

**A RETROSPECTIVE ANALYSIS OF THE CIRCUMSTANTIAL FACTORS
CONTRIBUTING TO DROWNING INCIDENTS REPORTED IN THE SOUTH
AFRICAN MEDIA**

By

Willem de Beer

DBRWIL007

*This study is in partial fulfilment of the requirements for the degree
Master of Philosophy (MPhil) in Emergency Medicine in the Faculty of Health Sciences
at the University of Cape Town*

Supervisor: Dr Colleen Saunders
Division of Emergency Medicine, Department of Surgery, Faculty of Health Sciences,
University of Cape Town

February 2022

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ACKNOWLEDGEMENTS

I would like to thank my wife Nicole du Plessis for her support during the write up of this Thesis. I want to especially thank Doctor Colleen Saunders for all her effort and support in helping me finish this Thesis. It was not easy for Dr. Saunders and I really appreciate what she did for me. Where other lecturers would have said it is not possible, she always believed that it was possible. Lastly, I would like to thank Lifesaving South Africa for allowing me access to their database and a thank you to the head office staff for their efforts in keeping the data base up to date. Their efforts play a big role in the prevention of drowning across the country

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ABBREVIATIONS

GBD	Global Burden of Disease
ILS	International Lifesaving Federation
LMIC	Low- and Middle-income countries
LSA	Lifesaving South Africa
NSRI	National Sea Rescue Institute
RLSS	Royal Life Saving Society
SA	South Africa
WHO	World Health Organization

PART A: LITERATURE REVIEW

Introduction

The World Health Organization (WHO) defines drowning as the process of experiencing respiratory impairment from submersion/immersion in liquid (1). The outcome of drowning events is classified as fatal, or non-fatal either with or without associated morbidity (1). Shared terminology is essential in order to accurately describe the extent of the problem and allow for effective comparison of trends and epidemiology. The WHO published a “Global report on drowning: preventing a leading killer” in 2014 highlighting the under recognition of drowning as a public health burden (1) and estimated that 236 000 people drowned globally in 2019 (2). Drowning is among the ten leading causes of death for children and young people in every region of the world (1). Increasing advocacy for recognition of the global burden of both fatal and nonfatal drowning recently culminated in the first ever United Nations resolution on drowning prevention (3).

The 2014 WHO Global Report on Drowning estimates that 91% of global drowning deaths occur in low- and middle- income countries (LMICs) (1). In particular, the WHO African region suffers the highest drowning mortality rate at 13.1 per 100 000 population (4). A 2020 Royal Life Saving Society (RLSS) drowning fact sheet reports that over one third (37%) of global drowning deaths in 2017 occurred in commonwealth countries (4), with a fatal drowning rate of 4.6 per 100 000 per year (4). Six African countries are ranked in the top ten Commonwealth countries with the highest number of drowning deaths in 2017 (4). South Africa, with 1439 deaths and a mortality rate of 2.62 per 100 000 population, was ranked 7th (4).

Globally, South Africa is ranked 21st in all-age drowning mortality, but was among the top ten for child drownings in the world in 2017 (5). Although the Global Burden of Disease (GBD) data estimates that the unintentional drowning mortality rate in South Africa has decreased from 5.09 per 100 000 population in 2015 to 3.95 per 100 000 population in 2017 (8), recent evidence suggests that the burden of fatal drowning in South Africa is stable at approximately 3.0 per 100 000 population (8).

This thesis will focus on describing the activities that victims were involved in immediately prior to drowning incidents in South Africa. The following literature review will therefore review the literature describing the steps of the drowning chain of survival, identifying key drowning risk factors, and discussing issues related to the surveillance of, and reporting on drowning.

The drowning chain of survival

The drowning chain of survival, proposed by Szpilman et al (2014), refers to a series of steps that can be taken to reduce mortality associated with drowning and any attempted aquatic rescue (13). The drowning chain of survival serves as a guide for policy and advocacy efforts, resource allocation and priority setting in drowning prevention (13). The steps include (i) prevention of drowning, where increased educational tools and workshops are created to improve community awareness regarding water safety and drowning; (ii) Recognizing distress, whereby the community are trained to recognize an individual that is in distress and needs help to be removed from the body of water; (iii) Provision of flotation, where there is a focus on making flotation devices more readily available at areas at a high risk of drowning; (iv) Removal from water, this includes educating the public and potential rescuers how to safely remove a drowning victim from the body of water; and, lastly, (v) Provision of appropriate care, where access is increased to appropriate medical attention (13). The drowning chain of survival is a guide for both non experienced and experienced rescuers and provides a step-by-step approach to not only preventing drowning but to also give effective medical care.



Figure 1 The drowning chain of survival (Szpilman et al. 2014)(13)

From the chain of survival, the importance of understanding the precipitating factors that contribute to drowning incidents. Understanding the epidemiology and risk factors for drowning can improve the prevention programs currently being used in geographical areas that are classified as high risk and also improve awareness of the risk factors associated with drowning.(7) The fight against drowning must not be seen as one single aspect, it has to be seen as a program with different components where each component needs to be understood for it to be a success (13).

Drowning risk factors

Globally, key risk factors are consistent and show that drowning risk is multifactorial. Risk factors include alcohol consumption, unsafe access to bodies of water, inadequate adult supervision, underlying medical conditions, the absence of appropriate policies, legislation and regulation and most importantly age and sex (1). The WHO Global Report on Drowning states that drowning mortality rates in LMICs are approximately threefold higher than those in high income countries (1), and some risk factors are more relevant in low resource settings when compared to high resource settings (14). Risk factors associated with drowning are discussed in more detail below.

While risk factors for drowning in South Africa are consistent with those observed globally, there may be additional local risk factors due to high levels of inequality, poverty, poor infrastructure, and ineffective service delivery that contribute to the high rates observed in Southern Africa (14).

Age

Globally, the highest drowning rates occur among children under the age of five years (1). The WHO Global report on drowning indicates that drowning accounts for 43% among children aged five and younger in Bangladesh (1). Over 40% of drowning deaths in South Africa occur in children under the age of 15 years (8). In the South African province of the Western Cape, the highest age-specific mortality rate was seen in children under the age of five years, with a rate of 4.8 per 100 000 population, with a slightly less mortality rate in all children (0-19 years) at 3.8 per 100 000 population (15). Morris et al indicates that 55.5% of drowning deaths in inland Gauteng are children younger than 15 years (9). Lifesaving South Africa (LSA) reported in 2015 that the highest rate of drowning incidents occurred in children younger than 10 years (10). The drowning mortality rate in the Western Cape children was significantly higher than that observed in adults, the report indicates that 60% of drowning occurs in adults under the age of 30 years (14). Quan et al (2003) indicates that the age group of 65 years risk of drowning is also increased, due to underlying diseases (16).

Sex

The WHO report on drowning indicates that fatal drowning are more common in males (1). The report indicates that, when compared to females, men are more than double the amount involved in fatal drowning (1). Locally, the ratio between males and females in the Western Cape was 4:1

between 2010 and mid-2017 (15). Young adult males between the ages of 20 to 34 years, and adolescents between the ages of 15 to 19 years, has been indicated to have a high drowning mortality rate (5.7 – 6.6 per 100 000 population), with the male to female ratios between 5.8:1 and 12.6:1, thus indicating elevated risk behavior of males (15). The age group with the highest male to female ratio was between the ages of 25 years to 29 years (15).

Body of water

The body of water in which drowning incidents occur differs with age, with an increased proportion of drowning in larger, natural bodies of water increasing with age (15). In the Western Cape, 72.2% of fatal drowning incidents in children under the ages of five years occur in and around their homes (14). In adults, 77.8% of fatal drowning incidents occurring between 2010 and 2016 occurred in larger, open natural bodies of water with 28.6% occurring in oceans or lagoons (14). A research study conducted in Australia specifically focusing on international travelers indicated that unintentional drowning incidents from this group predominantly happened in the ocean (17). A National Sea Rescue Institute (NSRI) study done in South Africa over a period of five years (2010-2015) found that 45.2% of rescue operations was conducted in the Southwestern coastal region, focusing on the Western Cape Province (18). This study indicates that there is a large burden of ocean drowning in the Western Cape Province.

Supervision

The lack of adequate supervision of children has been indicated as a preventable risk factor for unintentional drowning (1). In South Africa there is a small percentage of drowning in children younger than five years that are witnessed by a caregiver or adult (14). Unemployment, poverty, and structural inequalities have been identified as issues that affects sufficient supervision in South Africa (14). Adolescents have a higher propensity for risky behavior and are less likely to be supervised, thereby placing them at risk as well (14).

Temporal factors

These factors are associated with increased exposure to recreational water activities. In South Africa, fatal drowning incidents tend to occur during the warmer seasons, with 24.7% of incidents

occurring during spring and 42.0% occurring during summer (8). The majority of drowning incidents occur over weekends, and there has been an increased risk associated with public-holidays (8). The majority of incidents occur in the afternoon and early evening, with 59% of the incidents happening between 12h00 – 19h59 (6).

Alcohol and recreational drug use

Alcohol consumption has been associated with drowning in men and adolescents (1). There is limited reporting in South Africa on the association of alcohol consumption and drowning. One study done between 2001 and 2005 indicated that 40% of drowning deaths in which blood alcohol measurements were taken were positive for the presence of blood alcohol, and 85% of these cases had a blood alcohol level at or above 0.05g/100ml (19).

Existing medical conditions

In the elderly, existing medical conditions have been identified as risk factors for drowning (16). In the age group of 64 years and over the majority of drowning deaths had pre-existing medical conditions (16). These include epilepsy and seizure disorders (16). In children, autism has also been identified as an increased drowning risk factor (16).

Drowning injury surveillance and reporting

The reporting on drowning is a vital component in the fight against drowning. It affects the way that drowning prevention programs and tools are modified and implemented. There is sufficient epidemiological data available for high-income settings like Australia and the USA, and certain low-income settings such as Bangladesh have been well studied and data around drowning is easily accessible (1). The surveillance data for the African continent, despite having a very high rate of drowning mortality is lacking, thus making reporting difficult, prevention programs increasingly likely to fail and increased mortality rates (1). Even in settings with regular and substantial drowning surveillance, there are limitations in the quality and completeness of data collected. By using a global reporting system, it can create a standard dataset that can help the prevention and education on drowning.

The 2003 Utstein report on drowning was a consensus process outlining the rationale for selecting data elements to be reported, the definition and priority of the data and scoring methods (11). It is intended to improve clarity of scientific communication and comparability of scientific investigations. It is identifying a lack of common nomenclature definitions and consistency in scientific reports of research (11). The Utstein guidelines were developed for improved definitions and reporting of data related to drowning. The second International Utstein-style consensus conference, held in 2017, reassessed and updated the data that should be focused upon and reported in drowning studies (11). The findings of these studies were that reporting should consist of core data and supplementary data (11). Core data were considered important and feasible to be reported in most systems worldwide. The results show that almost any investigator can reliably gather core data so that a minimum universal worldwide data set is feasible (11). Supplementary data were considered important but typically comprised information that is difficult to capture reliably (such as time points and time intervals) or may be nonessential (11). The core data consists of:

Victim identifier, such as a number, or bar code

Information regarding the victim is sometimes hard to gather, especially if the victim's identity remains unidentified, and a universal bar code or numbering system can improve the reporting on drowning incidents as well as identifying unknown victims faster (11). The use of a bar code can help sort and stratify information, that can be used to identify subcategories that include male or female, type of incident, geographical area of incident, time of incident and outcome – fatal or non-fatal drowning.

Sex: male or female

Research has shown that males tend to have more risky attitudes and are prone to more accidents that can lead to drowning. Identifying sex allows the researcher to add to this data or it can indicate a shift in risk from both sexes (11).

Race and ethnic background

By identifying the race and ethnic background, the researcher can identify whether ethnic background can influence behavior regarding unsafe swimming practices that can lead to drowning (11).

Age

The researcher can identify which age group is more at risk for drowning, thereby influencing educational programs that are rolled out into the community, to make the educational programs age appropriate (11).

Incident time of day

This is crucial information for the researcher, as it indicates what time of day there needs to be more visible policing of bodies of water, or the time of day that a young child might be exposed to less supervision and have increased risk of drowning (11).

Precipitating event

Alcohol has been identified as one of the main contributors to drowning, but the researcher can identify more behavior and activity trends that can lead to prevention campaigns that are specifically focused on identified precipitating factors that are reported with drowning incidents (11). There is very little published evidence on precipitating behaviors, which is why the current study is of value.

Was patients face submerged?

This allows the researcher to distinguish between non-fatal drowning incidents and fatal drowning incidents (11).

Pre-existing illness

Allows the researcher to identify high risk candidates for drowning even before they step into the water. Certain patients like asthmatics who tire easily can be identified and add to the literature regarding pre-existing conditions and drowning (11).

These standards of reporting paved the way for establishing sufficient databases to record drowning incident data. The focus on the core data was that it is expected to be the bare minimum information gathered from the scene, via the emergency services, and making it easier to create uniform reporting, gathering data for research purposes. (7) The main reason for uniformed gathering of data, according to Wallis et al (2015) is to improve drowning prevention strategies (12). Poor data collection hinders prevention strategies (12). These prevention strategies include Education, where programs are rolled out to inform and educate the children on how to safely access a body of water and swimming skills. The second prevention strategy consists of swimming lessons, where children are being exposed to swimming lessons from an early age,

thereby improving their skills and awareness during a swimming session (12). The third prevention strategy consist of pool fencing. Pool fencing is indicated for home pools, to reduce risk of drowning if child is left unsupervised playing around a home swimming pool. Franklin et al (2016) points to the fact that when concrete efforts are made to improve fencing around swimming pools it can decrease the risk in drowning dramatically (17). The research indicates that although these prevention strategies might work for young children between the ages of two and four years, the data shows that these prevention strategies do not improve the risk of drowning on older children and adolescents (17) The precipitating factor before the incident is crucial to any prevention strategy, as it can pinpoint factors contributing to increased risk (17).

Precipitating events as risk factors

The data on precipitating events has significant value in the prevention of fatal drowning incidents. It is important to understand what exactly happened before a drowning incident and what events took place. The data can help the researcher pinpoint events that can be classified as high risk and target prevention interventions appropriately. From the use of alcohol at beaches, to unsupervised swimming of children, the factors can help create awareness in behavioral patterns that can lead to drowning incidents. Educational tools and programs can then be created according to the framework of reported data on events that takes place before a drowning incident.

Currently there is insufficient data regarding precipitating factors before a drowning event. In recent years, LSA has established a database of drowning incidents in South Africa that are reported to LSA directly or in the news media. This database attempts to record the information gathered during and after the incident and includes basic reporting on precipitating factors of the incident. A simple search on www.news24.com for articles regarding drowning shows that in some cases the precipitating factors are stated, such as a group of tourists getting into trouble with high tide, or statements saying that alcohol was involved. There is a need to analyze precipitating factors before a drowning incident as the information gathered can be of life saving value. Not only does it act as the basis of every prevention strategy, it can also guide civil society organizations such as LSA and the NSRI on the areas that need to be focused on in their promotional programs for drowning prevention, as well as making sure that they are able to focus on risk factors to stop them from happening.

Conclusion

The world has a drowning problem. Not only does the world have a high mortality rate due to drowning incidents, it also has many areas of concern regarding the reporting of drowning. While the global drowning prevention community does everything in its power to create awareness of drowning, the ultimate battle in the fight for drowning prevention will be hampered due to the lack of a globally uniform reporting of drowning incidents. Without such, educational and prevention programs will be inadequate and will not reach a global audience. Reporting will still be limited to high income settings and many lives will still be lost on other continents due to lack of awareness.

It is of the utmost importance that drowning incidents are dissected from the events leading up to the incident, to what happened during the incident and the events after the incidents. This will ensure that there is a clear picture formed on drowning.

References:

- 1.) World Health Organization. Global report on drowning: preventing a leading killer. World Health Organization; 2014.
- 2.) World Health Organization. WHO guideline on the prevention of drowning through provision of day-care and basic swimming and water safety skills.
- 3.) Saunders, C. J., Sindall, R., Queiroga, A. C., May, G., Byers, B., Graham, D., & Scarr, J. (2020). World Conference on Drowning Prevention 2019, Durban, South Africa.
- 4.) Peden AE, Franklin RC, Willcox-Pidgeon S. Media reporting of summer drowning: A partial picture, useful for advocacy. *Health promotion journal of Australia*. 2020 Sep;31(3):491-6.
- 5) Lin, C. Y., Wang, Y. F., Lu, T. H., & Kawach, I. (2015). Unintentional drowning mortality, by age and body of water: an analysis of 60 countries. *Injury prevention*, 21(e1), e43-e50.
- 6) Global Burden of Disease Collaborative Network, 2017. Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States. Available from: <http://ghdx.healthdata.org/gbd-results-tool>
- 7) Smith G. The global burden of drowning. *Handbook on drowning; prevention, rescue, treatment*. Germany, Springer-Verlag. 2006:56-61.
- 8) Saunders CJ, Sewduth D, Naidoo N. Keeping our heads above water: a systematic review of fatal drowning in South Africa. *South African Medical Journal*. 2018;108(1):61-8.
- 9.) Morris NK, du Toit-Prinsloo L, Saayman G. Drowning in Pretoria, South Africa: a 10-year review. *Journal of forensic and legal medicine*. 2016 Jan 1;37:6670.
- 10.) Matthew J, Sewduth D, Tommy D. Making waves for Livesaving South - Africa: A nine – month drowning and rescue epidemiological review..
- 11.) Idris AH, Bierens JJ, Perkins GD, Wenzel V, Nadkarni V, Morley P, Warner DS, Topjian A, Venema AM, Branche CM, Szpilman D. 2015 revised Utstein-style recommended guidelines for uniform reporting of data from drowning-related resuscitation: An ILCOR advisory statement. *Circulation: Cardiovascular Quality and Outcomes*. 2017 Jul;10(7):e000024.
- 12.) Wallis BA, Watt K, Franklin RC, Taylor M, Nixon JW, Kimble RM. Interventions associated with drowning prevention in children and adolescents: systematic literature review. *Injury prevention*. 2015 Jun 1;21(3):195-204.

- 13.) Szpilman D, Webber J, Quan L, Bierens J, Morizot-Leite L, Langendorfer SJ, Beerman S, Løfgren B. Creating a drowning chain of survival. *Resuscitation*. 2014 Sep 1;85(9):1149-52.
- 14.) Saunders CJ, Adriaanse R, Simons A, van Niekerk A. Fatal drowning in the Western Cape, South Africa: a 7-year retrospective, epidemiological study. *Injury prevention*. 2019 Dec 1;25(6):529-34.
- 15.) Martyn M. The Global Burden of Drowning. In *Drowning 2014* (pp. 91-94). Springer, Berlin, Heidelberg.
- 16.) Quan L, Cummings P. Characteristics of drowning by different age groups. *Injury Prevention*. 2003 Jun 1;9(2):163-8.
- 17.) Peden AE, Franklin RC, Leggat PA. International travelers and unintentional fatal drowning in Australia—a 10 year review 2002–12. *Journal of travel medicine*. 2016 Mar 1;23(2).
- 18.) Erasmus E, Robertson C, Van Hoving DJ. The epidemiology of operations performed by the National Sea Rescue Institute of South Africa over a 5-year period. *International maritime health*. 2018;69(1):1-7.
- 19.) Donson H, Van Niekerk A. Unintentional drowning in urban South Africa: a retrospective investigation, 2001–2005. *International journal of injury control and safety promotion*. 2013 Sep 1;20(3):218-26.

PART B: MANUSCRIPT IN ARTICLE FORMAT

Article formatted for publication in the *International Journal of Aquatic Research and Education*.

(Guidelines for authors available here: https://scholarworks.bgsu.edu/ijare/for_authors.html)

**A retrospective analysis of the circumstantial factors contributing to
drowning incidents reported in the South African media**

Willem de Beer¹, Kyle Corbett², Colleen J. Saunders^{1,2}

¹ Division of Emergency Medicine, University of Cape Town, Cape Town, South Africa ²

Lifesaving South Africa, South Africa

Corresponding author:

Dr Colleen Saunders

Division of Emergency Medicine, University of Cape Town

Cape Town, South Africa

Telephone: +27 21 650 4842

Email: Colleen.saunders@uct.ac.za

Abstract

The first consensus guidelines for the uniform reporting of drowning were published in 2003, and specifically call for the precipitating factor to be described. The aim of this study was to describe the precipitating factors contributing to fatal drowning incidents reported in the South African media between January 2017 and March 2021 through a retrospective analysis of the Lifesaving South Africa media report database. There were 767 fatal drowning incidents reported during this period. Two thirds (66%) of reported incidents occurred during spring and summer, and the majority occurred in coastal provinces. Weekends and public holidays accounted for the highest frequency of reported incidents. Forty percent of reported fatal drowning victims were children under the age of 16 years. Approximately half (48%) of fatal drowning victims were swimming at the time of the incident, 17% drowned following accidental entry into the water and 11% were boating or sailing at the time of the incident. Understanding the activity immediately preceding the drowning event allows for more efficient and context appropriate design of prevention interventions.

Keywords: Drowning prevention; Water safety; Swimming; Injury; fatal drowning

INTRODUCTION

Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid and drowning outcomes should be categorized as fatal, non-fatal with morbidity or non-fatal without morbidity (1). According to Saunders et al (2018), non-fatal drowning incidents are often associated with significant morbidity and socioeconomic burden from severe pulmonary and neurological sequelae (2). The WHO Global Burden of Disease study estimates that 125 to 500 years of healthy life (disability-adjusted life-years) were lost due to drowning in South Africa (SA) in 2012 (3). At the start of the millennium, drowning became the third leading cause globally of unintentional injury related death. It is estimated that the mortality rate was 7.4 per 100 000 of the population (2) the drowning mortality rate was considerably higher at 13.1 per 100 000 population for the WHO African region (3) and in 2012 this region was found to account for 20% of drowning globally (2).

Following the first ever United Nations resolution on drowning prevention in 2021 (4) , there have been renewed efforts in the global fight to reduce the burden of both fatal and non-fatal drowning. International and local water safety and lifesaving organizations have increasingly sought to reduce drowning with limited funding and capacity. The strategic implementation of water safety interventions that are evidence-informed is, therefore, of prime importance in resource-limited settings such as SA. Whilst a number of key risk factors for drowning have been identified at a global level (5), the absence of reliable drowning surveillance in low- and middle-income countries (LMIC), particularly in Africa (6), has resulted in knowledge gaps in our understanding of local, contextual risk factors for drowning.

The first consensus guidelines for the uniform reporting of drowning were published in 2003 and revised in 2015 (7). These Utstein-style guidelines propose a minimum and prioritized set of data that should be reported in studies of drowning and resuscitation. These include variables

describing (i) victim information, (ii) scene information, (iii) emergency department evaluation and treatment, (iv) hospital course and (v) disposition. It specifically calls for the precipitating factor to be described. For example, if the patient was under the influence of alcohol, did they experience a seizure or was there any substance abuse. Precipitating factors and behaviours have been added to reporting data, however, even though this is now seen as vital information, the data still lacks in substance or there is insufficient data when the incident is reported on. Understanding the full burden of drowning is vital to preventative measurements and policy making.

Lifesaving South Africa (LSA) is a registered not-for-profit, public benefit organization and is the national authority for lifesaving and lifesaving sport in South Africa (<https://lifesaving.co.za/>). As there is limited national drowning surveillance data available in South Africa, LSA has collated media reports on both fatal and non-fatal drowning incidents in South Africa since 2016. The database is updated by LSA head office administrators and used to issue an annual report on drowning statistics for its members. In consultation with LSA head office, we identified a need to assist with a robust analysis of this database. As the activity at the time of drowning is not collected or reported in formal fatality statistics (Statistics South Africa; Forensic Pathology Services), this database presents a unique opportunity to identify (but not quantify) common precipitating factors associated with fatal drowning incidents. An improved understanding of the precipitating factors will inform LSA's drowning prevention campaigns and provide an evidence base to aid in prioritizing campaigns when resources are limited. The aim of this study was, therefore, to describe the precipitating factors contributing to fatal drowning incidents reported in the South African media between January 2017 and March 2021.

METHODS

We conducted a retrospective descriptive study of the database, collated, and maintained by LSA, of drowning incidents reported directly to LSA or in the news media between January 2017 and March 2021. The analysis was restricted to known fatal drowning incidents as it was not feasible to follow up and confirm the outcome of all potentially non-fatal drowning incidents. In addition, significant variations in the description of non-fatal incidents meant that a uniform definition of non-fatal drowning could not be accurately applied to the database.

The Lifesaving South Africa drowning database uses media reports to record the reported precipitating factors and circumstances surrounding drowning incidents. The database is maintained by LSA head office staff through media alerts, structured searches and as incidents are reported by their members. All information contained in the database is available in the public domain and presents no risk to confidentiality. Following ethical approval (University of Cape Town Human Research Ethics Committee ref: HREC 627/2021), the LSA database was shared with the research team.

The following variables are contained in the LSA database and were analyzed in the current study:

Date and time of incident; Number of victims (Multiple or single); Age of victim/s; Sex of victim/s; Location of drowning; Body of water; Activity prior to drowning incident; and whether resuscitation was attempted. Activity prior to drowning incident was the primary variable of interest in this study and was coded in a two-stage process by WdB and CJS. During data collection and verification, activity prior to drowning was coded using a deductive approach. In the second stage, codes were collapsed into categories following review of all cases and agreement by both researchers. Where data was missing from the database, an internet search was performed to identify the original media reports and attempt to find the missing information. Where this was unsuccessful, the

variable was left blank, and indicators of missing information are provided for each variable. Data are presented using descriptive statistics, specifically proportions or frequencies as appropriate.

Descriptions of the distribution of incidents by month of the year excluded cases reported in 2021 (only three months of data) so as not to skew the distribution inappropriately.

RESULTS

There were 767 fatal drowning incidents included in the LSA media database for the period January 2017 to end March 2021. The dataset analyzed in the current study included 245 (31%) cases from 2017, 169 (22%) cases from 2018, 163 (21%) cases from 2019, 145 (19%) cases from 2020 and 45 (6%) cases from the first quarter of 2021 (Figure 2).

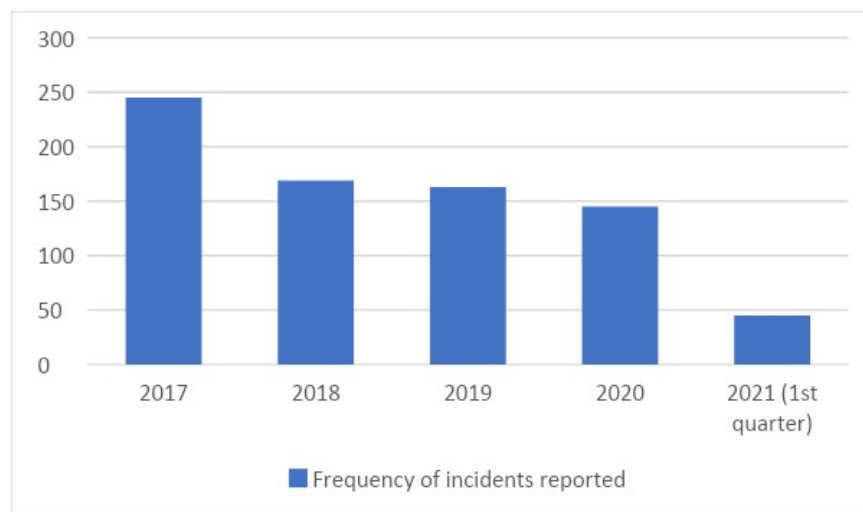


Figure 2 The frequency of drowning incidents reported in the news media by year

Table 1 shows the distribution of cases (excluding 2021) by month of the year. Two thirds (478, 66%) of reported incidents occurred during the spring (September – November) and summer (December – March) months. The majority of reported incidents (n=602, 79%) occurred in coastal provinces (Western Cape (n=241), Eastern Cape (n=96) and KwaZulu-Natal (n=279). A smaller number of incidents (n=160, 21%) were reported in inland provinces (Northern Cape (n=10), Northwest province (n=21), Mpumalanga (n=21), Limpopo (n=26), Free State (n=35), and Gauteng (n=47). There was no significant difference in the distribution of incidents by month between inland and coastal provinces.

Table 1 Distribution of reported drowning incidents by month of the year for both inland and coastal provinces (2017-2020)

Month	Inland provinces n, (%)	Coastal provinces n, (%)	Total n, (%)
January	30 (21)	80 (14)	110 (15)
February	18 (13)	51 (9)	69 (10)
March	10 (7)	64 (11)	74 (10)
April	7 (5)	35 (6)	42 (6)
May	3 (2)	31 (5)	34 (5)
June	9 (6)	18 (3)	27 (4)
July	4 (3)	27 (5)	31 (4)
August	4 (3)	29 (5)	33 (5)
September	9 (6)	48 (8)	57 (8)
October	9 (6)	55 (9)	64 (9)
November	17 (12)	52 (9)	69 (10)
December	21 (15)	88 (15)	109 (15)
Unknown	2 (1)	1 (<1)	3 (<1)
Total	143	579	722

Table 2 shows the distribution of reported incidents by day of the week. Forty six percent (46%) of reported incidents occurred on weekends and public holidays compared to just over half (54%) on weekdays. Saturdays (19%) and Sundays (18%) accounted for the highest frequency of incidents, with 10% of incidents occurring on the 12 public holidays during the year.

Table 2 Distribution of reported incidents by day of the week

Day of the week	Frequency of incidents, n (%)		Frequency of incidents, n (%)
Monday	95 (13)		
Tuesday	86 (11)		
Wednesday	60 (8)	Weekdays	402 (54)
Thursday	80 (11)		
Friday	81 (11)		
Saturday	141 (19)	Weekends and Public Holidays	349 (46)
Sunday	135 (18)		
Public Holidays	73 (10)		
Total	751		751
Undetermined	16		16

Table 3 shows the distribution of reported incidents by time of day on both weekdays as well as weekends and public holidays. The time of day was reported in only 69% of fatal drowning incidents captured in the media database. The highest proportion (39%) of reported incidents occurred in the afternoon, between mid-day and 15h59.

Table 3 Distribution of reported incidents by time of day

Time period	Weekdays, n (%)	Weekends & public holidays, n (%)	Total*, n (%)
Morning (08h00-11h59)	65 (26)	52 (19)	118 (22)
Afternoon (12h00-15h59)	90 (35)	116 (42)	206 (39)
Evening (16h00-19h59)	52 (20)	56 (20)	109 (21)
Night (20h00-07h59)	47 (19)	51 (19)	98 (18)
Total	254	275	531
Unknown	148	74	236

** Includes cases in which day of the week was undetermined (n=16).*

Nearly two thirds (n=454, 59%) of the reported incidents involved only a single patient whereas 313 (41%) of incidents involved multiple patients. Of the incidents in which the patient's sex was specified (n=744), 82% (n=613) of the patients were male and 18% (n=131) were female. This represents a male to female ratio of 4, 7:1. Forty percent (40%) of fatal drowning victims reported in the news media were children under the age of 16 years, and 10% were children aged 5 and younger (Table 4).

Table 4 Distribution of reported incidents by age category

Age category	Frequency, n (%)	Frequency, n (%)
Under 5 years	62 (10)	237 (40)
6-10 years	94 (16)	
11-15 years	81 (14)	
16-20 years	84 (14)	358 (60)
21-30 years	92 (15)	
31-40 years	86 (14)	
41-50 years	43 (7)	
51-60 years	32 (5)	
> 60 years	21 (3)	
Total	595	595
Unknown	172	

The body of water in which the drowning incident occurred was described in the majority (99%) of cases (Table 5). The large majority of incidents reported in the news media occurred in the ocean or a lagoon (54%), followed by incidents in canals, rivers or streams (18%). In the 62 incidents reported involving children under 5 years of age, 29% (n=18) occurred in a swimming pool (92% of which occurred as an accidental entry), 21% (n=13) occurred in canals, rivers or streams, and 16% (n=10) occurred in dams, ponds, lakes or vleis. Whilst a small number, it should be noted that four of the five drowning incidents occurring in pit latrines, occurred in this age group.

Table 5 Distribution of reported incidents by body of water

Body of water	Children (0-15 years), n (%)	Adults (16 years and older), n (%)	Total*, n (%)
Ocean and lagoons	63 (27)	244 (68)	412 (54)
Canals, rivers and streams	51 (22)	55 (15)	135 (18)
Dams, ponds, lakes and vleis	44 (19)	34 (10)	94 (12)
Swimming Pool	34 (15)	17 (5)	53 (7)
Stormwater trench, ditch and holes	21 (9)	1	26 (3)
Floodwaters	6 (3)	6 (2)	22 (3)
Quarry, reservoir, sewage pond	4 (2)	1 (<1)	8 (<1)
Pit latrine	5 (2)	0	5 (<1)
Bath or bucket	3 (1)	0	4 (<1)
Total	231	358	759
Unknown	6	0	8

* Total column includes cases in which the age group was undetermined (n=172).

The victim's activity at the time of the drowning incident was reported in 80% of the cases included in the database. In approximately half (48%) of the reported incidents, the victim was intentionally swimming at the time of drowning. In 17% of the incidents, the victim entered the water accidentally. Interestingly, 33% (n=33) of accidental entries resulting in a fatal drowning involved the victim attempting to cross a river, stream or canal.

Table 6 Distribution of reported drowning incidents by activity at the time of the incident

Activity at time of incident	Children (0-15 years), n (%)	Adults (16 years and older), n (%)	Total*, n (%)
Swimming	99 (55)	149 (49)	293 (48)
Accidental entry	59 (33)	31 (10)	101 (17)
Boating and sailing	1 (1)	34 (11)	66 (11)
Fishing	4 (2)	31 (10)	43 (7)
Caught in floodwaters	8 (4)	13 (4)	35 (6)
Baptisms and traditional ceremonies	0	12 (4)	20 (3)
Attempted rescues	2 (1)	12 (4)	15 (2)
Suspected intentional	6 (3)	6 (2)	14 (2)
Surfing and other watercraft	1 (1)	9 (3)	12 (2)
Scuba diving	0	7 (2)	11 (2)
Total	180	304	610
Unknown	57	54	157

* Includes 172 cases in which age group was undetermined.

DISCUSSION

This study presents the first published analysis of the patient's activity prior to fatal drowning in South Africa. A total of 767 drowning incidents in the period from January 2017 to March 2021 were described in this study. The incidents reported in the South African news media increased in spring and summer months which likely reflect periods of increased exposure to recreational water activities due to long holiday periods, warmer weather, increasing tourism numbers along the South African coastline that results in increased number of people swimming (7). Similarly, the relative predominance of incidents on weekends and public holidays is an indication of increased number of visitors to body of waters, where families tend to visit for prolonged times. The results of the study done by Peden et al (2018) indicates that drowning rates were twice as

high during holidays compared to school days in children among 5-17 years,(8) the impact was the most severe among younger children (8). Prevention strategies included improved awareness of the impact of school holidays on the adult and care givers that supervise young children during this time (8). Only sixty nine percent (69%) of incidents in the current study had reported time of day logged in the database, with the highest proportion of incidents, thirty nine percent (39%), occurring in the afternoon between mid-day (12h00) and 15h59. This coincides with the warmest temperature of the day, where people want to be in water to cool down from the heat.

The male to female ratio of drowning victims in this study was 4.7:1. This is higher than the 2:1 reported globally (5) but similar to previous estimates of the male to female ratio (9) from South Africa which ranged between 2.8:1 and 4:1 (9)(2). From the study by Saunders et al (2019), drowning mortality rates in the Western Cape province of South Africa were fourfold higher in males (5, 3 per 100 000 population) than females (1.2 per 100 000 population (9). This corroborates the findings of Idris et al (2003) that males are prone to more risky behavior when exposed to body of waters and are more at risk for fatal drowning incidents (10).

Forty percent of fatal drowning victims reported in the news media were children under the age of sixteen years and this proportion is similar to that previously reported for drowning in South Africa (9). It is interesting to note that only 10% of reported incidents involved children aged five and younger, despite this age group being consistently reported as that with the highest mortality rates (5,2,9). In Donson and van Niekerk's study (2013), the highest age adjusted drowning mortality rates were 6.3 per 100 000 population in children aged 0-4 years, and 2.2 per 100 000 population in children aged 5 – 14 years (11). As drowning in this age group is more likely to occur in and around the home (9), we can hypothesize that these incidents are more likely to be confined to domestic settings and to be of less public interest and therefore not reported on in the news media. This may account for the lower-than-expected proportion of reported incidents in this age group.

A description of the body of water in which the incident occurred was present in the majority of cases and this variable had the lowest rate of missingness in the database. The results indicate that children drown closer to home, with most incidents happening in swimming pools, rivers and dams when compared to adults, where the results indicates that incidents revolving adults tended to occur predominantly in oceans and lagoons. This is similar to previous reports by Peden et al (2018) (8) and Saunders et al (2018) (2). Of the 62 incidents reported involving children under five years of age, 29% of those occurred in a swimming pool, 21% occurred in canals, rivers or streams, 16% occurred in dams ponds, lakes or vleis.

The primary aim of this study was to describe the reported activity prior to drowning. This variable had a high rate of missingness (n=157, 20%) which reflects the difficulty in obtaining reliable information describing the activity. Previous studies have shown that a high proportion of drowning incidents, particularly in children, are unwitnessed (12) and it may therefore be impossible to determine what the patient was doing at the time. In those cases where the activity was determined, approximately half were intentionally swimming at the time and 17% were accidental entries into the water. Interestingly, thirty three percent (33%) of all accidental entries resulting in a fatal drowning involved victims attempting to cross a river, stream or canal which poses a key opportunity for multisectoral prevention interventions. A third of the incidents reported involving children were accidental entries into the water. As indicated already, with 62 incidents reported involving children under five years of age, 21% occurred in canals, rivers or streams, and 16% occurred in dams ponds, lakes or vleis. This is an indication of the struggle that children face traveling to school, with unkempt bridges and unsafe pathways increasing the risk of drowning in children. This is an indication that children under the age of sixteen, in certain low to middle income areas of South Africa attempt to cross these ponds, lakes or vleis to get to schools in their area (5).

In the adult age group, the predominant activity prior to drowning was swimming but recreational activities, such as boating and sailing, fishing, scuba diving and other watercraft usage, accounted for approximately a quarter of all reported cases. The influence of alcohol cannot be reliably ascertained from news media reports, and we were unable to report on this, however a follow up study needs to be initiated to determine whether alcohol plays a part in such recreational accidents. According to Donson and van Niekerk 2013 study (8) 41.5% of all the adult drowning victims were alcohol positive at the time of death (11). In Australia, Peden et al (2018) indicated that while 85% of the mortality rate of drowning incidents were identified as male, both sexes, male and female tend to consume alcohol at bodies of water (13). Alcohol increases drowning risk due to its effects on cognitive processing, central nervous system processing, and physiological responses. (13)

Religious practices (n=12; 4%) such as baptisms initiation ceremonies also contributed to incidents in the adult age group. This is not only a dangerous practice in South Africa, but a report in a Romanian newspaper indicated that a newborn baby died during the baptism that was performed (14). Attempted rescue also plays a role in increased risk for drowning, in both children and adult subgroups, according to Barcala-Furelos et al (2020) the phenomenon can be described as the “duty of care”, where the person witnessing the drowning has the urge to help the victim from not drowning, but these lay person “life savers” exposes themselves to an increased risk of drowning (15).

The current study has several limitations. Firstly, the dataset analyzed includes only those fatal drowning incidents that were reported in the South African news media and captured through a structured search. It is important to note that public reporting of incidents will be skewed towards those of more public interest and away from incidents occurring in private, domestic settings. This is clear from the fact that the research indicates higher drowning percentages at oceans and tidal pools, whereas previous epidemiological research in South Africa has shown that young children

predominantly drown in and around the home (2). Secondly, it is not feasible to confirm with certainty the reported facts surrounding each reported incident. At the time of capturing each incident, significant efforts are made by LSA staff to confirm key data points and follow up on missing information. However, we acknowledge that the circumstances surrounding each incident are not empirically measured. There were high rates of missingness in the data analyses in this study, particularly in the primary outcome of activity prior to drowning incident. Notwithstanding these limitations, the study findings add value in that they identify common, context-specific precipitating factors and activities that may present opportunities for effective prevention interventions.

CONCLUSION

Drowning is a global pandemic, accounting for the loss of unnecessary lives, that of adults and children alike. This study presents the first published analysis of the patient's activity prior to fatal drowning in South Africa in 767 incidents reported in the media. The epidemiological findings of this study are similar to that reported previously in other studies of drowning in South Africa. (2)(9) However, this study identifies previously undescribed activities that contribute to the drowning burden in South Africa. This research indicates that, primarily drowning incidents involves young children, accidentally entering the water and unable to help themselves out of the water. It also points to the fact that during public and school holidays there is an increased risk for drowning in children. It also indicates that many South African children risk their lives just by walking to school every day as they are faced with poorly maintained infrastructure such as bridges that they need to cross. This information can be used in the design of educational and awareness programs, prevention interventions and identifying opportunities for multi sectoral water safety efforts.

References:

- 1.) Van Beeck EF, Branche CM, Szpilman D, Modell JH, Bierens JJLM. A new definition of drowning: Towards documentation and prevention of a global public health problem. *Bull World Health Organ.* 2005;83(11):853–6.
- 2.) Saunders CJ, Sewduth D, Naidoo N. Keeping our heads above water: A systematic review of fatal drowning in South Africa. *South African Med J.* 2018;108(1):61–8.
- 3.) World Health Organization. (2019). Safer water, better health
- 4.) World Health Organization drowning prevention and the 2030 development agenda. Reference list: Electronic resources. Retrieved from:
<https://undocs.org/en/A/RES/75/273>.Date accessed: 12 February 2020
- 5.) World Health Organization. (2014). Global report on drowning: preventing a leading killer.
- 6.) International Lifesaving federations World drowning report (2007). Reference list: electronic resources.Retrieved:<https://www.ilsf.org/sites/ilsf.org/files/filefield/world-drowning-report-final-sept-27-2007.pdf> .Date accessed: 21 February 2021
- 7) The South African Government school calendar (2022). Reference list: Electronic resources. Retrieved from: <https://www.gov.za/aboutsa/school-calendar>. Date accessed: 10 February 2022.
- 8.) Peden, A. E., Barnsley, P. D., & Queiroga, A. C. (2019). The association between school holidays and unintentional fatal drowning among children and adolescents aged 5–17 years. *Journal of paediatrics and child health*, 55(5), 533-538.
- 9.) Saunders, C. J., Adriaanse, R., Simons, A., & van Niekerk, A. (2019). Fatal drowning in the Western Cape, South Africa: a 7-year retrospective, epidemiological study. *Injury prevention*, 25(6), 529-534.
- 10) Idris AH, Berg RA, Bierens J, Bossaert L, Branche CM, Gabrielli A, et al. Recommended Guidelines for Uniform Reporting of Data from Drowning the “Utstein Style.” *Circulation.* 2003;108(20):2565–74.

- 11.) Donson, H., & Van Niekerk, A. (2013). Unintentional drowning in urban South Africa: a retrospective investigation, 2001–2005. *International journal of injury control and safety promotion*, 20(3), 218-226.
- 12.) Joanknecht, L., Argent, A. C., van Dijk, M., & Van As, A. B. (2015). Childhood drowning in South Africa: local data should inform prevention strategies. *Pediatric surgery international*, 31(2), 123-130.
- 13.) Peden, A. E., Franklin, R. C., & Leggat, P. A. (2018). Breathalyzing and surveying riverusers in Australia to understand alcohol consumption and attitudes toward drowning risk. *BMC public health*, 18(1), 1-18.
- 14.) Perry. S.(2021 February 11) Newborn baby drowns during Baptism sparking calls for Religious ritual to be changed. Lad Bible. Retrieved from:<https://www.ladbible.com/news/latest-calls-tochange-baptisms-after-newborn-baby-drownsduring-ritual-20210211>. Date accessed: 13 February 2022.
- 15) Barcala-Furelos, R., Graham, D., Abelairas-Gomez, C., & Rodríguez-Núñez, A. (2021). Layrescuers in drowning incidents: A scoping review. *The American Journal of Emergency Medicine*, 44, 38-44.

PART C: APPENDICES

Appendix A: Research Proposal

Introduction

The World Health Organization Global Report on drowning in 2014 states that drowning is one of the top ten causes of death in children in Africa. Approximately 320 000 deaths occur due to drowning each year worldwide, and 90% of those deaths are in low-and-middle-income countries.

(1) Drowning is the process of experiencing respiratory impairment from submersion/immersion in liquid and drowning outcomes should be categorized as fatal, non-fatal with morbidity or nonfatal without morbidity.(2) It should be noted however that current drowning estimates underestimate the burden as they largely exclude non-fatal drowning incidents.(3)

According to the Global Burden of Disease Study 2016, the unintentional drowning mortality rate in South Africa was 3.95 per 100 000 population in 2016, with more than 2000 lives and 122 479 disability-adjusted life years lost due to unintentional drowning. There is a paucity of evidence describing the burden and epidemiology of non-fatal drowning incidents in South Africa. In a study done by Joanknecht et al (4), it illustrated the lack of South African data on non-fatal drowning as well as the difficulty in categorizing non-fatal drowning incidents. A Non-fatal Drowning Categorization Framework was created by Beerman et al (5) that classifies non-fatal drowning in two dimensions, one being the severity of respiratory impairment immediately after the drowning process has stopped and the second the morbidity category at the time when non-fatal drowning information is gathered, based on decline in functional ability.(5) However, the classification of non-fatal drowning in these two sub categories remains unsatisfactory and can lead to data not being used to improve the reporting on non-fatal drowning.

Ma et al (6) studied the risk factors associated with non-fatal drowning in the rural Chinese province of Guangdong, and illustrated how education in dangerous water activities, swimming training and enhancement in supervision among children might decrease the risk of non-fatal drowning.(6) Most submersion injuries in South Africa occur on the weekends between noon and 8pm at night.(7) December, January and February are months that are associated with increased risks for drowning in South Africa, due to the school holidays taking place, increased tourism and warm temperatures, allowing for more foot traffic at bodies of waters such as lakes, beaches and swimming pools.(8) Non-fatal drowning and fatal drowning for the children of age nil to four increased around the house, with buckets of waters, baths and swimming pools found to be the

leading cause of drowning for this age group.(8) Older children were found to be more susceptible to large bodies of water such as dams, and beaches(8) Older people over 65 are also at high risk for non-fatal drowning's, while it has also been shown that males are more likely to be drowning victims when compared to females.(6)

The main factors identified by Joanknecht et al for non-fatal drowning includes sex (where males are at higher risk compared to females), non-supervision of children, advanced age (over 65 and up) and Alcohol. (4) Alcohol is a massive risk factor for drowning, as one-third of cases in which alcohol was detected had a BAC consistent with being 'drunk' to 'very drunk', and males were 11 times more likely than females to have a positive BAC result.(8) In a study from 2001 to 2005 where alcohol levels were measured, 40% of drowning fatalities that occurred, 85% of those cases had a high blood alcohol level.(9) There is currently very little published data surrounding the precipitating factors of either fatal or non-fatal drowning incidents.

The first consensus guidelines for the uniform reporting of drowning were published in 2003 and revised in 2015.(10) These Utstein-style guidelines propose a minimum and prioritized set of data that should be reported in studies of drowning and resuscitation. These include variables describing (i) victim information, (ii) scene information, (iii) emergency department evaluation and treatment, (iv) hospital course and (v) disposition. It specifically calls for the precipitating factor to be described, if patient was under the influence of alcohol, did he experience a seizure or was there any substance abuse. Precipitating factors has been added to reporting data, however, even though this is now seen as vital information, the data still lacks in substance or there is insufficient data when incident is reported on. Understanding the full burden of drowning is vital to preventative measurements and policy making.

Lifesaving South Africa (LSA) is a registered not-for-profit, public benefit organization and is the national authority for lifesaving and lifesaving sport in South Africa (<https://lifesaving.co.za/>). As there is limited national drowning surveillance data available in South Africa, LSA has collated media reports on both fatal and non-fatal drowning incidents in South Africa since 2016. The database is updated by LSA head office administrators and used to issue an annual report on drowning statistics for its members. In consultation with LSA head office, we have identified a need to assist with a robust analysis of this database with the specific aim to identify common precipitating factors associated with both fatal and non-fatal drowning incidents. An improved understanding of the precipitating factors will inform LSA's drowning prevention campaigns and provide an evidence base to aid in prioritizing campaigns when resources are limited.

AIM AND OBJECTIVES:

The aim of this study is to describe the precipitating factors contributing to drowning incidents reported in the South African media between 2017 and 2020. In order to address this aim, the specific objectives of this study are:

- To perform a descriptive analysis of the Lifesaving South Africa database of drowning incidents reported by LSA members and the South African media between 2017 and 2020
- To identify common precipitating factors contributing to these incidents between 2017 and 2020, and describe the associated patient demographic characteristics

METHODOLOGY:

Study design

This will be a retrospective descriptive study of an existing database maintained by LSA.

Study setting and population

There are approximately 1500 fatal drowning incidents in South Africa annually, with little information available on the number of non-fatal incidents. LSA is a registered not-for-profit, public benefit organization and is the national authority for lifesaving and lifesaving sport in South Africa (<https://lifesaving.co.za/>). LSA head office maintains a database recording all drowning incidents reported by its members and/or the South African media. The current study seeks to analyse this database.

Data collection and management

The Lifesaving South Africa drowning database uses media reports to record the reported precipitating factors and circumstances surrounding drowning incidents. The database is maintained by LSA head office staff through media alerts, searches and as incidents are reported by their members. All information contained in the database is available in the public domain and presents no risk to confidentiality. Following ethical approval, the LSA database will be shared with the research team and preliminary approval for this study has been obtained from LSA.

The following variables are contained in the LSA database:

- Date and time of incident
- Number of victims
- Age of victim/s
- Sex of victim/s
- Location of drowning
- Body of water
- Activity prior to drowning incident
- Bystander involvement and actions
- whether resuscitation was attempted
- Outcome of incident (mortality, non-fatal with morbidity, non-fatal without morbidity).

Where data is missing from the database, an internet search will be performed to identify the original media reports and attempt to find the missing information. If this is unsuccessful, the variable will be left blank and indicators of missing information will be provided for each variable.

Data analysis:

Data will be analyzed descriptively. Numerical data will be presented as means and standard deviations. Categorical data will be presented as proportions or frequencies as appropriate.

Data management:

The data will be stored on a password protected computer that is only accessible by the researcher. The data will be stored in columns with the above mentioned headings. Any missing information will be cross referenced with media articles or radio articles to find any relevant information.

ETHICAL CONSIDERATIONS:

There are no major ethical considerations in this study as the LSA database is a series of media reports that are already in the public domain and open to anyone. There are no live patient interactions nor interventions requiring specific patient consent and there is no risk to patients. All private information will be kept private and sensitive information such as alcohol use or drug misuse will not be discussed in detail.

STRENGTHS AND LIMITATIONS:

The limitation of this study is that it does not take every single case of drowning into consideration, only those that were reported in the media or by members and recorded by the LSA database. The data collected from this study can be immensely valuable from a point to create public awareness of what happens in the moments before a drowning, and how it can be prevented. The evidence currently available only explains what happens during a drowning incident and after the incident occurs. This study will improve the body of evidence to understand what leads up to a drowning incident and how to prevent it.

DISSEMINATION OF FINDINGS:

This study can be used to identify precipitating factors surrounding non-fatal drowning incidents and will be shared in a report with Lifesaving South Africa and a research publication. It can lead to the identification of hot spots in relation to accidents and can help combat these incidents by creating awareness and promoting action plans to educate the public to avoid increases in similar incidents

References:

1. World Health Organization. Global report on drowning: preventing a leading killer. World Health Organ. 2014;58.
2. Van Beeck EF, Branche CM, Szpilman D, Modell JH, Bierens JJLM. A new definition of drowning: Towards documentation and prevention of a global public health problem. Bull World Health Organ. 2005;83(11):853–6.
3. Peden AE, Mahony AJ, Barnsley PD, Scarr J. Understanding the full burden of drowning: A retrospective, cross-sectional analysis of fatal and non-fatal drowning in Australia. BMJ Open. 2018;8(11):1–10.
4. Joanknecht L, Argent AC, van Dijk M, van As AB. Childhood drowning in South Africa: local data should inform prevention strategies. Pediatr Surg Int. 2015;31(2):123–30.
5. Statement DP, Beerman S, Clemens T, Meddings D, Rahman A, Szpilman D. Clarification and Categorization of Non-fatal Drowning. 2018;1–12.
6. Ma WJ, Nie SP, Xu HF, Xu YJ, Song XL, Guo QZ, et al. An analysis of risk factors of non-fatal drowning among children in rural areas of Guangdong Province, China: A case-control study. BMC Public Health. 2010;10.
7. Orlowski JP. Drowning, Near-Drowning, and Ice-Water Submersions. Pediatr Clin North Am. 1987;34(1):75–92.
8. Saunders CJ, Sewduth D, Naidoo N. Keeping our heads above water: A systematic review of fatal drowning in South Africa. South African Med J. 2018;108(1):61–8.
9. Roos C. An analytical study of the distribution of fatal ocean drowning by tidal phase and state in the Western Cape By. 2019;(December).
10. Idris AH, Berg RA, Bierens J, Bossaert L, Branche CM, Gabrielli A, et al. Recommended Guidelines for Uniform Reporting of Data from Drowning the “Utstein Style.” Circulation. 2003;108(20):2565–74.
11. Fife D, Scipio S, Crane GL. Fatal and Nonfatal Immersion Injuries Among New Jersey Residents. Am J Prev Med. 1991;7(4):189–93.

Appendix B: HREC Approval Letter



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee



Room G50- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

04 October 2021

HREC REF: 627/2021

Dr C Saunders
Division of Emergency Medicine
F-51, OMB
Email: c.saunders@uct.ac.za
Student: DBRWIL007@myuct.ac.za

Dear Dr Saunders

PROJECT TITLE: A RETROSPECTIVE ANALYSIS OF THE PRECIPITATING FACTORS CONTRIBUTING TO DROWNING INCIDENTS IN SOUTH AFRICA AS REPORTED IN THE SOUTH AFRICAN MEDIA-BSC CANDIDATE-MR WILKE DE BEER

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

This approval is subject to strict adherence to the HREC recommendations regarding research involving human participants during COVID -19, dated 17 March 2020: 06 July 2020 & 01 July 2021.

Approval is granted for one year until the 30 October 2022.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Mr Wilke de Beer will also be involved in this study.

Please quote the HREC REF 627/2021 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

HREC/REF 627/2021sa

Yours sincerely



PROFESSOR M. BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938
NHREC-registration number: REC-210208-007

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2006), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.