

Pediatric Submersion Injury in the Houston Metropolitan Area: A Multicenter Retrospective Outcomes Review

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BACKGROUND

Resuscitation for submersion injury has one of the highest salvage rates for out of hospital cardiac arrests. In Texas alone, there have been 1,988 pediatric deaths (index 1.5 per 100,000) from 1999-2016¹. Current literature implicates submersion time and duration of CPR as predictors for submersion injury outcomes. In this study, we retrospectively investigate and review outcomes for all types of pediatric submersion injury encounters at Texas Children's Hospital and Memorial Hermann Hospital from 2008-2013. We describe, analyze, and compare events from different bodies of water, type of rescuer, and length of submersion. We trend these preventable events throughout the study period to better understand the epidemiology of this patient population.

PURPOSE

To retrospectively review pediatric submersion injuries requiring evaluation by two tertiary medical centers in a large metropolitan area to better delineate risk factors for morbidity and mortality.

METHODS

- Retrospective chart review
- Children aged 0-18 presenting to Texas Children's Hospital or Memorial Hermann Hospital from 2008-2013
- Patients identified using ICD9 code diagnosis of unintentional submersion injury
- Patient information included age, sex, race/ethnicity, and prior medical history.
- Event information included body of water, submersion time, rescuer, resuscitative efforts prior to EMS arrival, EMS interventions and GCS at the scene.
- Hospital information included location and highest level of care.
- Outcome measures included mortality, length of stay, and status at time of discharge using the Utstein modification with pediatric cerebral performance scale.
- Independent and multivariable logistic regression models were used for analysis.

Demographics		N = 744
Sex		
	Male	465
	Female	278
Race/Ethnicity		
	White	281
	Black	175
	Hispanic	193
	Asian	41
	Other	8
	Unknown	43
Past Medical History		
	Epilepsy	16
	Developmental delay	5
	Other	5
	None	706

Table 1: Patient demographics for the study period

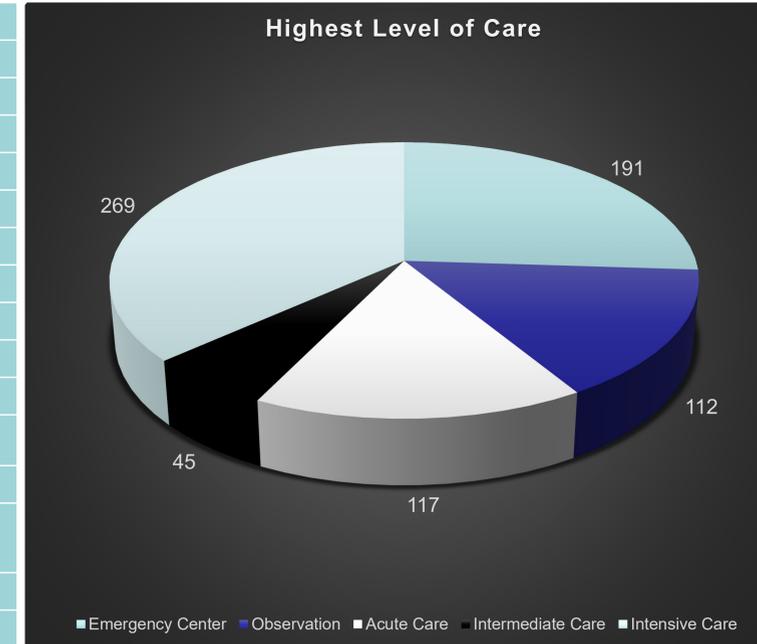


Fig 1: Highest level of care for submersion injuries

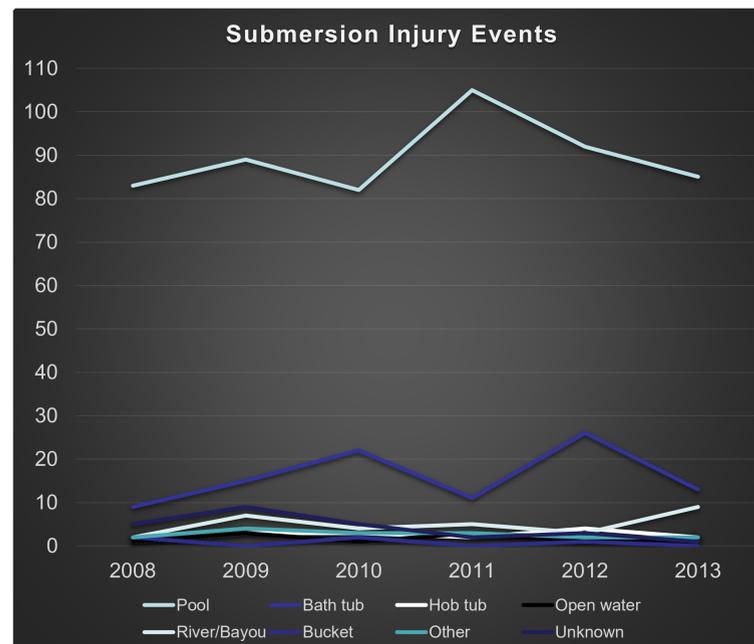


Fig 2: Events by body of water by year

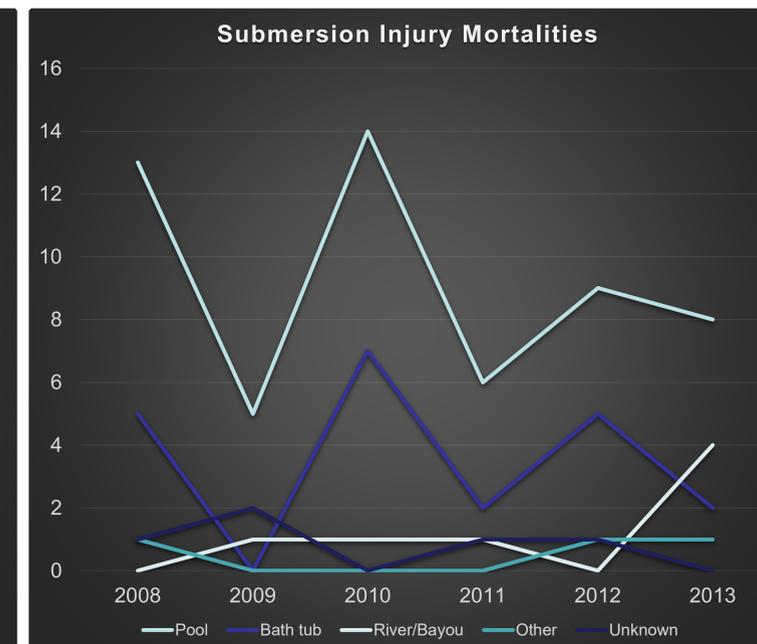


Fig 3: Mortality by body of water by year

RESULTS

- A total of 744 patients, 465 male and 278 female
- Median age of 3 years old (IQR 1.8, 5.0)
- 356 patients from Texas Children's Hospital, 381 patients from Memorial Hermann Hospital
- 96% of patients were previously healthy.
- Submersion time > 5 minutes had a 23.00 higher odds for mortality when compared to < 5 minutes ($p < 0.001$, 95% CI 9.64-54.87).
- Bathtub submersions had a 2.38 higher odds for mortality when compared to pool submersions ($p < 0.001$, 95% CI 2.26-2.52).
- Rescue by EMS had a 13.22 higher odds for mortality when compared to parent rescuers ($p < 0.001$, 95% CI 8.11-21.53).
- Median length of stay 1 day (IQR 0.0, 2.0)
- Age ($p < 0.001$, CI 0.96-0.98), unwitnessed events ($p < 0.02$, CI 0.66-0.96), and submersion time > 5 minutes ($p < 0.005$, CI 0.15-0.17) had lower cumulative incidences of hospital discharge (increased length of stay).
- Bathtub submersions were most common amongst survivors with severe impairment or in vegetative state. Pool submersions are most common amongst survivors with good or moderate impairment ($p < 0.001$).

CONCLUSION

Though pool submersion injuries are often the focus of preventative efforts, there is a higher risk for mortality and long-term neurologic disability from bathtub submersion injuries. Duration of submersion, regardless of body of water, again was demonstrated as a risk factor for mortality and increased length of stay. Ultimately, there were no significant differences per year during the study period. More research is needed, particularly as it relates to bathtub submersions, in order to reduce submersion injury mortality.

REFERENCES

1. Centers for Disease Control and Prevention, National Center for Health Statistics. Underlying Cause of Death 1999-2016 on CDC WONDER Online Database, released December, 2017. Data are from the Multiple Cause of Death Files, 1999-2016, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program.