American Journal of Emergency Medicine 69 (2023) 34–38

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Epidemiology and clinical characteristics of drowning patients presenting to a pediatric emergency department from 2017 to 2020

Katherine Macmillan, MD [a,*], Katherine Hoops, MD, MPH [a,b], Andrea C. Gielen, ScD, ScM [c], Eileen M. McDonald, MS [c], Laura Prichett, PhD, MHS [d], Isam Nasr, MD [e], Leticia Manning Ryan, MD, MPH [f]

[a] Johns Hopkins School of Medicine, Department of Anesthesia and Critical Care Medicine, United States
[b] Johns Hopkins Bloomberg School of Public Health, Department of Health Policy and Management, United States
[c] Johns Hopkins Center for Injury Research and Policy, United States
[d] Johns Hopkins School of Medicine, Department of Pediatrics, United States
[e] Johns Hopkins School of Medicine, Department of Pediatric Surgery and Trauma, United States
[f] Johns Hopkins School of Medicine, Department of Pediatric Emergency Medicine, United States

ARTICLE INFO

Article history:
Received 19 September 2022
Received in revised form 10 March 2023
Accepted 26 March 2023
Available online xxxx

Keywords:
Pediatric drowning
Pediatric emergency department
Injury
Injury prevention
Epidemiology

ABSTRACT

Background: Drowning is a common mechanism of injury in the pediatric population that often requires hospitalization. The primary objective of this study was to describe the epidemiology and clinical characteristics of pediatric drowning patients evaluated in a pediatric emergency department (PED), including the clinical interventions and outcomes of this patient population.
Methods: A retrospective cohort study was conducted of pediatric patients evaluated in a mid-Atlantic urban pediatric emergency department from January 2017 to December 2020 after a drowning event.
Results: Eighty patients ages 0–18 were identified, representing 57 79 unintentional events and 1 intentional self-injury event. The majority of patients (50%) were 1–4 years of age. The majority (65%) of patients 4 years of age or younger were White, whereas racial/ethnic minority patients accounted for the majority (73%) of patients 5 years of age or older. Most drowning events (74%) occurred in a pool, on Friday through Saturday (66%) and during the summer (73%). Oxygen was used in 54% of admitted patients and only in 9% of discharged patients. Cardiopulmonary resuscitation (CPR) was performed in 74% of admitted patients and 33% of discharged patients.
Conclusions: Drowning can be an intentional or unintentional source of injury in pediatric patients. Among the patients who presented to the emergency department for drowning, more than half received CPR and/or were admitted, suggesting high acuity and severity of these events. In this study population, outdoor pools, summer season and weekends are potential high yield targets for drowning prevention efforts.
Published by Elsevier Inc.

1. Introduction

Injuries are the leading cause of death for children and adolescents, and drowning is an injury mechanism known to have particularly high mortality and morbidity [1]. Recent data show that drowning is within the top seven causes of death by unintentional injury for all age groups, ranking first in ages 1–4 years and second in ages 5–9 years [2] Racial disparities are well documented, as Black children are 5–10 times more likely to drown in swimming pools than their age-matched white counterparts [3]. Drowning also represents a disproportionately high number of injury-related hospitalizations, with 50% of emergency department visits for nonfatal drowning leading to transfer of care or admission, in contrast to a 6% hospitalization rate for other injury-related visits [4]. Despite frequently updated recommendations from the American Academy of Pediatrics (AAP) on rescue and prevention strategies, drowning remains a significant threat to children [5].

Although several studies have previously described the epidemiology of nonfatal and fatal drowning events in the pediatric population, they have focused on frequency and location of the events [6-9]. Moreover, most studies were conducted >10 years ago [6-8] and epidemiology may have changed as a result of drowning prevention efforts from the AAP and others that were implemented over this period [5]. In addition, the Centers for Disease Control recommends continued surveillance of injury rates to target prevention strategies as needed [9]. There are less data available relevant to clinical interventions and outcomes, which are needed to guide treatment by health care professionals in the field, emergency department, and pediatric inpatient units. Similarly, updated data are helpful to assess current risk patterns

* Corresponding author at: 1800 Orleans Street, Ste 6302, Baltimore, MD 21287, United States.
E-mail address: kmacmil2@jh.edu (K. Macmillan).

https://doi.org/10.1016/j.ajem.2023.03.053
0735-6757/Published by Elsevier Inc.

and identify potential prevention strategies. Finally, given that published analyses of clinical interventions and outcomes predominantly use international data, region-specific data may be more helpful to inform targeted community-based prevention efforts, considering geographic and racial variation in risk patters [6,10,11].

The primary objective of this study was to describe the epidemiology and clinical characteristics of pediatric drowning patients presenting to a pediatric emergency department (PED). To address the noted gaps, we sought to describe in detail the clinical interventions and outcomes of this patient population. A more in-depth understanding of current clinical presentations and management is warranted to better characterize severity for nonfatal cases. For instance, although nonfatal drowning victims are known to have a higher likelihood of hospital admission than do patients with other types of unintentional injury, there is insufficient information about what components contribute to their clinical severity, including radiographic evidence of injury, the frequency of support such as oxygen therapy, and need for rescue measures like cardiopulmonary resuscitation (CPR).

2. Methods

We conducted a retrospective cohort study of pediatric patients aged 0–18 years who were evaluated in a mid-Atlantic urban PED for a drowning event from January 2017 to December 2020. This PED is a level 1 pediatric trauma center with an annual census of 35,000. The patient population is 60% Black and 20% white, and approximately 60% are publicly insured. Using an electronic medical record query, we identified patients with chief complaints that included the terms "drowning" or "submersion", nursing chief complaint comments that included the terms "drown," "drowning," or "submersion;" or ICD10 diagnosis codes of T75.1, V90, V92, W65, W67, W69, W73, W74, X71, X92, Y21.0, Y21.1, Y21.2, Y21.3, Y21.4, Y21.8, Y21.9. Standardized admission demographics (age, sex, race, date and time of presentation, mode of transport, and language) were populated into a secure Excel file (Microsoft, Redmond, WA). Admission demographics included medical record numbers to ensure that duplicate patients were not enrolled. The lead author (KM) performed an additional chart review of the PED and hospital course using a standardized chart review method and tool to collect information from results and notes that further described patient characteristics, clinical management, and outcomes. Abstracted data that were identified a priori as relevant clinical measures included: use of oxygen support, vasopressor or CPR use, images obtained and results, location of drowning event, and history of presenting illness. Information about clinical interventions was collected from review of documentation at all levels of medical training. Chest imaging was marked as abnormal if findings consistent with submersion were identified, including pulmonary edema, perihilar opacities or cuffing, or other opacities. Head CTs were defined as abnormal if the reading identified cerebral edema or fracture. We examined the distribution of patient characteristics by age, using age groups of <1, 1–4, 5–9,10–14 and 15–18 years of age. Descriptive characteristics such as demographics and disposition were evaluated by age group using a series of Fisher's exact tests. We also examined the distribution of patient demographic and clinical characteristics by PED disposition, per the categories admitted, discharged, and death, using a series of Fisher's exact tests. All analyses were performed using Stata 17.0 (College Park, TX). This study was approved by the Institutional Review Board and upheld principles outlined in the Declaration of Helsinki. This study was limited to retrospective chart review, so no efforts pertaining to patient relations were addressed. No conflicts of interest existed based on International Committee of Medical Journal Editors disclosure guidelines.

3. Results

This analysis identified 80 patients aged 0–18 years who presented to the PED after a drowning event during the study period. Of these, 79 events were reported to be unintentional and 1 event was reported to be an intentional injury (suicide attempt). Overall, the patients had a mean age of 5.6 ± 4.4 years and 64% were male. Forty-eight percent of patients were White and 38% were Black. The most common location was a pool (74%) and most patients presented to the emergency department via ambulance (81%). Table 1 displays patient characteristics stratified by age group. Half of all drowning events occurred in children between 1 and 4 years of age.

Table 2 shows that most patients presented to the PED in the afternoon (48%) and evening (44%). Friday, Saturday, and Sunday accounted for 66% of drowning events. Summer was the season with the highest number of drowning events across all age groups (72%). Twenty-three drowning events occurred in 2017, 22 occurred in each of 2018 and 2019, and 13 occurred in 2020.

>50% of patients evaluated in the PED were subsequently admitted (Table 3). Four patients died, three of whom died in the PED and one who later died in the Pediatric Intensive Care Unit (PICU). Of the 43 patients admitted, 60% were 1–4 years of age. Twenty-three were admitted to the general pediatric service (54%), 19 were admitted to the PICU (44%), and 1 (2%) was admitted to pediatric psychiatric unit because the drowning event was a suicide attempt. More than have the patients received CPR (59%) by bystanders, first responders, or emergency department staff [CPR is used here to represent rescue breaths, chest compressions, or both because we were unable to further classify based on detail provided in charting]. CPR was performed on 75% of admitted patients, 33% of discharged patients, and all patients who died ($p < 0.001$). Thirty patients (37%) received oxygen support via invasive (13%) or non-invasive (87%) modalities. Supplemental oxygen was used on 55% of admitted patients, 9% of discharged patients, and all patients who died ($p < 0.001$).

Table 1
Demographic overview stratified by age groups.

	All ages $n = 80$*	<1 year $n = 3$	1–4 years $n = 40$	5–9 years $n = 22$	10–14 years $n = 12$	15–18 years n = 3	p-value
Sex							0.92
Male	51 (64%)	2 (67%)	25 (63%)	13 (59%)	9 (75%)	2 (67%)	
Female	29 (36%)	1 (33%)	15 (37%)	9 (41%)	3 (25%)	1 (33%)	
Race							<0.001
Black	30 (38%)	2 (67%)	9 (23%)	11 (50%)	7 (58%)	1 (33%)	
White	38 (48%)	1 (33%)	27 (68%)	7 (32%)	2 (17%)	1 (33%)	
Asian	1 (1%)	0	0	0	3 (25%)	1 (33%)	
American Indian	1 (1%)	0	1 (3%)	0	0	0	
Two or more	3 (4%)	0	2 (5%)	1 (5%)	0	0	
Other/Unknown	7 (9%)	0	1 (3%)	3 (14%)	0	0	
Ethnicity							0.47
Hispanic	7 (9%)	1 (33%)	2 (5%)	2 (9%)	2 (17%)	0	
Not Hispanic	71 (89%)	2 (67%)	38 (95%)	19 (86%)	9 (75%)	3 (100%)	
Unknown	2 (2%)	0	0	1 (5%)	1 (8%)	0	

* Data are shown as n (%).

Table 2
Patient demographics and event details stratified by disposition.

	All ages n = 80*	Admitted n = 43	Discharged n = 33	Died n = 4	p-value
Sex					0.16
Female	29 (36%)	12 (28%)	16 (49%)	1 (25%)	
Male	51 (64%)	31 (72%)	17 (52%)	3 (75%)	
Race					0.14
Black	30 (38%)	19 (44%)	8 (24%)	3 (75%)	
White	38 (48%)	18 (42%)	20 (61%)	0	
Asian	1 (1%)	0	1 (3%)	0	
American Indian	1 (1%)	1 (2%)	0	0	
Two or more	3 (4%)	1 (2%)	1 (3%)	1 (25%)	
Other/Unknown	7 (9%)	4 (9%)	3 (9%)	0	
Ethnicity					0.022
Hispanic	7 (9%)	4 (9%)	2 (6%)	1 (25%)	
Not Hispanic	71 (89%)	39 (91%)	30 (91%)	2 (50.0%)	
Unknown	2 (3%)	0	1 (3%)	1 (25%)	
Body of Water					<0.001
Pool	59 (74%)	36 (84%)	22 (67%)	1 (25%)	
Natural body of water	12 (15%)	5 (12%)	6 (18%)	1 (25%)	
Bathtub	5 (6%)	1 (2%)	4 (12%)	0	
Bucket/Container	2 (3%)	0	0	2 (50%)	
Unknown	2 (3%)	1 (2%)	1 (3%)	0	
Mode of Transport					0.11
Ambulance	65 (81%)	35 (82%)	26 (79%)	4 (100%)	
Car	5 (6%)	0	5 (15%)	0	
Medical Flight	9 (11%)	7 (16%)	2 (6%)	0	
Police	1 (1%)	1 (2%)	0	0	
Time of Day					0.90
Afternoon	38 (48%)	21 (49%)	15 (46%)	2 (50%)	
Evening	35 (44%)	19 (44%)	14 (42%)	2 (50%)	
Morning	7 (9%)	3 (7%)	4 (12%)	0	
Weekend vs Weekday					0.45
F-Sun	53 (66%)	31 (72%)	20 (61%)	2 (50%)	
M-Th	27 (34%)	12 (28%)	13 (39%)	2 (50%)	
Season					0.038
Fall	4 (5%)	2 (5%)	2 (6%)	0	
Spring	13 (16%)	8 (19%)	2 (6%)	3 (75%)	
Summer	58 (73%)	31 (72%)	26 (79%)	1 (25%)	
Winter	5 (6%)	2 (5%)	3 (9%)	0	

* Data are shown as n (%).

Of the 62 (78%) patients who had chest x-rays obtained, 34 (54%) had abnormal findings. Table 4 breaks down the radiographic images by disposition and shows that 68% of admitted patients had abnormal chest x-ray findings, compared to only 12% abnormal findings in the discharged group ($p < 0.001$). Of the 10 patients who received head computed tomography (CT) imaging, two (20%) had abnormal results. One patient had a fracture and hematoma in setting of a drowning event that had occurred after a motor vehicle collision; and the other patient had evidence of brain edema based on effacement of extra-ventricular cerebrospinal fluid spaces.

Table 4
Intervention and imaging stratified by disposition.

	All ages n = 80*	Admitted n = 43	Discharged n = 33	Died n = 4	p-value
CPR	47 (59%)	32 (74%)	11 (33%)	4 (100%)	<0.001
CPR performed by					<0.001
Bystander	23 (49%)	19 (59%)	3 (27%)	1 (25%)	
Family	19 (40%)	11 (34%)	8 (73%)	0	
EMS, HS	3 (6%)	0	0	3 (75%)	
Unknown	2 (4%)	2 (6%)	0	0	
Oxygen support	30 (38%)	23 (54%)	3 (9%)	4 (100%)	<0.001
Oxygen support type					<0.001
NRB	6 (20%)	6 (26%)	0	0	
Blowby	3 (10%)	1 (4%)	2 (67%)	0	
NC	7 (23%)	6 (26%)	1 (33%)	0	
HFNC	7 (23%)	7 (30%)	0	0	
BiPAP	3 (10%)	2 (9%)	0	1 (25%)	
ETT	4 (13%)	1 (4%)	0	3 (75%)	
Chest x-ray					<0.001
Abnormal	34 (43%)	29 (67%)	4 (12%)	1 (25%)	
Normal	28 (35%)	12 (28%)	16 (49%)	0	
Not obtained	18 (23%)	2 (5%)	13 (39%)	3 (75%)	
Head CT					0.029
Abnormal	2 (3%)	1 (2%)	0	1 (25%)	
Normal	8 (10%)	6 (14%)	2 (6%)	0	
Not obtained	70 (88%)	36 (84%)	31 (94%)	3 (75%)	
Antibiotics	4 (5%)	4 (9%)	0	0	0.16

Abbreviations: NRB = non-rebreather; NC = nasal cannula; HFNC = high flow nasal cannula; BiPAP = bi-level positive airway pressure; ETT = endotracheal tube; CT = computed tomography.

4. Discussion

This study presents a description of pediatric patients treated at an urban PED after drowning events and shows some epidemiologic and clinical patterns that are helpful to inform prevention approaches. First, it is notable that our study captured an intentional submersion event in this pediatric population. While most published reports of suicide by drowning are focused on adults, one study did cite drowning as the cause of death in 10% of adolescent suicides [12,13]. As rates of pediatric suicidal ideation and attempts have been rising over the past decade, as well as in the last year due to stressors related to COVID-19, intentional submersion events may become more common and prevention strategies should reflect this potential intentionality [14]. Second, given the predominance of events occurring in pools and during the summer, seasonal approaches to emphasize pool safety may be indicated. Third, although we observed fewer patients during the final year of the study, the study period included the COVID-19 pandemic, which likely contributed to this observed decrease, potentially reflecting the shutdown of public pools and decrease in group gatherings around water.

Table 3
Patient disposition stratified by age group.

	All ages n = 80*	<1 year n = 3	1–4 years n = 40	5–9 years n = 22	10–14 years n = 12	15–18 years n = 3	p-value
PED Disposition							<0.001
Admitted	43 (54%)	1 (33%)	24 (60%)	11 (50%)	7 (58%)	0	
Discharged	33 (41%)	0	16 (40%)	10 (45%)	4 (33%)	3 (100%)	
Deceased	3 (5%)	2 (67%)	0	1 (5%)	1 (8%)	0	
Admission Unit							0.89
Ped Gen	23 (52%)	1 (33%)	16 (67%)	5 (45%)	1 (14%)	0	
PICU	19 (44%)	0	8 (33%)	6 (55%)	5 (71%)	0	
Psych	1 (2%)	0	0	0	1 (14%)	0	
Admission Disposition							0.2
Discharged	43 (98%)	1 (100%)	24 (100%)	11 (100%)	7 (88%)	0	
Deceased	1 (2%)	0	0	0	1 (12%)	0	

Abbreviations: PED = pediatric emergency department; PICU = pediatric intensive care unit.
* Data are shown as n (%).

Our data are consistent with known national trends such as the highest risk age group for drowning being 1–4 years and overrepresentation of children from racial/ethnic minority groups as fatalities [1-3]. Our hospital admission rates (>50%) were similar to those reported in a study conducted >5 years ago [4]. In combination with the mortality rate of 5%, these data demonstrate that drowning continues to be a significant threat to children and an injury mechanism of high severity. In considering clinical interventions, we noted that a substantial number of nonfatal drowning victims received CPR following brief submersion events and were transported to care via ambulance. In addition to further demonstrating the severity of injury, these findings lend support to the AAP recommendations that parents, caregivers, pool owners, older children and adolescents should learn CPR to lessen morbidity and mortality associated with drowning [5]. There may be opportunities to engage with Emergency Medical Services (EMS) for primary, secondary, and tertiary injury prevention efforts, including ensuring effective CPR in the field.

This study has several limitations, including the potential for missing and/or inaccurate information in the medical record due to the retrospective design. We were unable to report Glasgow Coma Scale reliably because charting was inconsistent about time of scoring and thus would be difficult to interpret; however, scores would be helpful in predicting morbidity related to events. We also found a paucity of descriptors that identified the presence or absence of safety measures. As there was no standardized intake form that prompted documentation of safety measures, i.e. enforcement of AAP recommended safety measures such as integrity of gates around pools, presence or absence of adult supervision, use of floatation/rescue devices, swimming competency, there is very limited information on these factors [5]. Similarly, this limited determination of whether local laws about fencing for public swimming pools and residential pools were followed [15-17]. Our study included patients presenting to a PED and pediatric trauma center, thus possibly skewing the data to more severe drowning events. We do not have information on potential nonfatal drowning events in children who never presented for evaluation because they were perceived to be stable or presented to other facilities. State protocols prohibit EMS staff from terminating resuscitation efforts in the field if the arrest is associated with a drowning event. Therefore, all patients evaluated by EMS would be brought into a PED to be pronounced dead and should not represent a hidden population of victims [18].

Although this was a single site study, which may limit generalizability, our data support national trends such as the highest risk age group for drowning being 1–4 years [1-3]. Similarly, assessment of drowning in an area with access to natural bodies of water and pools may be applicable to similar geographic locations. Our small sample size limited subgroup comparisons, but it is notable that all of the patients who died were from racial/ethnic minority groups. Despite the limitations of a retrospective chart review, this approach adds clinical management details not present in large databases. With the information about chest x-ray abnormalities and need for CPR, this review adds perspective to help explain why this injury type has an associated higher likelihood of admission and could guide disposition for PED providers.

In future studies, it would be important to conduct a review of inpatient and outpatient encounters for drowning victims to accurately describe the typical severity and interventions. A prospective study with an intake script for clinicians would be helpful in identifying what risk factors and protective factors are present during drowning events with the goal of understanding whether safety measures were present and targeting interventions. Also, based on the racial differences in drowning events across age groups, further evaluation could explore factors that could inform interventions that may require tailoring to specific groups by age and race.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRediT authorship contribution statement

Katherine Macmillan: Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Conceptualization. **Katherine Hoops:** Writing – review & editing, Conceptualization. **Andrea C. Gielen:** Writing – review & editing, Writing – original draft, Conceptualization. **Eileen M. McDonald:** Writing – review & editing, Conceptualization. **Laura Prichett:** Data curation, Formal analysis, Methodology, Software, Validation. **Isam Nasr:** Writing – review & editing, Conceptualization. **Leticia Manning Ryan:** Writing – review & editing, Writing – original draft, Supervision, Resources, Formal analysis, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

Mary Ellen Wilson graciously assisted in conducting the electronic medical record query for this review.

References

[1] 10 Leading Causes of Death by Age Group, United States – 2018 [Internet]. Baltimore (MD): National Center for Injury Prevention and Control; 2018. [cited 2021 Sept 8]. Available from. https://www.cdc.gov/injury/wisqars/pdf/leading_causes_of_death_by_age_group_2018-508.pdf.

[2] 10 Leading Causes of Injury Death by Age Group Highlighting Unintentional Injuries Deaths, United States – 2018 [Internet]. Baltimore (MD): National Center for Injury Prevention and Control; 2018. [cited 2021 Sept 8]. Available from. https://www.cdc.gov/injury/wisqars/pdf/leading_causes_of_injury_deaths_highlighting_unintentional_2018-508.pdf.

[3] Borse NN, Gilchrest J, Dellinger AM, Rudd RA, Ballestereos MF, Sleet DA. CDC childhood injury report: patterns of unintentional injuries among 0-19 year olds in the United States, 2000-2006. Family Comm Health. 2009 Apr.;32(2) [cited 2021 Sept 9]. [about 1p.]. Available from. https://journals.lww.com/familyandcommunityhealth/fulltext/2009/04000/cdc_childhood_injury_report__patterns_of.13.aspx. [cited 2021 Sept 9]. [about 1p.]. Available from.

[4] Ryan KM, Dugas J, Pina T, Maksimenko Y, Liu J. Drowning Injuries in the United States: Patient characteristics, mortality risk, and associated primary diagnoses. Injury [Internet]. 2020 Jun;51(11):2560–4. https://doi.org/10.1016/j.injury.2020.08.011. [cited 2021 Sept 9]. PubMed PMID: 32798037.

[5] Denny SA, Quan L, Gilchrist J, McCallin T, Shenoi R, Yusuf S, et al. Prevention of drowning. Pediatr Int. 2019 May;143(5). https://doi.org/10.1542/peds.2019-0850. [cited 2021 Sept 9]. Pubmed PMID: 30877146.

[6] Dirlik M, Bostancıoğlu B. Child drowning deaths in Aydin province, western Turkey, 2002–2012. Eur J Trauma Emerg Surg. 2015 Jan;41:683–8. https://doi.org/10.1007/s00068-015-0493-0. [cited 2021 Sept 10]. Pubmed PMID: 26038014.

[7] Amar-Singh HHS, Tan PS, Hashim L. Childhood drowning in Malaysia. Int J Inj Control Saf Promot. 2014;21(1):75–80. https://doi.org/10.1080/17457300.2013.792284. [cited 2021 Sept 9]. PubMed PMID: 23651461.

[8] Bowman SM, Aitken ME, Robbins JM, Baker SP. Trends in US pediatric drowning hospitalizations, 1993–2008. Pediatr Int. 2012 Feb;129(2):275–81. https://doi.org/10.1542/peds.2011-2491. [cited 2021 Sept 9]. PubMed PMID: 22250031, PubMed Central PMCID: PMC3269118.

[9] National Center for Injury Prevention and Control. Injury Prevention and Control. Centers for Disease Control and Prevention [Internet]; 2020 Jan. [cited 2023 Mar 8]. https://www.cdc.gov/injury/about/approach.html.

[10] Şık N, Şenol HB, Öztürk A, Yılmaz D, Duman A. A reappraisal of childhood drowning in a pediatric emergency department. Am J Emerg Med. Dec 2020;41:90–5. https://doi.org/10.1016/j.ajem.2020.12.059. [cited 2021 Sept 12]. Pubmed PMID: 33406460.

[11] Irwin CC, Irwin RL, Ryan TD, et al. Urban minority youth swimming (in)ability in the United States and associated demographic characteristics: toward a drowning prevention plan. Injury Prevent. 2009 Feb;15:234–9. [cited 2021 Sept 8]. Pubmed PMID: 19651995.

[12] 10 Leading Causes of Death, United States: 2010–2019, All Races, Both Sexes [Internet]. National Center for Injury Prevention and Control, Centers for Disease Control and Prevention; 2019. [cited 2021 Sept 8]. Available from. https://webappa.cdc.gov/cgi-bin/broker.exe.

[13] Haw C, Hawton K. Suicide and self-harm by drowning: a review of the literature. Archiv Suic Res. 2015 Sept;20(2):95–112. https://doi.org/10.1080/13811118.2015.1025120. [cited 2021 Sept 9]. Pubmed PMID: 26359547.

[14] Hill RM, Rufino K, Kurian S, Saxena J, Saxena K, Williams L. Suicide ideation and attempts in a pediatric emergency department before and during COVID-19. Pediatr

Int. 2021 Mar;147(3). https://doi.org/10.1542/peds.2020-029280. e2020029280. [cited Sept 9]. PubMed PMID: 33328339.
[15] Building Inspections [Internet]. Baltimore, MD: Baltimore County Government; 2021. [cited 2021 Sept 7]. Available from. https://www.baltimorecountymd.gov/departments/permits/buildinspec/#:~:text=Required%20pool%20fences%20and%20houses,closing%2C%20self%2Dlatching%20gate.
[16] Maryland laws for swimming pools and fences [Internet]. Baltimore, MD: Cochran Firm; 2022. [cited 2021 Sept 10]. Available from. http://drowninglaw.com/maryland-laws-for-swimming-pool-fences-and-gates/.
[17] Code of Maryland Regulations: Public Swimming Pools and Spas [Internet]. Baltimore, MD: Department of Health and Mental Hygiene; 2001. [cited 2021 Sept 9]. Available from. https://health.maryland.gov/washhealth/Documents/download-forms/MD%20COMAR%20Regulations%20for%20Swimming%20Pools%20and%20Spas.pdf.
[18] The Maryland Medical Protocols for Emergency Medical Services: Maryland Institute for Emergency Medical Services Systems [Internet]. Baltimore, MD: Division of State Documents, Office of the Secretary of State, State of Maryland; 2020 Aug. [cited 2021 Sept 6]. Available from. https://www.miemss.org/home/Portals/0/Docs/Guidelines_Protocols/MD-Medical-Protocols-2020-20200610.pdf?ver=2020-06-12-120333-457.