Recognition of a Drowning Victim by Bystanders: A Scoping Review

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Background: Globally, drowning is one of the leading causes of unintentional death. Whilst the World Health Organization (WHO) has identified that bystanders could play an important role in decreasing drowning deaths, few studies have evaluated whether bystanders can recognize a drowning victim. This scoping review aimed to identify common drowning characteristics to support bystanders in recognizing drowning.

Method: Studies were identified through a systematic search of databases from the year 2000 until 2020, with the review guided by the PRISMA Scoping review process. Two hundred and nineteen potentially relevant articles were identified, of which 23 met all inclusion criteria.

Results: There is limited to very limited empirical data describing how bystanders detect a distressed victim in the early stages of the drowning process.

Implications: When preventative measures fail (drowning chain of survival step one), responders need to be able to perform the necessary steps to interrupt the drowning process. This study categorizes behaviors that may indicate that a person is in danger or in need of help in the water, which should support bystanders in recognizing someone in distress and the need to activate rescue and emergency medical services (drowning chain of survival step two and “early recognition" in the domain of first aid education).

Conclusion: Whilst evidence is sparse, this review provides educators and training organizations with evidence-based behaviors which they can use to assist bystanders in understanding and identifying persons in danger or in need of help in the water.

Keywords: bystander, drowning recognition, drowning, rescue

With an estimated 236,000 annual drowning deaths worldwide, drowning prevention is a complex global public health challenge (World Health Organization [WHO], 2021). The WHO has identified bystanders as potentially valuable contributors to drowning prevention worldwide. Of the 10 key actions to prevent drowning identified in the Global Report on Drowning, the fourth is to train bystanders in safe rescue and resuscitation (WHO, 2017). In this context, a bystander is defined as any member of the public, be that family, friend, or stranger, who offers assistance (by attempting a rescue) to someone in distress (Franklin & Pearn, 2011; Pearn &

Franklin, 2012). The issue of aquatic rescue undertaken by bystanders is significant, as the initial response and action of a bystander can make a critical difference in preventing loss of life, both through rescuing someone from the water and early intervention after the rescue, such as application of CPR (Attard et al., 2015; Moran & Stanley, 2013; Venema et al., 2010). However, little is known about how informed members of the public (bystanders) are to recognize a victim who is drowning and whether they are equipped to engage in an aquatic rescue.

In the event of a drowning incident, the recognition of distress is a critical step, with early recognition the second link in the Universal Drowning Chain of Survival (Szpilman et al., 2014). However, a challenge for bystanders is that the signs of drowning are not always apparent. Many victims in significant difficulty are unable to ask or signal for help, and this makes early recognition difficult. Whilst bystanders are frequently involved in rescues in water environments, their level of experience varies considerably (Moran & Stanley, 2013). Many bystanders not trained or experienced in water safety, water-based rescue or medical assistance may not be aware when a rescuee requires assistance, as they lack the skills to assess the situation and associated hazards (Moran & Stanley, 2013; Pearn & Franklin, 2012). Unfortunately, in these situations it is not uncommon for the bystander to place both themselves and the rescuee(s) at risk while performing a rescue (Attard et al., 2015).

A recent Australian study (Petrass & Blitvich, 2018) indicated that many young adults lacked both the physical capacity and knowledge required to safely perform a rescue, a factor that may place them at increased risk if they are to attempt a rescue. Similarly, a New Zealand study found that almost half of the survey respondents (47%) reported that they would jump in and attempt to save someone, despite almost two-thirds (62%) identifying themselves as weak swimmers (Moran & Stanley, 2013). This may explain why it is not uncommon for the bystander rescuer to drown attempting a rescue with retrospective studies of such incidents reported in Australia (Franklin et al., 2010); the Netherlands (Venema et al., 2010); Turkey (Turgut, 2012) and the United States (Smith & Brenner, 1995).

The initial stressor for drowning is thought to be any event that results in a loss of control of breathing, flotation and/or ability to move within the water. The need to breathe and the desire to return to a point of safety is typically a victim's primary behavioral response when in distress, with breathing taking precedence over everything else which is primal.

The drowning process has been defined as a 4-stage sequential process (Pascual, 2014):

1. **Incident**: defined as the event that takes the victim out of his expected or normal situation and triggers a potentially threatening situation.
2. **Loss of aquatic competence**: defined as a situation in which a swimmer suffers a momentary physical disorder either in breathing, floating, or swimming, or in their ability to move within the water.
3. **Distress**: a period where swimmers voluntarily hold their breath, become psychologically and physiologically stressed and struggle to keep afloat and breathing.
4. **Drowning**: a period where swimmers start to breathe in liquid.

Drowning is a hypoxic injury that often starts before the victim submerges (Salomez & Vincent, 2004). Hypoxia causes weakness, inability to swim effectively, air hunger, confusion, and psychological activation with a stress response. In periods of loss of control and distress (Pascual (2014) drowning process Stage 2 and 3) victims are blindly focused on trying to get their airway above water to breathe; this may cause some to flail their arms and position their head facing upward. Often, a lack of oxygen makes them unable to

cooperate and respond appropriately. Pascual's (2014) Stage 3 (distress) in the drowning process, has also been referred to as the Instinctive Drowning Response (IDR) (Pia, 1974). However, empirical evidence indicates that it is not an autonomic response, with some victims showing no signs of distress, but simply becoming submerged. Uninterrupted, the distress stage results in: water aspiration, complete anoxia, and submersion, resulting in the victim typically becoming lost from sight.

When preventative measures fail (drowning chain of survival step one), responders need to be able to perform the necessary steps to interrupt the drowning process. The challenge is then to recognize someone in distress and identify the need to activate rescue and emergency medical services (drowning chain of survival step two). The sooner the chain of survival is initiated through early identification and interruption of the drowning process, the shorter the period without breathing, anoxia, and typically the better the outcome. Thus, early recognition of drowning and appropriate rescue action is paramount (Moran et al., 2016; Pascual, 2011; Quan et al., 2016). Accordingly, the aim of this review was to determine common behavioral drowning characteristics and ascertain how bystanders can recognize drowning. It is anticipated that such findings will have useful implications for drowning prevention, particularly for educators and training organizations that are responsible for curriculum development, and/or upskilling individuals within the community. Further, study findings should directly help bystanders to intervene early in the drowning process, a key element in the drowning response chain, thus enhancing the victim's recovery outcomes.

Methodology

The review was guided by the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-Scr) Statement, including the checklist and recommendations (Tricco et al., 2018). Four academic databases (PUBMED, SPORTDISCUS, EMBASE, SCOPUS) were searched for articles published between the year 2000 and 2020, inclusive. We chose 2000 as the cut off year as the new definition of drowning was adopted by consensus in 2002 (van Beeck et al., 2005), and this definition enabled more reliable and comprehensive information to be reported. The search was restricted to English search terms, with keywords such as "drowning detection", "drowning recognition", "rescues", "drowning", "layperson" and "bystander" employed in different combinations using Boolean operations AND/OR to search. The truncation/stemming technique was also used to broaden the search to include various word endings and spellings. Finally, the reference lists of all included articles, previous literature reviews on the topic and top hits from Google Scholar were hand-searched for further identification of potentially relevant studies and were assessed using the inclusion and exclusion criteria.

Eligibility Criteria

All studies assessing the phenomenon of aquatic rescues by bystanders and lifeguards/lifesavers were eligible for review. The inclusion criteria were (i) publication date between 2000 and 2020, (ii) written in English language, (iii) published in a scholarly peer-reviewed journal, and (iv) described behavioral characteristics that had been observed in drowning victims. Studies were excluded from the review if they were (i) unpublished thesis and dissertation studies, (iii) not published in a peer-reviewed journal, and (iii) examined fatal drowning associated with aquatic rescues but did not consider characteristics of victims.

Study Selection and Data Collection Processes

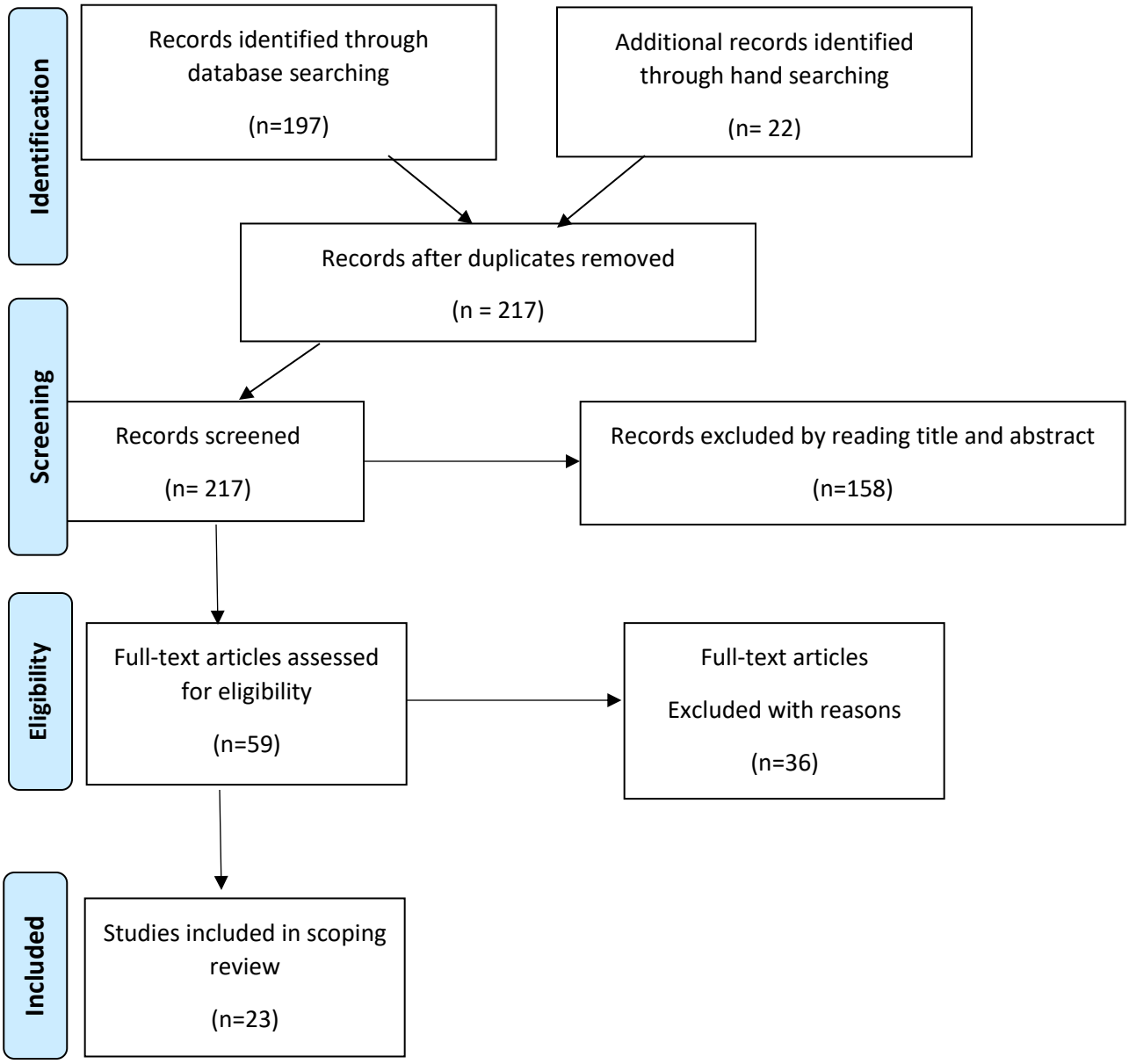
After performing the initial literature searches, the first author screened each study title and abstract for eligibility. Full text of all potentially relevant studies was subsequently retrieved and further examined for eligibility by both authors. The

PRISMA flow diagram (Figure 1) provides more detailed information regarding the selection process of studies. Studies that met inclusion criteria were then analyzed and synthesized in an electronic spreadsheet designed by the first author. Information extracted from each study included: (i) country in which study conducted, (ii) study design, (iii) participant characteristics; (iv) quality assessment score (ranging from 0–5 with higher scores indicating higher quality), (v) key findings, among others. This scoping review did not include a statistical synthesis called meta-analysis, as the studies were too dissimilar regarding methodology and data to enable the results to be combined in a meaningful way.

Results

The comprehensive search strategy resulted in a total of 219 articles, of which there were two duplicates. After reviewing the titles and abstracts, 158 articles were excluded because they did not fulfil the inclusion criteria. A total of 59 full text

Figure 1. PRISMA chart of the selection process.



articles were screened for suitability, with 36 excluded based on a priori criteria (Figure 1). A total of 23 papers met the inclusion criteria and were included in the qualitative analysis (Supplementary Table 1).

In contrast to the stereotypical drowning portrayed in the media and movies, where drowning is depicted as a dramatic event where people wave and scream, the results from the 23 included studies indicate that the signs of drowning are much more subtle. The results illustrated that drowning is often quiet, with one or more of the following behaviors a common sign of distress/drowning for children (defined as those aged ≥ 6 years) through to senior adults (defined as those ≥ 60 years). As there is limited information available for toddlers (defined as those aged 1 to 3 years), behaviors specific to this age group are noted explicitly. No empirical observation studies specific to infants (defined as ≤1 year) were identified, however videos of infant survival swim teaching show that this group do not spontaneously show self-save responses and tend to sink.

What must alert us to a potential incident/issue:

- *Behavior or actions that do not correspond to the person's abilities/skills: for example, a child alone/unsupervised in the water; swimming in the deep area; and/or*
- *Submerged head, head underwater or face down; and/or*
- *Motionless for more than 10 seconds.*

Facial Expression and Communication:

- *Eyes closed or glossed over and unfocused;*
- *Hair over forehead or eyes;*
- *Mouth below the surface of the water; or appearance of gasping/fighting for air;*
- *Lack of respiration, cough.*

Body Position and Motor Actions:

- *Head is low in the water, with mouth typically at or below water level;*
- *Head tilted back, nose-up posture;*
- *Change of the body position from horizontal to a more vertical position, sometimes appearing like they are climbing an invisible ladder;*
- *No or very limited leg movement;*
- *Arms pressing down on the surface of the water (either out to sides or in front) trying to push down to lift themselves above the waterline, not performing effective propulsion movements;*
- *For children (with limited aquatic exposure/experience), a vertical or face-up position with uncoordinated kicking and arm movements;*
- *Toddlers can adopt a vertical position, either face up or face down depending on the buoyancy of their body, but do not spontaneously show self-save responses;*
- *Toddlers tend to remain submerged or with the top of the head at surface level.*

Displacement:

- *Lack of movement in any direction other than bobbing up and down at the waterline; or*
- *Trying to swim in a particular direction but not making progress.*
- *Toddlers and children (with limited aquatic exposure/experience) do not attempt to more in a particular direction and displacement is only a result of motor actions in water.*

Discussion and Implications:

Lifeguarding and lifesaving literature have long focused on surveillance and the capacity to recognize the signs of a person in trouble, as this is a critical lifeguarding skill (Fenner et al., 1999;

Pia, 1997). Lifeguards are commonly taught to look for a specific set of behaviors that are considered to show drowning or distress situations, including splashing, frequent submersion, changes in body position, impairment of swimming effectiveness, and a lack of progress through the water, such as what might occur during the IDR (Pia, 1974). However, it is not possible for all individuals in the community to be trained as lifeguards, and therefore it is critical that bystanders are vigilant for behaviors that are earlier signs of distress, for example, a patron moving slowly due to weakness, physical condition, or fatigue, or apparently acting, or moving into the water beyond their skill level (Pascual, 2011).

Despite the limited opportunities to observe and record real drowning situations, findings from this review illustrated consistent behaviors that educators and training organizations can use to assist bystanders in understanding and identifying persons in danger or in need of help in the water. This will ensure the chain of survival is initiated through early identification of people experiencing difficulty in the water. Results from this scoping review indicate that victims show some or all these behaviors in almost all circumstances in which drowning occurs. However, as these behaviors (described in the Results section of this paper) are common, it may make it challenging for bystanders, particularly in crowded, unfamiliar, or challenging conditions, to recognize a person that is drowning. For example, bystanders in aquatic settings are faced with the challenge of dynamic scenes that are constantly changing, as splashing and submersions happen very frequently, and even strong swimmers will slow down or stop eventually.

Whilst the findings from Lanagan-Leitzel (2012) indicated that bystanders were especially good at identifying events where young children were performing dangerous activities, such as repeatedly submerging, horseplay, or going too far from shore, there is a need for untrained bystanders to be further educated on behaviors that characterize distress/drowning across all age groups. Further consideration and investigations are required to determine the most effective and efficient way to educate untrained bystanders across various age ranges. In circumstances where one is concerned about an individual in an aquatic setting, it is recommended that one ask the person "Are you okay?". If there is no response, call for help (alert a trained lifeguard/lifesaver; seek assistance from others etc.) and if in an unsupervised area, follow the recommendations for a safe rescue, remembering that one's personal safety should always be the priority. A quick response, through early identification of a potential distress or drowning incident will minimize the likelihood of an individual experiencing serious injury from the incident (Lanagan-Leitzel, 2012).

Further, whilst many studies have evaluated the quality of adult supervision that children receive when they are in aquatic environments (Petrass et al., 2017) investigations are warranted to determine whether parents responsible for the supervision of young children in aquatic settings have the knowledge and capacity to recognize individuals having trouble in the water. Finally, none of the included studies within this review considered that some victims display no signs, they just submerge. This notion, that drowning persons display no precursory signs adds to the complexity of observation and visual searching particularly for bystanders. Unless the person is observed submerging, it is unlikely that they will be detected and rescued in a timely manner. This is highly important because the longer an individual is submerged, the greater the risk of severe and permanent brain damage or death (Quan et al., 2016).

Limitations

Despite the comprehensive search across databases, some related papers might be missed due to application of English search terms and

including only studies published in English. Additionally, important data might be contained in non-peer-reviewed studies, conference abstracts, dissertations, or unpublished theses which were not considered in this scoping review. We do however believe that this work synthesizes the relevant evidence in the literature and will help guide educators and training organizations with evidence-based behaviors which they can use to assist bystanders in understanding and identifying persons in danger or in need of help in the water.

Conclusions and Recommendations.

Unquestionably, prevention is the first link in the drowning chain of survival. However, if preventative measures fail, early identification and interruption of the drowning process will reduce rescue time and improve the victim's prognosis. Knowledge about the behaviors of a drowning victim have been improving over time, and we now have a reasonably adequate level knowledge to identify the types of behaviors that are characteristic of a person in distress within an aquatic context. However, it remains unknown whether bystanders: (i) are aware of these characteristics, and (ii) can identify and act appropriately if they observe these behaviors.

Based on the evidence available, we can reasonably suggest that bystanders should observe certain behaviors that may indicate that a person is in danger or need of help in the water and activate the recommended sequence of action (drowning chain of survival). Whilst further work is required to understand the most effective way to educate untrained bystanders, we recommend that educators consult the "Drowning" topic covered in the 2020 Guidelines for further reading on recognizing signs of distress (The Global First Aid Reference Centre, 2021).

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Conflict of Interests

No conflicts of interest to be declared.

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