International Journal of Aquatic Research and Education

Volume 14 | Number 3 Article 5

3-29-2024

Lay Rescuer Equipment Preferences and Efficacy During a Simulated Drowning Event

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Recommended Citation

Miller, Alison M.; Ramos, William D.; Anderson, Kristina R.; and Cuvala, Jill (2024) "Lay Rescuer Equipment Preferences and Efficacy During a Simulated Drowning Event," *International Journal of Aquatic Research and Education*: Vol. 14: No. 3, Article 5.
DOI: https://doi.org/10.25035/ijare.14.03.05
Available at: https://scholarworks.bgsu.edu/ijare/vol14/iss3/5

Abstract

During a drowning incident where a lifeguard is not present, a bystander – referred to as a lay rescuer - may put themselves in danger by attempting a rescue. When lay rescuers can avoid entering the water by using rescue equipment to help a drowning victim, it serves to not only help the person actively drowning, but also provides a layer of protection to a lay rescuer. This study sought to examine the following questions: (a) which pieces of rescue equipment were preferred by lay rescuers at pre-determined short and long distances, (b) whether lay rescuers select appropriate rescue equipment based on the condition, (c) whether lay rescuers correctly deploy their preferred rescue equipment, and (d) what factors influence rescue equipment preference. A lab-based experiment was conducted where study participants were asked to react to a simulated drowning victim using six common pieces of rescue equipment provided. The findings suggested that life rings were preferred rescue equipment by lay rescuers and should be provided in unguarded aquatic environments.

Keywords: drowning, lay rescuer, equipment, preference

Background

Drowning claims the lives of 236,000 people per year worldwide (World Health Organization (WHO), 2019). In the United States an estimated 4,000 fatal and 8,000 nonfatal drownings occur annually (Centers for Disease Control (CDC), 2022). Drowning prevention is a complicated issue that involves many factors including barriers, supervision, and lack of water safety awareness (WHO, 2019). Over half of fatal and nonfatal drownings among those 15 years of age and over occur in unguarded bodies of water such as lakes, rivers, or oceans (CDC, 2022). Many aquatic incidents take place without a lifeguard present, as evidenced by a growing area of research examining the behavior of bystanders who become lay rescuers (United States Lifesaving Association (USLA), 2009). A “lay rescuer” is defined as someone who has not been professionally trained in contrast to an individual who has training as a lifeguard or water safety instructor (Dainty, et al., 2022). The lay rescuers responding to submersion incidents are likely to be at an increased risk of drowning due to lack of training and experience, especially when performing in-water rescues (Petrass & Blitvich, 2018; Franklin & Pearn, 2011). This raises questions regarding what can be done to provide the best options for lay rescuers to intervene in a drowning situation while keeping themselves safe.

Rescue Altruism

Lay rescuers may feel inclined to assist a drowning victim due to the result of a phenomenon described as rescue altruism (Pearn & Franklin, 2012). Rescue altruism consists of a Good Samaritan spirit, a perceived duty of-care, a perception

of subjective risk in which the individual believes there is a possibility of success, and personal courage that ignores the risk (Pearn & Franklin, 2012). A water safety poll conducted of 1,024 adults (> 18 years) found almost half (52%) would swim out to help a person who was having trouble in the water (American Red Cross, 2014). A 2017 study found that 29% of participants indicated that they would immediately dive in and rescue a drowning victim (Moran et al., 2017). Lay rescuers often feel compelled to help due to these layers of complicated factors and feelings of personal responsibility. Although shifting these perceptions and beliefs may be challenging, by understanding the perspective of the lay rescuer, we may be able to aid in prevention of injury and fatality.

When a lay rescuer attempts an in-water rescue, they may also, in turn, become the victim which is referred to as "aquatic victim-instead-of-rescuer syndrome" (Mecrow et al., 2014; Franklin & Pearn, 2011). A 2022 study revealed that children reported that they would enter the water if they saw someone in trouble, even after they were instructed not to do so (Anderson et al., 2022). A review conducted in 2021 found four profiles of the lay rescuer: (a) children rescuing children, (b) adults rescuing family members, (c) experts with experience in aquatic rescue, and (d) adults with cultural or professional motivations for rescue (Barcala-Furelos et al., 2021). Understanding who lay rescuers are and their motivations to rescue is an important component to preventing injury. The aquatic victim-instead-of-rescuer and rescue altruism phenomenon can be avoided through noncontact rescuers employing aquatic rescue equipment (Venema et al., 2010; Pearn & Franklin, 2009).

Rescue Equipment

When a lay rescuer attempts to help a drowning victim, they may have access to equipment that could assist in creating a safer rescue scenario. Many water safety programs advocate for standard rescue equipment to be available in spaces such as pools and open water sites (CDC, 2023). Even if the safety equipment is available, a lay rescuer may not possess the knowledge or skills to use it effectively. Furthermore, there are still aquatic spaces, such as open water areas, where aquatic rescue equipment is typically unavailable. Research has shown that, without rescue equipment, even trained lifeguards do not perform effectively and their personal safety is at risk due to the dangers associated with direct person-to-person contact with a drowning victim (Michniewicz, et al., 2008). The use of equipment can reduce the loss of life of both the rescuer and victim (Michniewicz, et al., 2008).

Although several studies were reviewed that retrospectively analyzed lay rescuer death rates, as well as trained lifeguards utilizing rescue equipment, little empirical research exists on the topic of the lay rescuer and their utilization of aquatic rescue equipment (Beale et al., 2019). This study sought to examine the

following objectives: (a) which pieces of rescue equipment were preferred by lay rescuers at pre-determined short and long distances, (b) whether lay rescuers select appropriate rescue equipment based on the condition, (c) whether lay rescuers correctly deploy their preferred rescue equipment, and (d) what factors influence equipment preference.

Method

This pilot study utilized an experimental design where each person participated in the same test scenario, and half of participants were randomly assigned to the near distance, and half to the far distance. Ethics approval was obtained by the Institutional Review Board of Indiana University (11469, June 14, 2021).

Participants

Participants were recruited within a suburban Midwest city and required to complete an on-line questionnaire to determine inclusion eligibility. Those who indicated having previous formal training or education on aquatic rescue involving equipment were excluded from the study to ensure participants fit a lay rescuer profile. Participants were eligible to participate if they had never completed formal lifeguarding training or a citizen-based water safety program involving the use of rescue equipment. Eligible participants were contacted to schedule a time to participate in the experiment for 30 minutes blocks per person. Each participant received a $50 gift card incentive for their participation.

Procedures

During recruitment, prospective participants were informed that the experiment would be in a pool environment and related to water safety; also, they were informed they would not be entering the water at any time. Participants were first greeted in a pre-determined meeting area outside of the pool area for check-in and provided the study information sheet for verbal consent. Participants were then individually ushered into a hallway adjacent to the pool space still without view of available rescue equipment, pool space, or positioning of the simulated victim (Figure 1). Research team members informed participants that they would enter a scene where a simulated active drowning victim in the water needs their assistance. Participants were also informed that even though it’s a simulated emergency, they should treat the victim as a person in immediate danger. The subject's goal was to select and employ equipment to move the subject from a position out in the pool (either a near - 6ft. or far - 20ft distance) to a position of safety on a side wall.

Participants were given the following conditions: (1) never enter the water, (2) pieces of equipment are available from which they can choose to support a rescue, and (3) they should continue using their chosen piece of equipment, or try different pieces of equipment, until the victim is brought to a position of safety

(pool wall) or until they felt they could not complete the rescue attempt. Finally, participants were asked to verbally indicate to the research team when they felt they were done with the attempted rescue. Participants were video recorded for reliability checking and analyses related to time-to-complete-task.

Available rescue equipment included: (a) life ring with attached rope (RB/LR), (b) shepherd's crooks (2 types: firm and smooth hook ends), (c) throw bag, (d) rescue tube, and (e) reaching pole. Figure 1 provides a visual representation of the available equipment. Notably, two trained lifeguards were on deck to monitor the protocol for safety. The simulated drowning victim was also an experienced swimmer (either a college swim club subject or certified Water Safety Instructor®).

Figure 1

Rescue Equipment

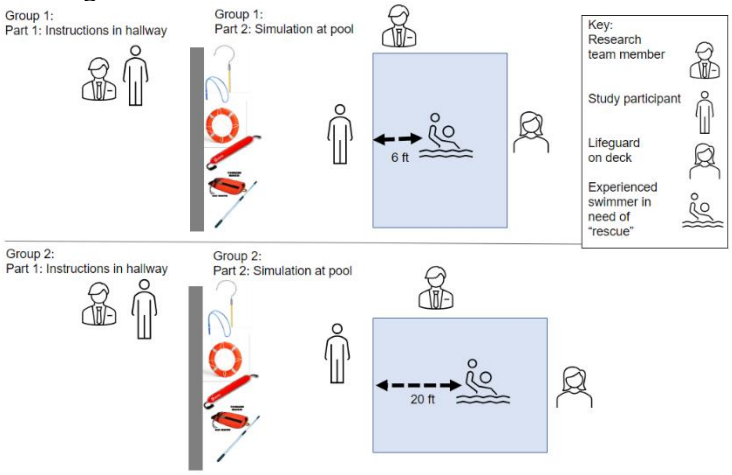
Shepherd's crook (firm)	Shepherd's crook (smooth)	Life Ring	Rescue tube	Throw bag	Reaching pole
					

Data Collection

The following data were collected via video recording during the experiment: (a) the primary equipment choice (and second, third, etc., if applicable); (b) whether the first piece of equipment reached the victim; and (c) whether the rescue equipment was used correctly/appropriately for the scenario. In addition, time from space entry to equipment grab and the time from victim touch to victim grasp side of pool were also collected via video recording for accuracy. Figure 2 represents a diagram of the study site layout. After the in-water scenario was completed, participants were asked to complete a questionnaire to gain further insight into their decision-making process regarding equipment use. The questionnaire aimed to inform the following: (a) why they chose the utilized piece of equipment, (b) what would have been their second choice, (c) what would have been their last choice, and (e) whether there are non-standard pieces of equipment they identify as being useful in a rescue scenario. Questionnaire responses were reviewed by the research team, and relevant information gleaned was used to provide context to the lab-based portion of the study.

Figure 2

Simulation Diagram



Results

Subject Demographics

The majority of participants were 18-22 years old (74%), white (60%), and female (68%) (Table 1).

Table 1

Participant Demographics

Age	
18-22	37 (74%)
23-33	7 (14%)
35-60	6 (12%)
Total	50 (100%)
Race and Ethnicity	
White	29 (60%)
Nonwhite	21 (40%)
Total	50 (100%)
Gender	
Female	34 (68%)
Male	15 (30%)
Nonbinary	1 (2%)
Total	50 (100%)

Equipment Choices

For near attempts (n=27), the equipment choice most frequently selected first was the life ring (n=12, 44%), followed by the rescue tube (n=8, 30%). For far attempts (n=23) the equipment choice most frequently selected first was the life ring (n=19, 83%), followed by the shepherd's crook smooth (n=3, 13%) (Table 2). The throw bag was never selected as a first choice. At long distances the first equipment choice reached the victim 70% (n=16) of the time and 89% (n=24) of the time at near distances. The overall number of rescue attempts ranged from one to eight (Table 3). The majority of participants exposed to the near rescue distance made one attempt, and most participants exposed to the far rescue distance used two attempts (Table 3). The majority of rescues were considered successful 94% (n=47). Attempts were coded as successful if the participant was able to move the simulated drowning victim from the middle of the pool to a place of safety (Table 4). Equipment selection was coded as appropriate based on the distance of near or far and the likelihood of the equipment selected being able to reach the victim.

Table 2

First Equipment Choice

	Overall	Near	Far
Life ring	31 (62%)	12 (44%)	19 (83%)
Rescue Tube	9 (18%)	8 (30%)	1 (4.3%)
Shepherd's Crook Smooth	5 (10%)	3 (11%)	3 (13%)
Shepherd's Crook Firm	3 (6%)	2 (7.4%)	0 (0%)
Reaching Pole	2 (4%)	2 (7.4%)	0 (0%)
Throw Bag	0 (0%)	0 (0%)	0 (0%)
Total	50	27	23

Table 3
Overall Number of Rescue Attempts

Number of Attempts	Near	Far	Total
1	20	3	23
2	2	9	11
3	4	4	8
4	0	2	2
5	0	3	3
6	1	0	1
7	0	1	1
8	0	1	1
Total	27	23	50

Table 4
Rescue Success

	Yes	No	Total
Appropriate Equipment Selected	43 (86%)	7 (14%)	50
Successful Rescue	47 (94%)	3 (6%)	50
Did First Equipment Choice Reach the Victim	40 (80%)	10 (20%)	50

Time

On average, the time from equipment grab to victim touch was 19 seconds for near distance, with a range of 4-57 seconds. From victim touch to victim grasp side of the pool (i.e., position of safety) the average time for near distance was 12 seconds, with a range of 3-32 seconds (Table 5). For the far distance, the average time from equipment grab to victim touch was 52.48 seconds, with a range of 7-187 seconds. From victim touch to victim grasp side of the pool, the average time for the far distance was 20 seconds with a range of 5-48 seconds. The results indicated a significant difference between near and far distances for time from equipment grab to victim touch ($z=-4.139$, $p<.001$, $U=98.5$) and time from victim touch to victim grasp side of pool ($z=-4.224$, $p<.001$, $U=87.5$). The time for both time variables was significantly greater for far distances than for the near distance. A one-way ANOVA revealed that a statistically significant difference existed between near and far attempts when comparing the number of attempts completed ($F(1,48) = 12.653$, $p<.001$) (Table 3).

Table 5
Time Measurement for Rescue Attempts

		Minimum	Maximum	Mean	SD
Far	Time from equipment grab to victim touch (seconds)	7	187	52.48	52.61
	Time from victim touch to victim grasp side of pool (seconds)	5	48	20	13.38
Near	Time from equipment grab to victim touch (seconds)	4	57	13.96	15.53
	Time from victim touch to victim grasp side of pool (seconds)	3	32	8.22	5.52

Discussion

Rescue Equipment

The life ring was used the majority of the time for both near and far attempts. The reason for this outcome was reiterated in the post-experiment survey responses where participants indicated they had seen this piece of rescue equipment on television. Their previous exposure to the life ring bolstered their confidence in choosing this piece of equipment. The following are responses to the post-experiment survey indicating why the life ring was the first choice.

> "Life ring-looked most familiar, what you see in the movies."
> "Life ring: most identifiable. Familiar with it from movies and pool-related things."

This could provide potential evidence that the life ring is the most recognizable and easiest to use piece of equipment for lay rescuers to use in a real-world rescue attempt.

Having rescue devices such as life rings at non-guarded aquatic facilities or open water locations could potentially aid bystanders in assisting drowning victims without the bystander having to enter the water. The 2023 Model Aquatic Health Code (MAHC) housed within the Centers for Disease Control and Prevention (CDC) provides standard guidelines which state the following:

> 5.8.5.4 Safety Equipment and Signage Required at Facilities without Lifeguards5.8.5.4.1AThrowing Device AQUATIC VENUES whose depth

> exceeds 2 feet (61.0 cm) of standing water shall provide and maintain a U.S. Coast Guard-approved aquatic rescue throwing device, with at least a quarter-inch (6.3 mm) thick rope whose length is 50 feet (15.2 m) or 1.5 times the width of the POOL, whichever is less.5.8.5.4.1.1Throwing Device Location The rescue throwing device shall be located in the immediate vicinity to the AQUATIC VENUE and be accessible to BATHERS. 5.8.5.4.2AReaching Pole AQUATIC VENUES whose depth exceeds 2 feet (61 cm) of standing water shall provide and maintain a reaching pole of 12 foot (3.7 m) to 16 foot (4.9 m) in length, non-telescopic, light in weight, and with a securely attached Shepherd's Crook with an aperture of at least 18 inches (45.7 cm). (CDC, 2023)

Within these guidelines the use of a throwing device is mentioned in general without identifying any specific device. Results from our research, however, indicate that when given an option between several throwing devices including a life ring, throw bag, and rescue tube, the clear preference was for the life ring. We suggest that the Council for the Model Aquatic Health Code (CMAHC) might consider verbiage that's more specific to include life rings.

In the drowning chain of survival, the first step is to ask someone to call for help, and the second is to provide a flotation device to the victim (Moran et al., 2017). These devices are unfortunately not always available at the scene of a drowning incident (Szpilman et al., 2014). Research from Canada revealed that 78% of water rescues were performed by lay rescuers (Royal Life Saving Society Canada, 2004). From 2005 to 2009 in the U.S., five times more drowning fatalities were reported at unguarded sites compared with guarded sites (103 vs. 17) for drowning fatalities per annum, respectively (USLA, 2009). Although rescue equipment cannot take the place of a lifeguard, it has the capacity to provide some level of safety for both potential drowning victims and the bystanders who aid them.

Time

Observational studies of victims at beaches suggest that non-swimming adults out of their depth in water are generally unable to struggle on the surface for more than one minute, whereas infants and young children can submerge in as little as 20 seconds (Pia, 1974). In this current study, the average time to deploy the rescue equipment to the drowning victim was 52.48 seconds for far distances and 13.96 seconds for near distances. This indicates that lay rescuers were able to deploy rescue equipment to the adult victim in less than one minute for both near and far distances. This was, however, a controlled environment where the victim was clearly identified, and the rescue equipment was readily available.

Limitations

This study tested participant equipment preferences by providing six equipment choices to participants to select from when performing a rescue to the simulated drowning victim at near and far distances. Having this pre-determined choice could have impacted the amount of time the lay rescuer took to rescue the victim. A future study could test each of the pieces of equipment separately rather than having all available for the subject to choose from. By removing the element of choice, the success of each piece of equipment when deployed in a rescue could be more clearly measured.

Conclusion

Drowning prevention efforts are complex and require comprehensive approaches. Research around lay rescuer behavior in drowning situations is vital in order to prevent fatal drowning incidents. It is unrealistic to assume that lay rescuers will simply stop rescuing drowning victims, since rescue altruism and the desire to save another human being's life overrides this strategy. Instead, efforts should be focused on providing everyone with the knowledge and tools, when appropriate, they need to help a drowning victim without entering the water.

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