¹	Age Groups				Total
	0-4yrs	5-9yrs	10-14yrs	15-17yrs	
Accidental drowning: boating related	0	0	0	1	1
Accidental drowning in natural body of water (E910.0-910.3)	6	2	6	4	18
Accidental drowning in bathtub (E910.4)	6	1	0	0	7
Accidental drowning in Pool (E910.8)	60	8	3	2	73
Other or Unidentified Location:					
Accidental drowning in Other/Unspecified Location (E910.4)	3	0	0	0	3
Drowning undetermined accidental or intentional (E984)	0	0	1	1	2
Drowning Diagnosis (Dx Code: 994.1)	6	4	2	1	13
Total:	81	15	12	9	117

¹ OSHPD Emergency Department Data (2005-2007).

The present report primarily uses the *International Classification of Disease 9th Edition* external cause of injury codes (E-codes) to identify immersion incidents. Additionally, there were cases where there was no E-code provided. However, the primary diagnosis was listed as a "drowning and non-fatal submersion" (ICD-9 code: 994.1). For this analysis, these cases were identified as a distinct group referenced as "Drowning Diagnosis." Those cases identified with an E-Code of E910.4 & E984 and those with a diagnosis code of 994.1 were grouped into the "Other or Unidentified Location" group.

Patient Disposition: Among all immersion incidents that resulted in hospitalization, 12% (n=14) resulted in the death of the child (Figure 18). Near-drownings accounted for the remaining 88% (n=103) of these events, with 81.4% (n=96) of these children being sent home. Five children (4.3%) required further hospitalization and were admitted to an acute care facility. One child left the hospital against medical advice (AMA).



Among children 0-4 years of age, 85.2% were discharged to home, two children were transferred or admitted to an acute care facility, and one left the hospital against medical advice. Of the 14 children who expired after being hospitalized, the majority (64.3%) were 0-4 years of age (Table 8).

Table 8: Immersion Related Hospitalization: Disposition of Patient by Age Group

Patient Disposition	Age Groups				Total ¹
	0-4yrs	5-9yrs	10-14yrs	15-17yrs	
Discharged to Home	69	12	8	7	96
Discharged to Acute Care Facility	2	1	1	1	5
Left Against Medical Advice (AMA)	1	0	0	0	1
Died	9	2	3	0	14
Other	0	0	0	1	1
Total:	81	15	12	9	117

¹OSHPD Emergency Department Data (2005-2007).

Hospitalization Incident Rates: The age-specific incident rate for immersion related hospitalizations among OC children was 4.9 per 100,000 children – corresponding to a fatality rate of 0.6 per 100,000 (4.3 per 100,000 for near-drowning; Table 9).

Children 0-4 years of age had a much higher hospitalization rate (12.2 per 100,000) compared to any other age group. The incident rate for males was higher than females (6 vs. 3.7 per 100,000, respectively). Among those with a known race/ethnicity, Whites had the highest rate at 9.6 per 100,000. The next highest group was Asians with a rate of 6.3 per 100,000.

Table 9: Age-Specific Hospitalization Rates per 100,000 Children

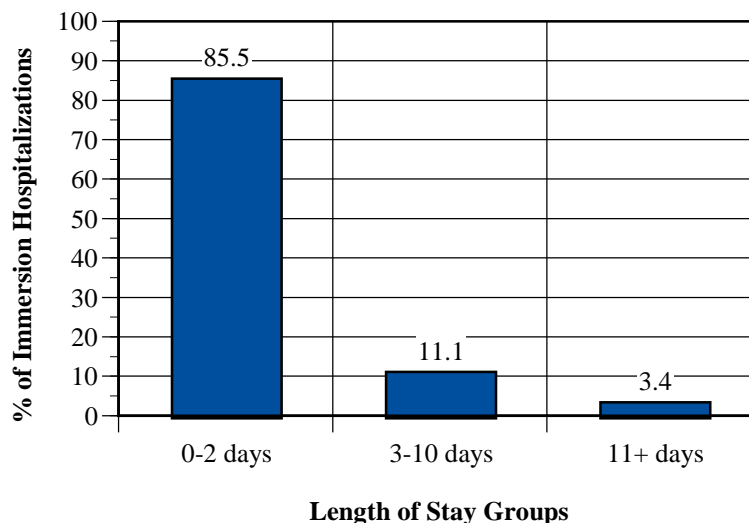
All Incidents	Year			Total¹	Population (0-17 yrs)²	3yr Avg. Rate per 100,000
	2005	2006	2007			
Drowning	6	4	4	14	798,551	0.6
Near-Drowning	29	33	41	103	798,551	4.3
Sex						
Male	20	21	33	74	408,638	6.0
Female	15	16	12	43	389,913	3.7
Age Group						
0-4 yrs	28	27	26	81	221,618	12.2
5-9 yrs	4	4	7	15	213,547	2.3
10-14 yrs	1	3	8	12	227,034	1.8
15-17 yrs	2	3	4	9	136,352	2.2
Race/Ethnicity						
White	23	28	31	82	286,007	9.6
Black	0	1	0	1	9,955	3.3
Hispanic	1	2	3	6	365,726	0.5
Asian/PI	7	5	8	20	105,146	6.3
Other	4	1	3	8	31,717	8.4
Total (Ages 0-17):	35	37	45	117	798,551	4.9

¹OSHDPD Emergency Department Data (2005-2007).

²California Department of Finance Population Projections (2006).

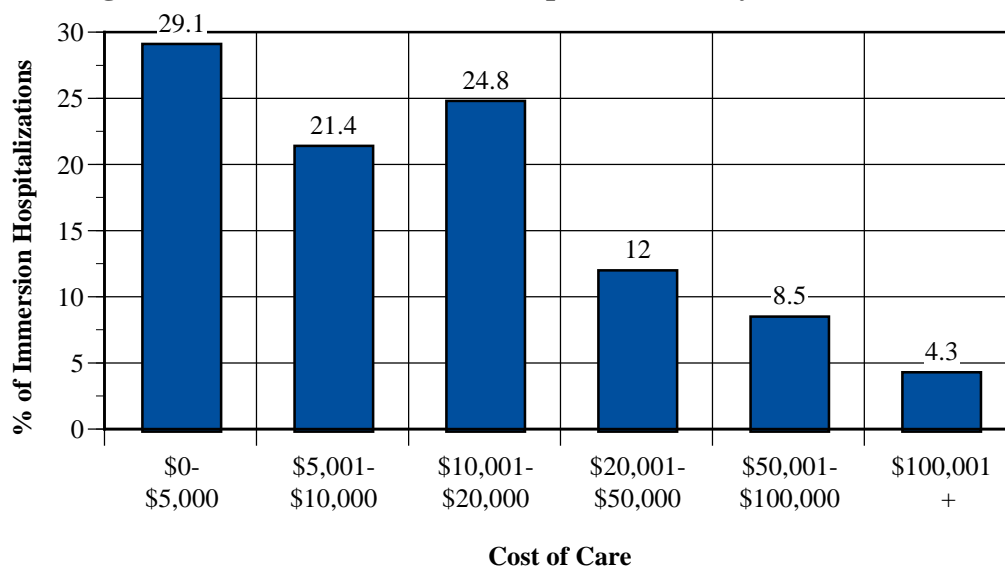
Length of Stay: The average length of stay over the three-year period for all immersion related hospitalizations was 2.7 days. During the three year period, the majority of hospitalizations (85.5%) lasted from 0-2 days. Those children requiring hospital stays from 3 to 10 days accounted for 11.1% of visits, with only 3.4% requiring more than 10 days in the hospital (Figure 19).

Figure 19: Immersion Related Hospitalizations by Length of Stay



Cost of Care: The average cost of immersion related hospitalization was \$28,176 per incident. As shown in Figure 20, the total charges for about 75% of all hospitalizations were less than \$20,000. About one-in-five cases (20.5%) resulted in hospital charges between \$20,001 and \$100,000 and in 4.3% of cases charges exceeded \$100,000.

Figure 20: Immersion Related Hospitalizations by Cost of Care



Drowning Deaths

Immersion Related Deaths (Children 0-17 years of age)

Immersion Related Deaths by Type of Encounter: There were a total of 25 child deaths during this three-year period (0-17 years), representing 12.3% of all immersion incidents that resulted in an ED visit and/or subsequent hospitalization. Among all deaths, 11 children expired in the emergency department and an additional 14 children expired after being hospitalized (Table 10).

Table 10: Immersion Related Deaths: Data Source by Year of Admission (0-17 yr Olds)

ED/Hospital	Year			Total ¹	Population (0-17 yrs) ²	3yr Avg. Rate per 100,000
	2005	2006	2007			
Emergency Department	4	4	3	11	798,551	0.5
Patient Hospitalization	6	4	4	14	798,551	0.6
Total (Ages 0-17yrs):	10	8	7	25	798,551	1.0

¹OSHPD Emergency Department/Patient Discharge Data (2005-2007).

²California Department of Finance Population Projections (2006).

Immersion Related Deaths by Age-Group: Young children (0-4 years) are at a much higher risk for drowning compared to older children (Table 11). With a drowning death rate of 2.7 per 100,000 population, 0-4 year olds were 4.5 times more likely to drown compared to 5 to 9 year olds and 6.8 times more likely than 10 to 14 year olds. Importantly, in 2005 there was a large number of drowning deaths (n=10) among 0-4 year olds compared to the two subsequent years, representing more than half (55.6%) of all cases over the three-year period.

Table 11: Immersion Related Deaths: Age Group by Year of Admission

Age Group	Year			Total ¹	Population By Age ²	3yr Avg. Rate per 100,000
	2005	2006	2007			
0-4 yrs	10	4	4	18	221,618	2.7
5-9 yrs	0	3	1	4	213,547	0.6
10-14 yrs	0	1	2	3	227,034	0.4
15-17 yrs	0	0	0	0	136,352	0.0
Total (Ages 0-17yrs):	10	8	7	25	798,551	1.0

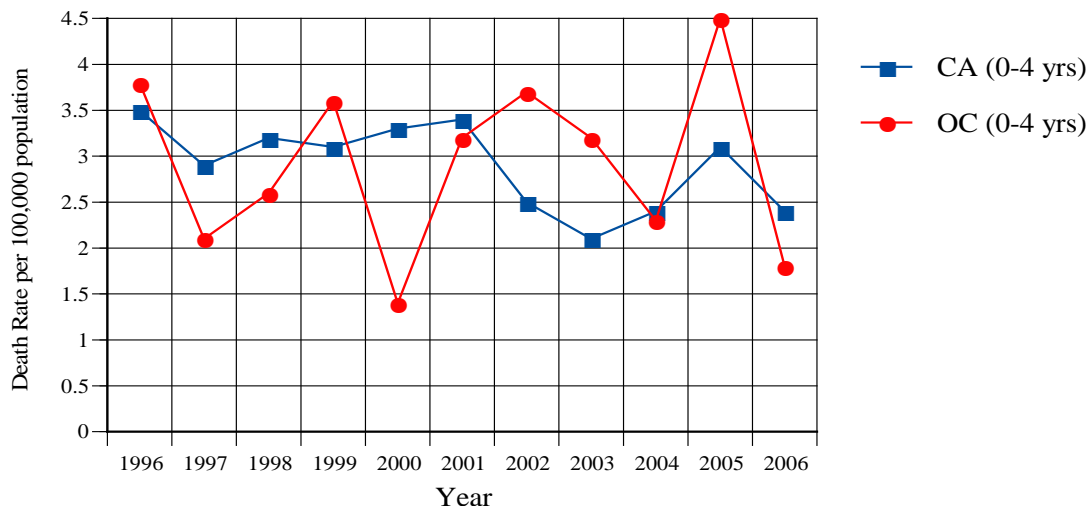
¹OSHPD Emergency Department/Patient Discharge Data (2005-2007).

²California Department of Finance Population Projections (2006).

Immersion Related Deaths (Children 0-4 years of age)

Immersion Related Deaths – California & Orange County (Ten-year period): Over the past decade, the drowning death rate for children 0 to 4 years of age in Orange County has fluctuated from year to year with an average of 2.9 per 100,000 (Figure 21). Similarly, the statewide rate has averaged 2.9 per 100,000 (Source: State/County Death Files).

Figure 21: Drowning Deaths Rates for Children 0-4 yrs California & OC Trends (1996-2006)



Immersion Related Deaths – select California Counties (2004-2006): Due to the relatively small number of cases and resulting wide variation in annual death rates, Figure 22 below presents a 3-year average drowning death rate for 0 to 4 year olds in Orange County compared to the state and other southern California counties. The average drowning death rate for young children (0-4 years) in Orange County for this 3-year time period (2004-2006) was comparable to the statewide rate (2.9 vs. 2.7 per 100,000) and several other southern counties (e.g., San Diego, Imperial, Santa Barbara, Ventura), but much lower compared to San Bernardino (5.7) and Riverside (5.6).

Figure 22: Average Drowning Death Rates for Children 0-4 yrs - Select CA Counties (2004-2006)

