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Eyes Save Lives Water Safety Program for Parents and Caregivers: Program Design and Pilot Evaluation from Southern California

Rachel Love-Smith
University of California – Irvine, Irvine, USA

William A. Koon
University of New South Wales, Sydney, Australia; Hoag Memorial Hospital Presbyterian, Newport Beach, USA, w.koon@unsw.edu.au

Lauren Tabios
Hoag Memorial Hospital Presbyterian, Newport Beach, USA

Scott M. Bartell
University of California – Irvine, Irvine, USA

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Eyes Save Lives Water Safety Program for Parents and Caregivers: Program Design and Pilot Evaluation from Southern California

Cover Page Footnote

The authors acknowledge Lawyane Ponzio, RN for her role in developing the Eyes Save Lives program. We also thank Corey Hilderbrand, City of Irvine Aquatics Supervisor, and Brian Cordeiro, Newport Beach Recreation Supervisor, for their role in facilitating delivery of the program during their city's swim lesson sessions.

Abstract

Despite expert consensus and evidence-based preventative strategies against drowning, limited formal study exists on translating recommendations into practical and effective interventions. This paper describes the design of an education-based drowning prevention intervention and reports results from a pilot evaluation of the program's effect on self-reported water-safe behaviors, attitudes, self-efficacy, and knowledge. Parents and caregivers attending children's swim lessons in July and August 2018 participated in a brief water-safety education program. A pre-post-test design evaluated "Theory of Planned Behavior" indicators to assess for changes. We found significant increases in scores related to water safety knowledge, attitudes on maintaining arms reach distance to children in the pool, recognizing a child in distress, and self-efficacy of responding to water emergencies involving a child between pre- and post-program. Swim lessons provided a captive audience receptive to drowning prevention information. Due to minimal costs, the program could easily be replicated and delivered to a variety of parent groups.

Keywords: drowning, injury prevention, swimming, health education, program evaluation, health theory, water safety education

Background

Drowning is an underappreciated health threat: an estimated 372,000 drowning deaths occur annually worldwide, although the true number is likely higher (WHO, 2014). In the United States, drowning causes approximately 3,500 deaths annually and is the leading cause of unintentional injury-related death in children ages 1-4 (WISQARS, 2019). Additionally, the burden of non-fatal drowning has only recently become a focus of drowning researchers and is not well understood. According to CDC injury data, for every child who dies from drowning, another five visit emergency departments for non-fatal submersion events (WISQARS, 2019).

Drowning is of particular concern in California: 444 people died from drowning in 2017, and between 2008 and 2014 there was an average of 1,213 emergency department visits and 463 hospitalizations per year, statewide, for non-fatal submersion (Epi Center California Injury Data Online, 2019). Orange County, in Southern California, documented 101 drowning cases in 2017, 43 fatal and 58 non-fatal, 64% of which occurred in a pool or spa (OCFA, 2017).

The World Health Organization (WHO) has released high level guidelines on evidence-based interventions and strategies to prevent drowning (WHO, 2017). For example, installing barriers around swimming pools (Thompson & Rivara, 1998), promoting and legislating lifejacket use (Bugeja et al., 2014; Cummings et

al., 2011), and teaching school-aged children to swim (Brenner et al., 2009) have been proposed. Other interventions and community-based programs to prevent drowning are common, but evidence for these program's effectiveness is limited, and few programs use behavior theory frameworks or formative evaluation (Leavy et al., 2016; Wallis et al., 2015).

The aim of this study and paper was to evaluate the efficacy of a brief, educational drowning prevention program to increase self-reported water-safe behaviors, attitudes, self-efficacy, and knowledge in parents and caregivers attending children's swim lessons in Irvine and Newport Beach, California. In addition, this study sought to assess the relationship among cognitive indicators (i.e., attitude, subjective norm, self-efficacy, knowledge) and self-reported water safety related behaviors.

Method and Materials

Emergency department nurses and community health educators developed the *Eyes Save Lives* water safety program as a brief, 12-15-minute, informational presentation relying on Social Cognitive Theory and Health Belief Model constructs as well as the 2014 Drowning Chain of Survival (Bandura, 1998; Jones et al., 2015; Szpilman et al., 2014). Six drowning prevention experts assessed initial drafts for content and suggested modifications. The revised presentation underwent four pilot sessions resulting in the development of a script for presenters versus a list of talking points and inclusion of new educational packet material, specifically, an article discussing fears and misinformation on "Dry Drowning" (Hawkins et al., 2017). We included other education resources on skin cancer prevention, beach safety, pool safety, a home water safety checklist, and information on pool barriers. The final presentation included large, printed poster-style slides with images on one side and presenters' script on the reverse. Final presentation components with their theoretical constructs are listed in Table One. The 2018 version of *Eyes Save Lives* can be downloaded **here** (using MS PowerPoint).

Table 1

Eyes Save Lives presentation components and theoretical constructs

Slide	Title	Principal Activities and Learning Points	Theory Constructs
1	Eyes Save Lives: Watch me in the water!	• Drowning can happen quickly and quietly	• Risk susceptibility
2	What is Drowning?	• Drowning definition and outcomes	• Risk severity

		• Discuss terminology and when someone needs to seek medical care	
3	Drowning Statistics: National	• National drowning statistics (WISQARS, 2019)	• Risk susceptibility
4	Drowning Statistics: Local (2017)	• Local drowning statistics (OCFA, 2017)	• Risk susceptibility
5	Local Drowning Prevention Efforts	• Local water safety laws and advocacy groups	• Barrier to action
6	What can you do?	• Drowning chain of survival (Szpilman et al., 2014)	• Self-efficacy
7	Prevention: Active Adult Supervision	• Define "distraction free" (Denny et al., 2019; Denny et al., 2021) • Handout Water Watcher Tags • Encourage maintaining an "arm's reach distance" of young children in the pool (Denny et al., 2019; Denny, et al., 2021)	• Behavioral capacity • Self-control • Cue to action
8	Prevention: Fencing	• Handout: "Safety Barrier Guidelines for Residential Pools" • Describe effective pool barriers (Thompson & Rivara, 1998) • Encourage awareness of friends/relatives pools that children visit	• Behavioral capacity • Benefit to action • Expectancies
9	Prevention: Life jackets	• Promote life jackets use in boats and while swimming in open water or pools (Quan et al., 2018) • Describe and demonstrate U.S. Coast Guard approved life jackets vs. non-approved swim vests and floats • Review and demonstrate proper lifejacket fit	• Behavioral capacity • Observational learning

10	Prevention: Swim Lessons	• Swim lessons are important but do not "drown-proof" children (Brenner et al., 2009) • Locations and scholarships • Adult swim lessons available	• Behavioral capacity • Expectancies
11	Recognize and Remove	• Signs of distress: sniffing position, climbing the ladder, hair in the face (American Red Cross, 2016; USLA, 2017) • Personal safety awareness (Franklin & Pearn, 2011)	• Behavioral capacity • Self-efficacy
12	Provide Care Until Help Arrives	• Encourage age-appropriate CPR course • CPR rescue statistics (Tobin et al., 2017) • Describe Importance of ventilations in drowning resuscitation (Truhlář et al., 2015)	• Behavioral capacity • Self-efficacy • Expectancies
13	Thank You	• Encourage participants review and complete the "Water Safety Checklist"	• Self-efficacy • Cue to action

Participants

During July and August 2018, researchers from the Department of Population Health and Disease Prevention at the University of California, Irvine and the Community Health Department at Hoag Memorial Hospital Presbyterian in Newport Beach conducted a pre-post pilot evaluation to assess the *Eyes Save Lives* water safety program for parents and caregivers. Adults attending children's swim lessons in the cities of Irvine and Newport Beach, California participated. We included all participants who were 18 years of age and older, spoke English, and completed both a written consent form, and the pre-program survey.

At the beginning of children's swim lesson sessions, health educators verbally recruited participants by advertising a "short water safety presentation" providing start and finish times for each presentation. Upon arrival, individuals received pre-prepared packets containing a consent form, one-page pre-program survey, and water safety educational resources. Consented participants completed and returned pre-program surveys prior to presentation start time. Approximately three weeks after the program, participants received a post-program survey via

email. Individuals who did not complete the survey were sent weekly reminder emails for up to five weeks.

Researchers obtained administrative support from the aquatics directors in both cities to conduct the program and subsequent evaluation; the University of California Irvine's Institutional Review Board approved this research (HS#2018-4329).

Outcome measures were used to (i) assess changes between pre- and post-program responses and (ii) model the relationship between cognitive indicators and behavioral outcomes reported on the post-program survey. We crafted outcome measures using Theory of Planned Behavior constructs: attitude, subjective norms, perceived behavioral control (self-efficacy), and actual behavior (Ajzen, 1991). We included water safety knowledge as an additional construct. We assumed that parents generally have the intention of keeping their children safe and/or would overestimate those intentions, and thus excluded questions on behavioral intention. Directly observing actual water safety behavior was not feasible for our study so we used participants' self-reported behavior. A 7-point Likert-scale was used for all cognitive indicators, behavioral assessment, and select process evaluation questions.

Pre-program survey sections included: contact information, number and age of children, amount of pool exposure, cognitive indicators, water-safe behaviors, and an open-ended question on the signs of distress in the water. All cognitive indicator questions in the pre-program survey were linked in the post-program survey. To assess drowning prevention knowledge, participants were asked: (i) where most drowning events occur, (ii) where drowning ranks in cause of death among children ages 1 to 4, (iii) number of drowning prevention safety features legally required for residential pools in California, and (iv) the most effective CPR technique for drowning victims. Additional cognitive indicator questions measured self-efficacy, "I know what do to in a water emergency involving children" and attitudes "I need to be in the water or within arm's reach when supervising young children in the pool", "I need to maintain constant visual contact when supervising children in the pool", "Non-swimmers who are in the pool should use U.S. Coast Guard approved lifejackets." Lastly, participants were asked to select a response on the 7-point Likert-scale for the statement, "While supervising children in the pool, I use a cell-phone, talk, or use alcohol."

Post-program survey sections included: demographic information, cognitive indicators, water-safe behaviors, exposure, and process evaluation. Each cognitive indicator (i.e., knowledge, social norm, attitude, and self-efficacy) as well as self-reported behavior had 3-5 Likert-type items. We included exposure

questions such as: “Do you have a pool?” “During an office visit, has a pediatrician or nurse ever talked to you about drowning prevention?” and “Do you know how to swim?” Individuals with a residential pool were further questioned on their drowning prevention safety features. The post-program survey also had an open-ended question on the signs of distress in the water. Qualitative data were also collected for process evaluation related questions such as program strengths and weaknesses and concepts participants felt important to share with peers.

We used descriptive statistics (i.e., mean, standard deviation) to summarize data on demographics, exposures of interest, and qualitative data collected in post-test process evaluation. We used an independent-samples t-test to evaluate if pre-program composite knowledge scores differed between the unmatched subset of participants who completed only the pre-program survey and the matched subset of individuals who completed both pre- and post-program surveys.

We used matched-pairs t-tests to (i) compare linked pre-post questions on cognitive indicators and self-reported behavior item-by-item, and (ii) assess for changes in participant composite knowledge score from pre- to post-program.

Participants were asked to describe what a drowning person looks like on both pre- and post-program surveys. We classified open-ended answers into eight response-generated categories: erratic, quiet, sinking, breathing issues, vertical position (climbing the ladder), sniffing position (nose up out of the water), and hair in the face. We recorded each category as a dichotomous variable with two mutually exclusive groups: included or not included in participant response. We used McNemar’s exact test to determine if a significant difference in the proportion of participants mentioning each of the eight categories existed between pre- and post-program.

To investigate the relationship between predictive, cognitive indicators and dependent, self-reported behavioral outcomes, we used multiple linear regression with fixed effects terms for attitude, self-efficacy, social norm, and knowledge as predictors of behavior. Each term, excluding knowledge, had 3-5 Likert-type items combined into a single composite score for analysis. We performed all analyses in R Studio (R Core Team, 2019).

Results

The program was delivered to an estimated 443 parents via 59 presentations at three locations. We collected 172 pre-program surveys (additional parents frequently joined the presentation after initiation and thus had not completed pre-program surveys), of which 26 had incomplete contact information and 18 had rejected or unreadable handwritten email addresses. Of the remaining 128 participants

contacted via email, 44 (34%) completed the post-program survey. Primary characteristics of the matched sample population (n=44) included: female (82%); White (46%) or Asian (36%); 35-49 years old (73%); obtained a college degree or higher (86%); and had an annual household income over $100,000 (66%).

We compared pre-program knowledge scores between the matched (n=42) and unmatched (n=112) subsets of participants who answered all four knowledge questions. We found no significant difference between matched (M = 2.78, SD = 0.82) and unmatched (M = 2.63, SD = 0.85) pre-program knowledge scores; t (73.4) = 1.03, p=0.31). We found a significant increase between participants' pre and post composite knowledge scores (pre-program M = 1.95, SD = 0.61; post-program M = 2.25, SD = 0.61; t (40) = 0.13, p = 0.012.).

We evaluated change in participants' Likert-score of linked cognitive indicator questions pre- and post-program (Table 2). We found a significant increase in attitude score on the importance of being within arm's reach of a child in the water as well as reported confidence in responding to an emergency situation in the water. Participants reported a statistically insignificant change in distracted supervision after the presentation.

Post-program responses indicated participants began to rethink signs of distress in the water. Within our matched subset (n=44) we were able to analyze 29 matched pair responses; 16 respondents in the pre-program survey and one respondent from the post-test did not respond to the open-ended question. Compared to pre-program, participant's post-program responses less frequently mentioned erratic behaviors such as panicking, flailing, splashing, and screaming; and signs of obvious submersion such as sinking and bobbing up and down. McNemar's exact test identified evidence of a statistically significant difference in the proportion of participants who mentioned respective categories pre- and post-program (Table 3). Similarly, post-program respondents more frequently recalled the three signs of distress from the presentation: vertical position/ climbing the ladder), sniffing position, and hair in the face. McNemar's exact test again confirmed a significant shift in proportion of respondents mentioning the presentation's signs of distress.

Table 2

Dependent-samples t-test comparison of directly linked cognitive indicator questions on pre- and post-program survey in matched sample group (n=44)

	Pre	**Post**	**Change, pre to post**		
	M(SD)	***M(SD)***	**Mean Diff.**	**β(95% CI)**	**p**
While supervising children in the pool, I use a cell phone, talk, or use alcohol.	5.95 (1.55)	5.52 (1.50)	-0.476	(-0.97, ∞)	0.9426
I need to be in the water or within arm's reach when supervising young children in the pool.	6.04 (1.37)	6.82 (0.45)	0.762	(0.38, ∞)	< 0.001*
Non-swimmers who are in the pool should use a U.S. Coast Guard approved life jacket.	6.21 (1.55)	6.43 (1.25)	0.19	(-0.31, ∞)	0.2642
I know what to do in a water emergency involving young children.	4.10 (1.48)	5.66 (1.12)	1.52	(1.06, ∞)	< 0.0001*
I need to maintain constant visual contact while supervising children in the pool.	6.79 (0.95)	6.93 (0.95)	0.14	(-0.12, ∞)	0.186

Notes. Likert-scale response for first question listed is (1 - Always ; 7 - Never) all questions thereafter are (1 - Strongly Disagree; 7 - Strongly Agree). *M* and *SD* are used to represent mean and standard deviation, respectively. * indicates $p < 0.05$.

Multiple linear regression analysis was used to test if selected cognitive indicators significantly predicted participants' reported water-safe behaviors. Social norm was a significant predictor of water-safe behaviors while controlling for other cognitive indicators (β=0.44, p=0.003). Knowledge, attitude, and self-efficacy were not statistically significant predictors (β=0.27, p=0.08; β=0.21, p=0.18; and β=0.01, p=0.95; respectively). Overall the model explained 35.4% of the variance in participants' water-safe behaviors (F(4,37) = 5.07, p = 0.002, adj-R^2=0.28).

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Table 3

McNemar's exact test to assess for a significant difference in the proportion of participants mentioning each of the eight water distress categories pre- and post-program (n=29)

Variable Category	**Description of responses**	**% of Pre-test response***	**% of Post-test responses***	**b**	**c**	**p**
Erratic	Panicked, flailing, splashing, screaming	62.07	13.79	15	1	< 0.001*
Quiet	Silently slip underwater, no signs	37.93	17.24	7	1	0.070
Sinking	Submerged, underwater, bobbing	62.07	27.58	14	4	0.031*
Breathing	Choking, sputtering, coughing	3.45	10.35	1	3	0.625
Vertical	Vertical position, climbing the ladder	13.79	44.89	1	10	0.012*
Sniffing	Sniffing position, nose or face up, head back	3.45	31.03	0	8	0.008*
Hair	Hair over the forehead in the face, hair covering eyes	0.000	51.72	0	15	< 0.0001*

Notes. Proportions may not add to 100 as some participants wrote multiple descriptions down which were classified into more than one category. * indicates $p < 0.05$

The *Eyes Save Lives* program was well received by participants. The mean composite process evaluation score, comprised of the sum of three Likert-type items related to presentation material, speaker delivery, and program relevance and usefulness, was 20.16 (SD = 1.68) out of 21 possible points.

When asked what advice they would share with another parent who did not attend the program, the majority (63%) noted distraction-free supervision, many commenting specifically on cell-phone use and socializing. Parents also mentioned using "Water Watcher Tags" to help implement "rotating supervisory duty" or having active adults "always on guard" and "in charge of watching the kids" without distraction. Other advice included children's usage of U.S. Coast Guard approved floatation devices while in the pool (13%), that drowning can occur quickly and silently (4%), and the necessity of CPR training (4%).

When asked about the weakest aspect of the program and how we could improve, parents would have liked to see CPR demonstrations or a place to sign-up for CPR lessons after the presentation. Additional suggestions included addition of more real-life stories for emotional impact, a setting with less distraction, and that the presentation felt rushed. Some participants also felt presentation attendance was negligible and swim lesson programs should "require parents to join [the] presentation" in order to "reach as many people as possible". One parent stated: "I think these kinds of reminders need to happen more often (more than once a year)".

Discussion

Literature on utilization of behavior theory framework and program evaluation in drowning prevention and water safety interventions is limited. As a result, a lack of evidence exists on the design, content, and efficacy of educational programs intended to influence behavioral change related to water safety. This pilot evaluation provides preliminary evidence that short, water safety information sessions with parents may change the drivers of behavior that might ultimately save a child's life.

In univariate analyses, we found evidence of statistically significant increases in participant water safety knowledge, attitudes that support adults being within arms-reach of young children in the water, and self-reported confidence to act in a drowning emergency. These results, while limited, indicated this program has potential to influence cognitive indicators of a parent's water safety intentions and behaviors.

Interestingly, evidence of increased attitude score related to maintaining constant visual contact while supervising children in the pool, a main component of the program, was statistically insignificant. In free text post-program responses

however, participants heavily emphasized supervision and watching children in the pool as major learning points from the program. The insignificant result may be due to lack of variance and small sample size, or participant confusion, as the question did not specify an age group to be constantly supervised. Regardless, recent American Academy of Pediatrics recommendations specify even older children and better swimmers require constant focused supervision, a subject to be highlighted in future renditions of this program (Denny et al., 2019; Denny et al. 2021).

Additionally, these data indicated a surprising although statistically insignificant increase in self-reported parent distraction while supervising children in pools. This seemingly counterintuitive result may potentially be related to improved knowledge of what distraction-free supervision entails, and increased awareness of ones' distracting behaviors. It is plausible participants indicated low levels of distraction on their pre-program survey, but after learning that activities such as socializing, eating, drinking, texting, social media, other cell phone use, and reading all reduce vigilance, reported more accurate levels of distraction in post-program survey responses. Although the result was not statistically significant, this peculiar element of the pilot evaluation underscored the need for water safety programs to include specific, defining information on distracting behaviors when discussing adult supervision.

Participants' descriptions of a person in distress in the water, an important component of the Drowning Chain of Survival, shifted from pre- and post-program responses. The program emphasized that drowning happens quickly and silently, contrary to popular depiction in movies and television. The proportion of participants reporting erratic behaviors (i.e. panic, flailing, splashing, and screaming) dropped significantly from pre- to post- program surveys. The three signs of distress described in the presentation resonated with participants and as a result gained significantly higher reporting proportion in the post-program survey.

The use of behavior theory frameworks was helpful in designing and organizing program material and content, and evidence from a multivariable analysis indicated responses to questions on knowledge, self-efficacy, attitude, and social norms had some role in explaining variance in self-reported water safety behavior. While statistically significant, this multivariable model only explained 35% of self-reported behavior variance, indicating some another factor or a combination of factors weighed heavily in this process. That this model did not explain more variance in self-reported water safety behavior was not surprising; this pilot evaluation had a small sample size and there are a myriad of personal, cultural, socio-economic, environmental, and water safety behavior is influenced by other external factors. In any case, this initial result should encourage other water

safety practitioners to utilize health behavior theory and frameworks when designing programs and evaluation tools.

While participants were generally satisfied with the program and considered distraction-free supervision crucial advice they would share with other parents, notable recommendations included providing CPR signup information and/or demonstration and requiring parent/guardian participation in the program as part of their child's swim lesson instruction.

Further, more robust evaluation is needed of water safety educational interventions. Nevertheless, these findings suggested that a short, educational program could move the needle, even if slightly, in parent's knowledge, attitudes, self-efficacy, and perceptions of drowning.

Limitations

The main limitations in this study included the lack of a control group, substantial loss to follow up and self-reported data subject to social desirability bias. Volunteer bias was also present throughout the study from initial recruitment to follow-up—of the 443 parents who viewed the presentation, only 176 completed a pre-program survey, and the post-program response rate was 34%. The results from our analysis of pre-post program surveys may not be generalizable to the larger group, as there may be selection effects. More valid and reliable data analysis could have been achieved by ensuring that both pre- and post-program surveys had 3-5 Likert-type items in each area to combine into a single composite score. Instead, we used item-by-item comparison of linked questions.

Additionally, this study took place in middle to high income locations, which limited generalizability to other socio-demographic populations. It is unclear whether or not this program would evoke similar change in behavior drivers for other racial groups, lower income communities, and parents who do not speak English as a first language.

Finally, we cannot assume that the favorable increases in reported cognitive indicators were due solely to our program. Although unlikely, it is possible that participants received water-safety information from other sources in the short time period between our pre- and post-program surveys.

Conclusion

This pilot evaluation indicated that changes in attitude and knowledge related to water safety practices were possible with short drowning prevention education presentations for parents and caregivers. Due to minimal cost, feasible implementation in a variety of settings, and relatively simple logistical

requirements, this program could easily be replicated, customized, and delivered to a variety of parent groups.

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