



World Water Safety

INTERNATIONAL LIFE SAVING FEDERATION

Gemeenteplein 26 – 3010 Leuven – Belgium
Tel: +32/ 16 896060 – E-mail: ils.hq@telenet.be - Web: www.ilsf.org

MEDICAL POSITION STATEMENT - MPS 22

RESEARCH NEEDS FOR DROWNING

“To understand the true burden of drowning we need to recognize and understand the whole process of the drowning timeline”

BACKGROUND

The problem

Drowning is a leading killer worldwide and a growing public health burden. [WHO 2015] One major contribution to this is that everyone is still “looking for solutions without accurately knowing the problem”.

For identification and analysis of a specific topic such as drowning, one needs to be able to collect reliable and sufficient data to be scientifically analyzed. Under reporting contributes significantly to misunderstanding of the process of drowning. Estimates show that under reporting can comprise as much as 94% of all drowning events [Szpilman 2012].

Why collecting reliable and adequate data is hard to achieve?

Many limitations occur while collecting drowning data: [IDRA 2019]

1. Drowning is a very complex disease with hundreds of variables involved in its whole process [Szpilman 2017],
2. Research shows that academic studies still consider different drowning definitions and terminology [Schmidt 2017].
3. Lack of worldwide consensus on definitions, terminology and a clear definition of what data to collect on fatal and non-fatal drowning limits multicenter studies which are the cornerstone for high Level Of Evidence (LOE) publications. [Szpilman 2018].
4. Definitions, terminology and data collected by local, national, and international agencies is not uniform and a standardized, and integrated data collection systems on drowning are essentially for data comparison [Papa 2005, Sempstrott 2011].
5. Understanding the proper fit of data to be collected in the drowning timeline is essential for comparison. [Szpilman 2016]
6. An estimated 90% of all drowning deaths occur in low- and middle- income countries and are not reported. [WHO 2015].
7. Some fatal drowning cases are not properly classified according to the International Statistical Classification of Diseases, even for high-income countries [Lu 2010].

8. At the hospital, some cases are misjudged, and drowning is not coded properly as the primary cause.
9. The burden of drowning has primarily been measured using information from fatal drowning events, [Idris 2017] excluding non-fatal cases which are the majority of events.
10. Although the majority of the media and publishers focus data regarding the resuscitation of drowning victims, the incidence of resuscitation being performed is only one in every 112,000 of interventions by lifeguards (0,0009%). Prevention is 99,8% of all interventions [Szpilman 2018].

As in any other research field, it is important that the solution proposed (intervention), considers the level of evidence (LOE), the feasibility and cost effectiveness of the intervention, independent of being a preparative (educative), preventive, rescue or mitigative intervention. The primary objective of the majority of drowning research has been to reduce the fatal drowning and/or it's morbidity. Instead the efforts should be mainly on how to prevent the event. Our lack of knowledge of the drowning process as a whole makes us still ignorant about "how much (effort and economics) is needed on education to avoid one drowning event?" "How many lifeguards are needed to avoid one event?" "Can a particular drowning prevention intervention be applied in any water scenario?"

Although many have been involved in drowning research since the 2002 ILS World Conference on Drowning Prevention in the Netherlands, there is still a long way until the main drowning research needs are fulfilled

The objective of this statement is to provide a detailed description of the drowning timeline (Appendix A) and list research needs (gaps and questions) along the drowning process, including triggers, actions and consequent interventions, where good LOE research is still lacking. With this section, we aim to raise important topics and provide powerful insights as a tool to prioritize all interventions needed considering the measurement of future cost/benefit ratios related to outcome in terms of public health, financial aspects, political scope and social impacts.

The solution - research needs

In order to properly identify the research needs for drowning prevention it is crucial that we do realize that we implement drowning interventions (solutions) throughout the whole drowning process. Not infrequently authors misjudge concepts and describe, for example, "provide oxygen to the victim at the scene" as a "preventive intervention" when it should be considered "injury mitigation"

Addressing drowning as a traumatic event and using the drowning timeline (figure 1) can bridge the gap in defining and understanding the whole drowning process and allows researchers to define a set of questions needed to be answered with well-designed research studies of the highest LOE possible.

As with other types of trauma, the lack of clear-cut distinctions between pre-event, event and post-event, as well as between triggers, actions and interventions, hampers the systematic collection of drowning-related data (see appendix A for detailed explanations of drowning timeline) [Szpilman 2016]. This, in turn, has severe impacts on the quality of the estimates of the global burden of drowning, and consequently on the effectiveness of drowning prevention strategies.

STATEMENT

An enormous need to address the gaps of drowning research together with lack of high LOE in current literature calls for more attention of all involved and compromised with obtaining effective solutions to reduce drowning and turn water into a safer environment. Several areas and topics are proposed in appendix B as a detailed (but not exhaustive) example.

Some highlighted facts on drowning research needs and current knowledge

- As a leading killer around the world, drowning needs to get extra attention from researchers so that many of the gaps in knowledge can be fulfilled
- Before we look for solutions (interventions) we need to be sure we have identified and characterized the problem as much as possible.
- There are many barriers to study the problem at local, national or international setting but this must not serve as an excuse to hamper research and actions.
- Since there is a lack of worldwide consensus on definitions, terminology and what data should be collected on fatal and non-fatal drowning, it is advisable to follow your local or national guidelines, so to allow comparisons of data and a possible higher LOE.
- While proposing any question to be investigated make a previous reflection considering difficulties to run it, time consumption, cost, impact, and feasibility to apply in real world.
- Think if the question is well formulated, where it fits in the drowning timeline (pre-event, event or post-event), what are the actions and/or interventions being evaluated and if it corresponds to what the author truly expects to investigate.
- There is an unbalance preference of literature publication of fatal cases and resuscitation, although this is the minority of occurrence. Researchers should try to move from considering exclusively death as the only outcome to event occurrence and/or morbidity.

LEVEL OF EVIDENCE

This document is based on expert consensus and literature.

POTENTIAL CONFLICT OF INTEREST STATEMENT

None of the participants in the consensus process leading to this position statement has a conflict of interest with the stakeholder industry, technology, persons or organizations that are identified and/or impacted by the position statement.

REFERENCES

- World Health Organization. Global Report on Drowning. World Health Publications;2015.
- Szpilman D, Billy Doyle, Jenny Smith, Rachel Griffiths, Mike Tipton. [Challenges and Feasibility of Applying Reasoning and Decision- Making for a Lifeguard Undertaking a Rescue](#). International Journal of Emergency Mental Health and Human Resilience, Vol.19, No. 4, pp 1-9.
- Schmidt AC, Sempsrott JR, Szpilman D, Queiroga AC, Davison MS, Zeigler RJ, McAlister SJ. [The use of non-uniform drowning terminology: a follow-up study](#). Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2017; 25:72.
- IDRA 2019, retrieved from research gaps based on drowning timeline questions to be answered. <http://idra.world/research-gaps-based-on-drowning-timeline-questions-to-be-answered/>
- Szpilman D, Sempsrott J, Webber J, Hawkins SC, Barcala-Furelos R, Schmidt A, Queiroga AC. “Dry drowning” and other myths. Cleveland Clinic Journal of Medicine. 2018 July;85(7):529-535.
- Szpilman David, Tipton Mike, Sempsrott Justin, Webber Jonathon, Bierens Joost, Dawes Peter, Seabra Rui, Barcala-Furelos Roberto, Queiroga Ana Catarina, [Drowning timeline: a new systematic model of the drowning process](#), Am J Emerg Med. 2016 Nov;34(11):2224-2226.
- Lu T-H, Lunetta P, Walker S. Quality of cause-of-death reporting using ICD-10 drowning codes: a descriptive study of 69 countries. BMC Med Res Methodol 2010;10:30.
- Szpilman D, Bierens JJLM, Handley AJ, Orlowski JP. Drowning. N Engl J Med 2012;366:2102–10.
- Idris AH, Bierens JJLM, Perkins GD, et al. 2015 revised Utstein-style recommended guidelines for uniform reporting of data from drowning-related resuscitation An ILCOR advisory statement 2017. Resuscitation 118 (2017)147-158.
- Szpilman D, Oliveira RB, Mocellin O, Webber J. Is drowning a mere mater of resuscitation? Resuscitation 129 (2018) 103-106.
- Papa L, Hoelle R, Idris A. Systematic review of definitions for drowning incidents. Resuscitation 2005;65:255–64.
- Sempsrott J, Slattery D, Schmidt A, Penalosa B, Crittle T. Systematic Review of Non-Utstein Style Drowning Terms. Annals of Emergency Medicine 2011;58:S321.

APPROVAL

Primary authors: David Szpilman, MD, John Pearn, MD, & Ana Catarina Queiroga, PhD
Policy Statement developed by ILS Medical Committee June 2019
Endorsed by the ILS Rescue Commission 28/08/2019
Adopted by the ILS Board 06/10/2019

APPENDIX A THE DROWNING TIMELINE – THE WHOLE PROCESS TO RESEARCH



Figure 1

TERMINOLOGY DESCRIPTION

Phase: corresponds to a part in a series of related actions of the drowning timeline, before it starts, during the process and after it ends. In the current model there are 3 phases: pre-event, event and post-event.

Triggers: Anything that serves as a stimulus and initiates or precipitates an action. In this model we have identified “community at risk” as the trigger for preparation; “person(s) at risk” as the trigger for prevention; “person(s) in stress/distress as the trigger for reaction; and “person being rescued or rescued” as the trigger for mitigation.

Action: Any measure taken during any phase of the drowning timeline will necessarily fall in one of 4 categories of action: prepare, prevent, react or mitigate that will be activated by specific triggers and will lead to specific interventions.

Intervention: Is any measure taken during a specific category of action that will have influence on what happens, modifying or hindering the impact of a drowning event.

Pre-event: The pre-event is the phase before the drowning process starts and comprises two actions (preparation and prevention) that were triggered either by a community at risk (preparation) or a person or group at risk (prevention).

Event: The event phase encompasses any action taken in the water triggered by a person in stress or distress, while the drowning process is taking place. Possible actions are: self-rescue, rescue, or no rescue. If the rescue is being performed by a first responder, being it a layperson or a professional, some mitigation interventions might take place while the victim is still in the water, such as first in-water efforts to provide life-support.

Post-event: The post-event phase is only composed of mitigation actions – those that will make the impact of the drowning less severe, harmful, or painful. It starts after extrication from the water has ended and extends until all the health care ceases, such as ambulance attendance, hospital and post-hospital care.

PREPARATION

The triggers are simply the identification of a community at a risk of drowning for any reason. Actions are directed at communities at risk, taken before an incident aimed at improving effectiveness of Prevent, React and Mitigate actions. The rationale for the separation of this concept in the timeline is of major importance. Many of the interventions in the “preparation” category have been mistakenly taught as a type of preventative interventions, when they are more about being “prepared to react or to mitigate” the injuries/death rather than actually preventing the incident (the contact between human and the trauma agent) from happening.

Preparation to prevent consists of education in its different forms usually away from aquatic setting, e.g. educational videos, billboards, school activities and others.

Preparation to react consists of learning how to react to danger situation to yourself or others in an aquatic setting, e.g. learn how to swim, recognizing a potential drowning victim, and/or rescue techniques.

Preparation to mitigate consists of training in and outside an aquatic setting, including learning drowning and CPR protocols. All forms of preparation can be taught both to the general public to professionals, but the contents and responsibilities might differ.

Each category have 3 interventions: Understand the problem, Plan the best strategy to fight the problem, and Implement the plan and verify its effectiveness.

PREVENTION

Including any actions directed to risky environments and users, and taken before an incident aimed at stopping the drowning event from occurring. Is triggered by a person(s) at risk and has been mistaken described as one single category of intervention, however, this we've identified two different categories of prevention entailing distinct types of interventions:

Active prevention (risky areas/hazards): actions directed to a specific area or detection of risky behaviors at the scene such as proactively placing warning signage to sign a rip current or identifying and signage environment hazards or behaviors.

Reactive prevention (risky activities/behavior), actions directed at specific individuals or groups to stop an imminent danger such as a lifeguard whistling to a bather who is at imminent risk and directing them to safety or by simply removing bather or group from the dangerous situation before the event of drowning starts.

REACTION

Any action taken during the water stage is regarded as the event phase, which coincides with reaction in the timeline. Reaction initiated by a stressful condition, when a person feels at risk of drowning, followed or not by a distress situation when the ability to rationally cope with the stressful condition is overwhelmed. Actions directed at a person (or group) in stress or distress and taken after an incident while in water aimed at interrupting the progress of drowning once it started. Reaction will only stop with the extrication from the water/danger

Self-rescue occurs when the person is able to get out of the difficult situation without external assistance, usually reaching only stress.

Rescue occurs when the person is assisted by someone else (can be a relative, a friend, a lifeguard).

No-rescue is when help is needed but not provided.

MITIGATION

Usually starts when the victim is still in contact with the 'trauma aggressor' and before extrication from the water has ended. Start with actions directed at a specific person, or group, taken while performing the rescue or immediately after the rescue aimed at reducing the impact of the injury on the victim(s). Casualty assessment during the event phase induces in-water mitigation actions. Mitigation actions in the post-event phase are initiated only after extrication from immediate danger has ended. The overlapping section between reaction and mitigation actions represents the intersection of the two actions. This occurs when the victim is being rescued and the rescuer is also applying mitigating interventions to reduce the impact of the drowning process before removing the victim from the water. During the event mitigating interventions are usually performed by professionals, such as lifeguards or first responders and may include: opening the airway while rescue is taking place; a first responder performing in-water ventilations; providing oxygen using a facemask while extricating an individual from a water disaster like a flood, but still in a boat and in danger. During the post-event phase includes all interventions related to provision of health care and can be categorized as: local (ambulance), at hospital; and post-hospital interventions and may include: a drowning victim being assisted in a critical situation at the beach; specific health care provided during transportation to a ER and hospitalization; home care rehabilitation (after release from hospital) which can include physical and psychological assistance.

APPENDIX B

Non-Exhaustive List of examples of drowning research gaps and questions still to be answered, categorized based on the drowning timeline

(G=Gap, Q=questions)

PREPARATION

G: Measuring the whole drowning problem at local, regional and national level

Q: What and where are the sources to collect the figures on drowning?

Q: What data to collect on drowning?

Q: Drowning definition and terminology – Is there a consensus after all?

G: Effectiveness of lifesaving service

Q: What is the best relation among preparation X prevention X rescue X mitigation actions?

Q: What are the costs and the effectiveness of each action of the drowning timeline for a specific lifesaving service?

G: Lifesaving sport

Q: What is the true value of lifesaving competition to reduce the burden of drowning?

Q: Are we using the lifesaving competition tool for the best to reduce the burden of drowning?

Q: Lifesaving sport – how does it fit as a preventive tool?

G: Anatomopathology (usually post-mortem)

Q: What is the strongest evidence to drowning diagnostic?

Q: How to differentiate a primary from a secondary (precipitant disease) drowning?

Preparation to prevent

G: Education on active prevention actions

Q: What has more impact, visual, written, or audio stimulus or a combo?

Q: What colour and signs are more impacting to call for people's attention?

G: Education on reactive prevention actions

Q: How many tips are needed to spot/ recognize a bather/swimmer in imminent danger?

Q: What is the most impacting message to convince a bather/swimmer that he is at imminent risk?

Q: What are the pitfalls of beach surveillance?

Preparation to react

G: Education on "self-rescue"

Q: What are the basic swimming skills for each aquatic environment?

Q: Difficulty in the water: How to avoid getting into distress?

G: Education on rescue

Q: What is the safest way to help without becoming a second victim?

Q: What is the best lifesaving equipment on the surf beaches?

Q: How many decisions does a lifeguard have to make on a single rescue?

Q: How to decide who to pick first in a multiple victim scenario?

Q: What is the rate between the number of lifeguards and population at different aquatic scenarios?

Q: What would be the most appropriate lifeguard tower for each particular scenario?

Preparation to mitigate

G: In-water mitigation education

Q: Is the in-water education to lay public adequate?

Q: What's the best way to teach in-water mitigation for lifeguards?

Q: What are the basic and advanced procedures to teach for in-water moment?

G: Pre-hospital out-water mitigation

Q: What manoeuvres to teach regarding transportation of the patient from water to a dry place?

Q: What are the best ratio students per manikin for effective learning and training of CPR?

Q: Advanced airways management on drowning victims: laryngeal mask vs oro tracheal tube?

Q: Non-prescription drugs, other than alcohol, and their role in drowning triggers.

Q: What is the synergy between alcohol and prescription drugs as a cause of drowning?

G: Education at Emergency room

Q: What procedures to teach to ER staff regarding drowning victims?

Q: What are the difficulties on advanced management of the airways on drowning victims?

Q: How important is to teach the drowning chain to health professionals?

Q: What would be the best way to teach the drowning classification according to severity?

G: Education at Hospital attendance

Q: What are the basic skills to manage a drowning victim to teach health professionals at the ER?

Q: How to calculate prognostic factor on drowning survival?

Q: What are the brain protective measures on post-CPR drowning?

Q: How long to keep the patient on artificial ventilation?

Q: Is the knowledge of the microorganism in the water where drowning occurred any good to decide on which antibiotic to use?

G: Education for the post-hospital

Q: What are and how the psychological effects of drowning affect a victim throughout his life?

Q: How to reduce the psychological effect of a drowning episode?

Q: What is the treatable vs untreatable sequels from a drowning episode?

Q: Is there a need to return and seek medical consultant after all?

PREVENTION

Active prevention (risky areas/hazards)

G: Cost of active preventive actions taken versus benefits.

Q: Which active preventive action is more cost-effective for pool safety?

G: Major active actions VS minor ones.

Q: Warning signage is more effective than prohibiting access to risky areas?

G: Active prevention actions on areas of great risk of tsunamis.

Q: What are the measures to keep population safe against tsunamis?

G: Active prevention actions on river safety

Q: How to impact with preventive measures the so scattered river population?

G: Active prevention action affecting drowning burden

Q: How is the identification of reducing of drowning figures related to active prevention?

Q: What is the first step in preventing drowning? Does it start with pool fences, public education, swim lessons, or some other intervention?

Reactive prevention (risky activities/behaviour)

G: Lifeguard cost of active VS reactive prevention actions.

Q: Are lifeguarding services (an active and reactive preventive staff) more cost-effective than population educational well-designed and implemented programs (preparation)?

G: Too late VS too early lifeguard whistling to a bather who is at imminent risk.

Q: What are the pitfalls for a lifeguard when whistling too early or too late to a bather/swimmer in danger?

G: Reactive prevention actions on areas of great risk of tsunamis.

Q: Are the warning systems effective?

G: Reactive prevention actions on a flood

Q: How are the safety procedures in a flood while in the car?

REACTION

Self-rescue

Q: What mechanisms a self-rescued victim used to escape?

Q: Is it possible to reduce the heat loss during long rescues?

Q: How many victims in trouble wave and/or shout for help?

Q: Is it possible to self-rescue while in distress?

Rescue

Q: In a common lifeguarding service day, what is the number/ratio of rescues made without getting in water?

Q: From all rescues done, how many drowning victims were in cardiac arrest?

Q: Using the start triage system on rescues what are the odds for each drowning grade?

Q: What is the most useful floatation equipment for a daily use?

No-rescue

G: No-rescue

Q: What are we missing about the victims not rescued?

MITIGATION

G: In-rescue mitigation

Q: In which cases in-water mitigation is needed/useful?

Q: What is the best lifeguard equipment to help conduct in-water mitigation procedures?

Q: When to proceed and not on doing in-water mitigation?

G: Pre-hospital out-water mitigation

Q: What is the safest way to transport the patient from water to a dry place?

Q: What are essential basic and advanced medical equipment to have for drowning?

Q: Drowning approach: Victim to the hospital or hospital to the victim?

Q: Cervical immobilization: When is it really indicated?

Q: What are the factors which determine and modify the taking of "agency", for performing CPR in the drowning victim?

Q: What is the current status of “Dispatcher –guided CPR in the specific scenario of drowning/

G: Emergency room

Q: How is the triage by severity of drowning arriving at ER?

Q: What complementary exams to ask for a drowning patient based on severity?

Q: Are there any refusals to resuscitate at the ER?

G: Hospital attendance

Q: Who's drowning patients to send to intensive care units?

Q: Hypothermia is protective in which drowning patients?

Q: Prognostic need to be based on drowning severity?

G: Post-hospital

Q: How many people need psychological care?

Q: How a drowning affects a victim in the following 20 years of their life?

Q: How many need physical rehabilitation care?