International Journal of Aquatic Research and Education

Volume 11 | Number 3 Article 4

2-16-2019

Can You Float? Part 2 - Perceptions and Practice of Lifejacket Use Among Young Adults

Kevin Moran Ph.D.
The University of Auckland, k.moran@auckland.ac.nz

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Cover Page Footnote
Acknowledgments My thanks to the undergraduate students of physical education who took part in the study with unflagging enthusiasm and professional commitment. Your contribution to drowning prevention and the critical input of water safety education to our charges is much appreciated.

Abstract

Personal flotation devices (PFDs), commonly referred to as lifejackets, have been identified as an extremely effective form of drowning prevention and was identified as a critical distinct water competency by Stallman and colleagues (2017). In this second phase of the *Can You Float?* study, perceptions and practice of a range of lifejacket tasks among students (*N* = 40) with known water proficiency were examined. Participants estimated exertion levels before and after practical testing of six simulated survival tasks when wearing lifejackets. All participants completed a 25m sprint swim, 5-minute endurance swim, 5-minute float, and 25m partner assist but many failed to complete a 15m underwater swim (63%) and deep water exit (63%). Students underestimated the level of exertion required to complete the underwater swim and deep water exit. Reasons for, and implications of, this underestimation are discussed and recommendations for the teaching of lifejacket competency in water safety programs are made.

Keywords: drowning prevention, water safety, lifejackets, personal flotation devices (PFD), water competency, real and perceived competency

Introduction

In the second phase of the *Can You Float?* study, the focus of inquiry shifts from unassisted to assisted flotation via the use of personal flotation devices (PFDs), more commonly referred to as lifejackets or buoyancy aids (Cassel & Newstead, 2015). It has been widely reported that increased lifejacket wear would have a dramatic effect on reducing the number of drowning-related deaths each year (for example, the WHO Global Report on Drowning, 2014; International Lifesaving Federation [ILS], 2015). In 2015, the U.S. Coast Guard reported that 76% of the 626 recorded boating-related fatalities were caused by drowning and 85% of the victims were not wearing life jackets (U.S. Coast Guard, 2015). A recent U.K. study of rescue data reported increased lifejacket wear was shown to be significantly correlated with lower fatality rates across all marine and coastal activities with survivability among those casualties wearing life jackets estimated at 94% (Pitman, Wright, & Hocken, 2018). In New Zealand, retrospective analysis of drowning data showed that in fatal boating incidents where it was known if a lifejacket was worn, three quarters (76%) of the victims did not wear a lifejacket (Water Safety New Zealand, 2012).

While most studies have reported on lifejacket use among watercraft users (for example, Cummings, Mueller, & Quan, 2011; Howland, Hingson, Mangione, Bell, & Bak, 1996; Mangione, Chow, 2014; Mangione, Chow, & Nguyen, 2012; Pointer, Milligan, Garratt, Clark, & Tipton, 2018; Quistberg, Bennett, Quan, & Ebel, 2014; Quistberg, Quan, Ebel, Bennett, & Mueller, 2014), some studies of other lifejacket activities in open water locations have been reported. An early study on the promotion of lifejacket use reported increased use and ownership of lifejackets among children and adolescents in King County, Washington State (Bennett, Cummings, Quan, & Lewis, 1999). A more recent study from the same region has proposed the use of lifejackets for swimming or playing in or near the water for young and poor swimmers (Quan, Mangione, Bennett & Chow, 2017). A New Zealand study of land-based rock fishers at a high-risk surf coastline reported a gradual increase in lifejacket use over a 10-year period of a rock-based fisher safety promotion (Moran, 2017).

Several studies have investigated the positive effects of mandatory lifejacket use via legislation (for example, in Australia, Bugeja, Cassell, Brodie, & Walters, 2014; Cassell & Newstead, 2015; in the U.S., Chung, Quan, Bennett, Kernic, & Ebel, 2014; Mangione & Chow, 2014). The study by Mangione and Chow (2014) compared the impact of mandatory regulation versus educational intervention and found that both approaches showed increased lifejacket use among adults. For a comprehensive review of the personal, social, and environmental factors associated with lifejacket use, a systematic literature review by Peden and colleagues relating to the factors associated with both increased and decreased lifejacket use in adults and children is recommended reading (Peden, Demant, Hagger & Hamilton, 2018).

Despite the increasingly-reported value of lifejacket use in, on, or around water, little is known about what educational experience and training informs people’s decision-making with regards to the use of buoyancy aids. Historically, buoyancy aids were considered a hindrance to the acquisition of swimming and flotation competency and were excluded from many swimming and water safety programs (Quan, 2014). Given the accumulation of evidence in favour of their use, it is not surprising that many water safety organisations now include information and instruction on lifejacket use in their teaching manuals and instructional programs (for example, American Red Cross, 2009, AUSTSWIM, 2015, Lifesaving Society Canada, 2011; Royal Life Saving Society – RLSSUK, 2012). Many organisations routinely include assessment of lifejacket competency in their certification (for example, RLSS - Australia Swim and Survive Active Award 7- Fit a PFD correctly while treading water, swim 100 metres using survival strokes, demonstrate HELP technique and climb out of the water whilst wearing the PFD (RLSSA, n.d.). Unfortunately, some traditional learn-to-swim programs include lifejacket use only as an adjunct to the teaching of swimming and not as critical component of the teaching of water competency.

Lifejacket use has recently been identified as a distinct and separate water competency, irrespective of other survival competencies a person at risk of drowning may possess (Stallman, Moran, Quan, & Langendorfer, 2017). Based on available research evidence, the authors concluded that lifejacket wear should be promoted and taught as a key safety component when in, on, or around water. They further recommended that proper fitting and familiarity with their use, as identified by MacDonald and colleagues (2015), should be taught and practiced in all water safety programs. Stallman and colleagues (2017) recommended that all practical water competencies that they had identified (i.e., safe entry and exit, swimming on surface and underwater, floating front, back, side, changing position and orientation in the water) should be practiced with and without a lifejacket. Furthermore, they reasoned that associated cognitive and affective competencies (such as risk recognition/estimation and assessment of personal competency) were essential components of drowning prevention education. In the case of lifejacket use, a common premise for their non-use in aquatic activity is that the possession of swimming competency obviates their need - an underestimation of risk and overestimation of one's proficiency that often has fatal consequences such as in the case of injury or loss of consciousness. Stallman and colleagues (2017) signalled the necessity of experiential learning so that learners could accurately reflect on the risks/demands of the aquatic environment (especially when in open water), and their capacity to cope with those risk/demands with both assisted and unassisted flotation.

The purpose of this second phase of the *Can You Float?* study was thus twofold: first, to examine the nature and extent of assisted floating competency via the use of lifejackets among young adults, and second, to explore the relationship between real and perceived lifejacket competency - a fundamental drowning prevention capacity.

Method

The study design chosen for this second phase of the *Can You Float?* project was, like the first phase on personal flotation without the use of a buoyancy aid, a paired, repeated measures (test-retest) experimental design where the participants served as their own control. Ethics clearance for the study was obtained from the University of Auckland Human Participants Ethics Committee (UAHPEC) as part of the *Can You Swim?* project (case number 010667).

Participants

Participants in this study were enrolled in an aquatics program in either a Bachelor of Physical Education [BPE] or Bachelor of Sport, Health and Physical Education [BSHPE] undergraduate degree. They were the same students who took part in the first phase of the *Can You Float?* study (Moran, 2018) with one additional late enrollee. Three participants did not complete part of the practical activity and were withdrawn from the final analysis ($N = 40$). The practical component was completed during the summer term (March-April, 2017) in the same heated (24 degrees C) outdoor pool (25m x 15m with a 2m deep end) that was used in the first phase of the *Can You Float?* study.

Procedures

As was the case in the first phase of the study (Moran, 2018), students completed a questionnaire relating to their understanding and experience of lifejacket use prior to the pool-based activities. It also asked them to rate the level of exertion required to complete a range of water activities when wearing a lifejacket. To reduce the possibility of response bias, participants were not told that some of the survey questions related directly to the practical tasks they would undergo in the course of their aquatics program. Upon completion of the practical activities, all participants were asked again to provide an estimate of the levels of exertion required to perform each activity.

Protocols developed in the initial phase of the *Can You Float?* study for the measurement of swimming and floating competencies previously reported (Moran, 2018) were again followed. Prior to entering the deep end of the pool (2m) via a compact jump, participants were instructed on how to correctly select and put on a lifejacket. Wearing a correctly fitted, no collar, buoyancy vest (50 Newton / Class Type 403 / EN 393 / EN ISO 12402-5), participants were assessed on six aquatic tasks. After entering the pool using a compact jump entry wearing the lifejacket and having paused on the surface for 30 seconds (to simulate countering cold water shock), participants attempted the first three assessed tasks in the following order – a 25m sprint swim (for swimming speed), a 5-minute stationary float in deep water (for stationary flotation), and a 5-minute continuous swim (for swimming endurance) using their choice of strokes. Without removing their lifejackets, participants were then given a 1-minute rest before attempting the final 3 assessed tasks that included a 15m underwater swim, followed by a partner assist for 25m (partner also wearing a lifejacket), and finally a deep water exit over a 410mm bulkhead at the deep end of the pool. The lifejacket assist task was included to relate lifejacket competency with the competency of assisting others, identified by Stallman and colleagues (2017) as competency 14 - Recognise and assist a drowning person. All tests were assessed using a pass/fail measure based on whether they had completed/not completed the task.

Survey Instrument

As was the case in the first phase of the *Can You Float?* study, the questionnaire sought information on socio-demographic characteristics (including age, sex, and ethnicity). Self-estimates of swimming competency included the use of a five-point scale of *very good, good, okay, weak,* or *cannot swim.* Five questions sought information on their experience of lifejacket use in aquatic recreational activities, their prior learning of lifejacket use, and their level of confidence about using lifejackets in deep open water. Information was also sought on whether they had ever experienced a life-threatening submersion experience (Moran, 2010), whether they had ever seen public rescue equipment (PRE), and whether they had ever assisted someone in trouble in the water.

To determine their attitudes towards lifejackets, participants were asked whether they agreed or disagreed with six statements about lifejackets (e.g., *my swim capacity means I don't have to wear a lifejacket*). To determine the extent of risky behaviour, participants were asked whether they had undertaken aquatic activities without wearing a lifejacket (e.g., *have you ever gone boating without wearing a lifejacket?*) using a 4-point scale frequency scale of *never, sometimes, often, always*.

Finally, participants were also asked to estimate their predicted exertion rating prior to completing the six practical activities when wearing a lifejacket using the same modified version of Borg's Ratings of Perceived Exertion (RPE) that was developed for previous water safety studies on clothing (Moran 2014a, 2015) and in the first phase of the current *Can You Float?* study that focused on unassisted flotation competency (Moran 2018). The 15-point scale, where a low score indicates minimal exertion, was chosen because of its suitability for simple applied studies (Borg, 1982, 1998) such as the current study of perceived and real effort required in simulated drowning survival activities.

The draft questionnaire and RPE scale were pilot tested on a group of 12 students not taking part in the lifejacket study. As a consequence of their input, the term 'lifejacket' was used in the revised questionnaire instead of 'buoyancy aid' or 'personal flotation device (PFD)' because it was the more familiar and publicly-accepted term even though 'lifejacket' technically is inappropriate. Participants were then made aware of the correct differentiation of buoyancy aid and lifejacket as part of the teaching program.

Data Gathering and Analysis

As was the case in the first phase of the study, all data were double entered and cleaned in Microsoft Excel and then transferred to SPSS (Version 24, Armonk, NY, USA) for statistical analysis. Descriptive statistics were reported via numbers and percentages, and measures of central tendency and variability used included mean (*M*), standard deviation (SD), and standard error of the mean (*SEM*). Chi-square tests were used to determine the degree of relationships among independent variables (such as sex) and dependent variables (such as pre-activity RPE). The Shapiro-Wilk's test was used to determine whether the sample differences came from a normally-distributed population (Shapiro & Wilk, 1965). Results of the test revealed that all the differences came from normally-distributed populations (tests carried out at the $p < 0.05$ level). Therefore, dependent *t*-tests were deemed the most appropriate tests to assess the significance of the differences between the pre- and post-test values for each of the six lifejacket activities undertaken.

Results

The participants ($N = 40$) were young adults (17 – 22 years of age) with most (55%) aged between 17-20 years of age. Slightly more than half (55%) were female (n = 22), and most (83%) self-reported their water competency as *okay* (48%) or *good/very good* (35%). Most (65%) had been taught to swim and, of those who were taught, commercial swim schools (42%), high schools (27%), and primary schools (19%) were the main providers. When analysed by gender, no significant differences were evident in estimates of swimming competency with 22% of males and 14% of females describing themselves as *weak* while 23% of females and 17% of males considered themselves to be *very good*. When asked if they had ever experienced a life-threatening submersion experience (Moran, 2010), 28% reported that they had (n = 11). No significant difference was evident between male and female submersion experiences with 50% of males reporting self-escapes and 40% of females as the way of resolving an incident.

When asked about their experience of lifejackets, most (90%) reported having used them in aquatic activities, with boating (85%) and paddle craft (60%) being the most frequently cited activities. No statistically significant gender differences existed with 96% of females and 83% of males reporting using a lifejacket. When asked about their levels of confidence in using a lifejacket in open water, most (63%) were comfortable about using a them in open water and no significant gender differences were found in their perceived open water lifejacket competence (44% of females and 39% of males expressed some anxiety about using lifejackets in open water).

When asked whether they had been received any instruction on lifejacket use, more than half (53%) reported that they had and, of these, high schools (48%), primary schools (24%), family (19%) and private lessons (10%) were the reported providers. No significant differences were evident when lifejacket instruction was analysed by gender, 64% of females and 39% of males recalling having been taught lifejacket use. When asked whether they had ever seen any public rescue equipment (PRE), most (55%) reported that they had and that flotation rings (also referred to as angel rings, can buoys) were the most commonly cited type of rescue equipment. No statistically significant gender differences were found ($\chi^2(1) = 3.432$, $p = 0.064$) with 68% of females and 39% of males reporting having seen PREs. In both of these analyses, the descriptive differences between females and males may be a result of low statistical power in the ability of the analysis to find a significant difference.

Self-reported Behaviours Related to Lifejacket Use

Participants were asked to report on their behaviours related to lifejacket use during aquatic recreation (Table 1). Those who had not taken part in any of the activities were screened out of the frequency responses. Of those who had taken part in boating or rock-based fishing, many reported that they had, at some time, taken part in boating activities (74%) and rock-based fishing (79%) without wearing a lifejacket. When asked about safety behaviours, most (60%) had *never* ignored safety signage relating to lifejacket use, and one third (33%) had *never* heard their peers boasting about not wearing lifejackets.

DOI: 10.25035/ijare.11.03.04

Table 1 Self-reported Behaviours Related to Lifejacket Use in Aquatic Recreation

Have you ever -	**Never** ***n*** **(%)**	**Sometimes** ***n*** **(%)**	**Often** ***n*** **(%)**	**Always** ***n*** **(%)**
Gone boating without wearing a lifejacket? (*n* = 35)	9 (26%)	16 (46%)	7 (20%)	3 (9%)
Gone sailing without wearing a lifejacket? (*n* = 17)	12 (71%)	2 (12%)	2 (12%)	1 (6%)
Gone rock fishing without wearing a lifejacket? (*n* = 19)	4 (21%)	6 (32%)	4 (21%)	5 (26%)
Ignored signs to wear a lifejacket? (*n* = 40)	24 (60%)	15 (38%)	1 (3%)	-
Seen/heard friends boasting about not wearing a lifejacket? (*n* = 40)	13 (33%)	19 (48%)	8 (20%)	-

No statistically significant differences were evident when lifejacket use in boating, sailing, and fishing activities were analysed by gender with 47% of males and 16% of females likely to *often /always* not wear a lifejacket when boating 16%) or when rock-based fishing (males 63%, females 36%). No statistically significant gender differences were found (χ^2 (3) = 6.330, p = 0.097) 55% of females and 22% of males reporting that they *never* ignored signs relating to lifejacket use. Significantly more males (males 89%, females 50%) reported *sometimes* or *often* hearing friends boasting about not wearing a lifejacket (χ^2 (3) = 12.477, p = 0.006).

Beliefs Related to Buoyancy Aid Use

When asked whether they agreed or disagreed with a series of six statements relating to the use of lifejacket, most respondents gave favourable safety responses (Table 2). Most disagreed that: learning lifejacket use was not as important as learning to swim (60%); their swim competency meant they didn't need a lifejacket (92%); regulations regarding lifejacket use were unnecessary (78%); better swimmers did not need lifejacket (88%), and lifejackets were too costly to justify their purchase for casual boaters/fishers (78%).

Table 2 Beliefs about lifejacket use by gender

	Agree		Disagree		Total	
	Male *n(%)*	**Female** *n(%)*	**Male** *n/%*	**Female** *n/%*	**Agreed** *n/%*	**Disagree** *n/%*
Learning to use lifejackets not as important as learning to swim*	11 (61%)	5 (23%)	7 (39%)	17 (77%)	16 (40%)	24 (60%)
My swim capacity means I don't need to wear a lifejacket *	3 (17%)	0 (0%)	15 (83%)	22 (100%)	3 (8%)	37 (92%)
Use of lifejackets is the responsibility of each person	17 (94%)	17 (77%)	1 (6%)	5 (23%)	34 (85%)	6 (15%)
Don't need regulations to make lifejacket use compulsory	4 (22%)	5 (23%)	14 (78%)	17 (77%)	9 (22%)	31(78%)
Better swimmers don't need to wear lifejackets	4 (22%)	1 (5%)	14 (78%)	21 (95%)	5 (13%)	35 (88%)
Lifejackets are too costly to justify their purchase for casual boaters/fishers	5 (28%)	4 (18%)	13 (72%)	18 (82%)	9 (22%)	31 (78%)

*Significant difference at the 0.05 level

Significantly more females (females 77%, males 39%) disagreed that learning how to use lifejackets was not as important as learning to swim (χ^2 (1) = 6.077, p = 0.014) and that their swim capacity meant that they didn't need to wear a lifejacket (females 100%, males 83%) (χ^2 (1) = 3.964, p = 0.046). No further significant differences were found in the other responses, although 22% of males agreed that better swimmers didn't need to wear lifejackets compared with only 5% of females. Only 28% of males and 18% of females felt lifejackets were too expensive for casual users to purchase.

Lifejackets Practical Competencies

All participants were successful in completing a 25m sprint swim, 5-minute distance swim (using their own stroke choices), 5-minute survival float, and a 25m partner assist when wearing a lifejacket (Table 3). Recall that these items were only measured as pass-fail, not using times to complete.

Most participants failed to complete the 15m underwater swim (63%) and deep water exit (63%) over a 410mm bulkhead when wearing a lifejacket. When analysed by gender, significantly more males than females (males 56%, females 23%) were able to complete the underwater swim (χ^2 (1) = 4.552, p = 0.033) and the deep water exit over a 410mm bulkhead (χ^2 (1) = 4.552, p = 0.033), irrespective of self-reported swimming competency.

DOI: 10.25035/ijare.11.03.04

Table 3 Practical lifejacket activities by gender

Lifejacket activities	Pass/Fail	Total *n* (%)	Male *n* (%)	Female *n* (%)
1) Speed swim (25m)	Pass	40 (100%)	18 (45.0%)	22 (55.0%)
	Fail	-	-	-
2) Survival float (5 min)	Pass	40 (100%)	18 (45.0%)	22 (55.0%)
	Fail	-	-	-
3) Survival swim (5 min)	Pass	40 (100%)	18 (45.0%)	22 (55.0%)
	Fail	-	-	-
4) Underwater swim (15m)	Pass*	15 (37.5%)	10 (55.6%)	5 (22.7%)
	Fail	25 (62.5%)	8 (44.4%)	17 (77.3%)
5) Partner assist (25m)	Pass	40 (100%)	18 (45.0%)	22 (55.0%)
	Fail	-	-	-
6) Deep end exit (410mm height)	Pass*	15 (37.5%)	10 (55.6%)	5 (22.7%)
	Fail	25 (62.5%)	8 (44.4%)	17 (77.3%)

*Significant difference at the 0.05 level

Perceptions of Exertion When Performing Lifejacket Tasks

Participants estimated the exertion required to complete the buoyancy aid tasks prior to undergoing the practical tests using a version of Borg's ratings of perceived exertion (RPE) scale (Borg, 1982, 1998) modified for water competency evaluation (Moran, 2015). Tables 4a and 4b show the pre- and post-testing estimates of perceived exertion for each of the lifejacket tasks. Table 4a shows that the post-task exertion ratings for the 25m sprint and 5-minute swim in a lifejacket were greater than the original estimates but the estimate for the 5-minute float in a lifejacket decreased. Table 4b shows that the post-task exertion ratings for the 15m underwater swim and the deep water exit in a lifejacket were greater than the original estimates but the estimate for the partner assist wearing lifejackets decreased.

Paired samples comparison of pre- and post-task ratings of perceived exertion found significant differences in exertion estimates in all six activities (Table 5). Post-test exertion estimates for the survival float and partner assist were significantly lower; estimates for the sprint, endurance and underwater swims, and deep water exit were significantly higher.

Table 4a Pre- and post- activity ratings of perceived exertion for activities 1-3

RPE Score	Pre-activity 1) Sprint 25m *n*/%		Post-activity 1) Sprint 25m *n*/%		Pre-activity 2) Float (5 min) *n*/%		Post-activity 2) Float (5 min) *n*/%		Pre-activity 3) Swim (5 min) *n*/%		Post-activity 3) Swim (5 min) *n*/%	
≤6	-	-	2	(5%)	-	-	15	(38%)	-	-	-	-
7-8	-	-	3	(8%)	-	-	16	(40%)	-	-	4	(10%)
9-10	12	(30%)	10	(25%)	7	(18%)	8	(20%)	10	(25%)	8	(20%)
11-12	6	(15%)	4	(10%)	11	(28%)	1	(3%)	2	(5%)	2	(5%)
13-14	5	(13%)	6	(15%)	4	(10%)	-	-	6	(15%)	5	(13%)
15-16	11	(28%)	12	(30%)	14	(35%)	-	-	15	(38%)	11	(28%)
17-18	4	(10%)	2	(5%)	3	(8%)	-	-	2	(5%)	7	(18%)
19-20	2	(5%)	1	(3%)	2	(5%)	-	-	5	(13%)	3	(8%)
	m	10.23	*m*	12.28	*m*	9.98	*m*	7.63	*m*	11.25	*m*	13.93
	SD	3.109	*SD*	3.194	*SD*	3.076	*SD*	1.628	*SD*	3.380	*SD*	3.547
	SEM	.492	*SEM*	.505	*SEM*	.486	*SEM*	.257	*SEM*	.534	*SEM*	.561

DOI: 10.25035/ijare.11.03.04

Table 4b Pre- and post-activity ratings of perceived exertion for activities 4-6

RPE Score	Pre-activity 4) Underwater (15m) *n*/%		Post-activity 4) Underwater (15m) *n*/%		Pre-activity 5) Partner assist *n*/%		Post-activity 5) Partner assist *n*/%		Pre-activity 6) Deep water exit *n*/%		Post-activity 6) Deep water exit *n*/%	
≤6	-	-	-	-	-	-	2	(5%)	-	-	-	-
7-8	-	-	-	-	-	-	2	(5%)	-	-	-	-
9-10	8	(20%)	1	(3%)	4	(10%)	23	(58%)	1	(3%)	-	-
11-12	5	(13%)	-	-	6	(15%)	8	(20%)	6	(15%)	-	-
13-14	8	(20%)	-	-	11	(28%)	3	(8%)	12	(30%)	-	-
15-16	14	(35%)	6	(15%)	17	(43%)	1	(3%)	14	(35%)	10	(25%)
17-18	3	(8%)	16	(40%)	1	(3%)	-	-	3	(8%)	9	(23%)
19-20	2	(5%)	17	(43%)	1	(3%)	1	(3%)	4	(10%)	21	(53%)
	m	12.0	*m*	17.98	*m*	12.63	*m*	10.68	*m*	11.90	*m*	18.13
	SD	3.289	*SD*	1.860	*SD*	2.705	*SD*	2.347	*SD*	3.403	*SD*	1.727
	SEM	.520	*SEM*	.294	*SEM*	.428	*SEM*	.371	*SEM*	.538	*SEM*	.273

Table 5 Pre- and post-activity comparison of ratings of perceived exertion (RPE)

Lifejacket Activity		*m*	*SD*	*95% confidence interval* Lower	*Upper*	*t*	*p*
Speed swim (25m)	Pre-activity	10.23	3.109	-2.952	-1.148	-4.599	<0.001
	Post-activity	12.28	3.194				
Survival float (5 min)	Pre-activity	9.98	3.076	1.620	3.080	-6.513	<0.001
	Post-activity	7.63	1.628				
Survival swim (5 min)	Pre-activity	11.25	3.380	-3.536	-1.814	-6.283	<0.001
	Post-activity	13.93	3.547				
Underwater swim (15m)	Pre-activity	12.00	3.289	-6.937	-5.013	-12.561	<0.001
	Post-activity	17.98	1.860				
Partner assist (25m)	Pre-activity	12.63	2.705	1.060	2.840	4.433	<0.001
	Post-activity	10.68	1.727				
Deep water exit (410mm height)	Pre-activity	11.90	3.403	-7.291	-5.159	-11.816	<0.001
	Post-activity	18.13	1.727				

Discussion

The focus of this second phase of the *Can You Float?* Study was twofold. First, the study sought to determine the nature of young adults' competency, knowledge, attitudes, and behavior around lifejacket use as well as explore the relationship between real and perceived assisted floating competency when using lifejackets. As was the case in the first phase of the study (Moran 2018), fewer students had been taught flotation (via lifejacket use) than had been taught swimming (taught lifejacket competency 53%, taught swimming competency 65%), although most (90%) reported having used them in aquatic activity and most (63%) were comfortable about using them in open water.

When asked about their behaviors around lifejacket use, most participants who had undertaken boating and rock-based fishing activity had taken part, at some time, without using a lifejacket (boating 74%, rock-based fishing 79%). More than one-third (38%) admitted sometimes ignoring signs to wear a lifejacket and two-thirds (68%) had heard friends boasting about not wearing a lifejacket. Significantly more males were likely to have heard friends boasting about non-use (males 89%, females 50%). While the beliefs expressed about lifejacket use were generally positive (see Table 2), the self-reported behaviors surrounding lifejackets suggest that, even among this group of undergraduate trainee teachers, the necessity for lifejacket use has not been entirely embraced. Similarly, variable self-reported lifejacket use, especially among males, was reported among young adults (Gulliver & Begg, 2005) and adults (Howland et al., 1996).

Practical testing of lifejacket competency revealed some interesting results which suggested that teaching lifejacket use in a variety of simulated survival challenges is warranted. While all students successfully completed the sprint and endurance swimming and floating tasks, a 15m underwater swim and deep water exit over a 410mm bulkhead when wearing a lifejacket proved too difficult for many of these generally water competent participants (see Table 3). Previous studies by the author have reported similar findings among young adult participants when swimming and floating with/without clothing (Moran, 2015, 2014a) and when getting out of the water (Moran, 2014b). The present study reinforces the need to teach swimming and flotation competencies in conjunction with lifejackets and clothing in a range of simulated survival situations. Further research is required to test the practical competency of other groups, both young and old, who may not be as water competent as the participants in the present study.

As was the case with unsupported floating tasks of treading water and motionless floating reported in the first phase of the *Can You Float?* study (Moran, 2018), perceptions of the demands of many of the tasks changed significantly before and after practical testing. Whereas the post-test perceptions of the demands of unsupported floating tasks all increased significantly in the first phase of the study, lifejacket use lowered post-test estimates of the demands of floating and partner assist tasks (see Table 5), but swimming (sprint, endurance, underwater) and exit competencies when wearing a lifejacket indeed increased.

The perception of lower exertion levels when wearing a lifejacket to support floating and helping others could be viewed as an important experience of the value of wearing a lifejacket and thus a valuable part of lifejacket education. The success of all participants in completing the partner assist wearing a lifejacket and the associated significantly lower estimation of exertion required reinforces the importance of appropriate flotation in rescue scenarios as advocated in recent bystander rescue research (Moran, Webber, & Stanley, 2016; Moran, & Stanley, 2013). The inclusion of a partner assist exercise using lifejackets provides a strong indication of the inter-relationship between practical water competencies, identified by Stallman and colleagues (2017) as Competency 8 - Lifejacket competency and Competency 14 – Recognise/assist a drowning person. Emphasis on the interactions of the competencies – practical, cognitive, and affective - in future drowning prevention programs is strongly recommended.

The especially large increase in exertion ratings for the underwater swim and deep water exit suggest that many were unaware of the difficulty that wearing a lifejacket sometimes pose particularly in relation to submerging or getting out of the water. Furthermore, as advocated by Stallman and colleagues (2017), linking the teaching of the practical competency of lifejacket use (identified as Competency 8) with related cognitive competencies such as coping with risk (Competency 12) and assessing personal competency (Competency 13) is recommended as part of all water safety programs.

Overall, it would appear that many people (including even those with high levels of water competency skills) may not have accurate perceptions of the effect of lifejackets on related water competencies. Exposing students to simulated survival situations with and without lifejackets should help critical thinking about the necessity of supported flotation in activity in, on, or near water for all.

Limitations

While the second phase of the *Can you float?* study offers new and valuable insights into what people know, think, and can do in relation to supported flotation via the use of lifejackets, several limitations should be considered before applying the findings to water safety education. First, the lifejacket competency tests were designed for an adult group with known water competency. Further investigations and applications are required to determine whether they are suitable for younger age groups, adults, and among those with lower levels of water competency. Second, the participants were part of a physical education degree program and may have been more motivated to succeed and better accustomed to physical exertion so the use of a modified scale (Moran, 2015) based on Borg's Rate of Perceived Exertion (RPE) may have under reported the actual exertion.

Third, the testing took place in the confines of a heated, open air pool; further testing in open water conditions (where most fatal drownings occur) may give a more realistic estimate of open water flotation competency. Fourth, the type of flotation aid used was that of a non-collar, buoyancy vest most commonly associated with aquatic activities. Further study of the effects on survival tasks of other forms of flotation support including improvised aids such as balls, boards and water bottles as well as intended flotation aids such as wetsuits, arm and waist bands is recommended.

Finally, many of the statistical results, especially those focusing on gender differences were not statistically significantly difference although the descriptive numbers and percentages appeared to show some descriptive differences. Studies with larger sample sizes and a priori statistical power calculations should occur to examine the robustness of possible gender differences that have been found in previous studies.

Conclusion

The findings of this second phase of the *Can You Float?* study have provided important information on the teaching of lifejacket competency as well as new evidence on the relationship between real and perceived supported flotation competency. The results suggested that: lifejacket flotation competency was not as widely taught as physical swimming competency, which may account for some of the gaps between real and perceived supported floating capacity. The changed perception of exertion levels, in both directions, reinforces the need to expose students to the wearing of lifejackets when undergoing aquatics activity to allow the development of accurate self-assessment of task demands and personal competency. Based on the evidence presented here, it would appear prudent to investigate further the lifejacket component of existing water safety programs and develop more holistic teaching strategies that include activities to challenge participants to realistically assess the task and their competency levels.

References

American Red Cross (2009). *Swimming and water safety manual* (3rd Ed.) Yardley, PA: Staywell.

AUSTSWIM (2015). *Teaching swimming and water safety*. Mulgrave, Vic: AUSTSWIM.

Bennett, E., Cummings, P., Quan, L., & Lewis, F.M. (1999). Evaluation of a drowning prevention campaign in King County, Washington. *Injury Prevention, 5*(2), 109-113. DOI: 10.1136/ip.5.2.109

Borg, G.A.V. (1982). Psychosocial bases of perceived exertion. *Medical and Science in Sports & Exercise, 14*, 377-381.

Borg, G.A.V. (1998). *Borg's perceived exertion and pain scales*. Champaign, IL: Human Kinetics.

Bugeja, L., Cassell, E., Brodie, L., & Walter, S. (2014). Effectiveness of the 2005 compulsory personal flotation device (PFD) wearing regulations in reducing drowning deaths among recreational boaters in Victoria, Australia. *Injury Prevention*, *20*(6), 387-392. DOI:10.1136/injuryprev-2014-041169. Retrieved from: https://injuryprevention.bmj.com/content/early/2014/05/08/injuryprev-2014-041169.short

Cassell, E., & Newstead, S. (2015). Did compulsory wear regulations increase personal flotation device (PFD) use by boaters in small power recreational vessels? A before-after observational study conducted in Victoria, Australia. *Injury Prevention, 21*(1), 15-22. Retrieved from: https://doi:10.1136/injuryprev-2014-041170

Chung, C., Quan, L., Bennett, E., Kernic, M.A., & Ebel, B.E. (2014). Informing policy on open water drowning prevention: An observational survey of life jacket use in Washington State. *Injury Prevention*, *20*(4), 238-43. Retrieved from: https://doi.org/10.1136/injuryprev-2013-041005 PMID: 24513564

Cummings, P., Mueller, B.A., & Quan, L. (2011). Association between wearing a personal floatation device and death by drowning among recreational boaters: A matched cohort analysis of United States Coast Guard data. *Injury Prevention, 17*(3), 156–159. DOI: 10.1136/ip.2010.028688.

Gulliver, P., & Begg, D. (2005). Usual water related behaviour and 'near-drowning' incidents in young adults. *Australia and New Zealand Journal of Public Health 29*(3), 288-243.

Howland, J., Hingson, R., Mangione, T.W., Bell, N., & Bak, S. (1996). Why are most drowning victims men? Sex differences in aquatic skills and behaviours. *American Journal of Public Health*, *86*, 93-96.

International Life Saving Federation (ILS) (2015). Lifesaving Position Statement LPS 13 - Use of lifejackets (Personal flotation devices). Leuven, Belgium: ILS.

Lifesaving Society Canada (2011). *Teaching swim for life*. Ontario: RLSS Canada.

MacDonald, C.V., Brooks, C.J., Kozey, J.W., & Habib, A. (2011). The Influence of familiarity on life jacket donning performance: Implications for participant selection. *International Journal of Occupational Safety and Ergonomics*, *17*(1), 15-23. Retrieved from: https://doi.org/10.1080/10803548.2011.11076865

Mangione, T., & Chow, W. (2014). Changing life jacket wearing behavior: An evaluation of two approaches. *Journal of Public Health Policy, 35*, 204–

218. Retrieved from: https://doi.org/10.1057/jphp.2013.51 PMID: 24430805

Mangione, T., Chow, W., & Nguyen, J. (2012). Trends in lifejacket use among recreational boaters: a dozen years (1999-2010) of US observational data. *Journal of Public Health Policy, 33*(1), 59-74. Retrieved from: https://doi.org/10.1057/jphp.2011.55 PMID: 22071567

Moran, K. (2018). *Can you float?* Part I - Perceptions and practice of unsupported flotation competency among young adults. *International Journal of Aquatic Research and Education*, *10*(4), Art. 4. DOI: 10.25035/ijare.10.04.04

Moran, K. (2017). Rock-based fisher safety promotion: A decade on. *International Journal of Aquatic Research and Education*, *10*(2), Art. 1. DOI: 10.25035/ijare.10.02.01

Moran, K., Webber, J., & Stanley, T. (2016). The *4Rs of Aquatic Rescue*: Educating the public about safety and risks of bystander rescue, *Injury Control & Safety Promotion, 24*(3), 396-405 DOI: 10.1080/17457300.2016.1224904

Moran, K. (2015). Can you swim in clothes? Reflections on the perception and reality of the effect of clothing on water competency. *International Journal of Aquatic Research and Education*, *9*(2), 116-135. DOI: 10.25035/ijare.09.02.03

Moran, K. (2014a). Can you swim in clothes? An exploratory investigation of the effect of clothing on water competency. *International Journal of Aquatic Research and Education*, 8(4), 338-350. DOI: 10.25035/ijare.08.04.03

Moran, K. (2014b). Getting out of the water – how hard can that be? *International Journal of Aquatic Research and Education*, 8(4), 321-33. DOI: 10.25035/ijare.08.04.03

Moran, K. (2010). Risk of drowning: The iceberg phenomenon re-visited. *International Journal of Aquatic Research and Education*, *4(*2), 115-126. DOI: 10.25035/ijare.04.02.03

Moran, K., & Stanley, T. (2013). Readiness to rescue: Bystander perceptions of their capacity to respond in a drowning emergency. *International Journal of Aquatic Research and Education*, *7*(4), 290-300. DOI: 10.25035/ijare.07.04.03

Peden, A.E., Demant, D., Hagger, M.S., & Hamilton, K. (2018). Personal, social, and environmental factors associated with lifejacket wear in adults and children: A systematic literature review. *PLOS ONE*, *13*(5), e0196421. Retrieved from: https://doi.org/10.1371/Journal.pone.0196421

Pitman, S.J., Wright, M., & Hocken, R. (2018). An analysis of lifejacket wear, environmental factors, and casualty activity on marine accident fatality rates. *Safety Science*. Retrieved from: https://doi:10.106/j.ssci.2018.07.016

Pointer, K., Milligan, G.S., Garratt, K.L., Clark, S.P., & Tipton, M.J. (2018). A 10-year descriptive analysis of UK maritime and coastguard data on lifejacket use and drowning prevention. *Safety Science 109*, 195-200. Retrieved from: DOI: 10.1066/j.ssci.2018.06.003

Quan, L., Mangione, T., Bennett, E., & Chow, W. (2017). Use of life jackets and other types of flotation for in-water recreation in designated swim areas in Washington State. *Injury Prevention 24*(2), 123-129. Published online March 2017. Retrieved from: https://doi.10.1136/injuryprev-2016-042296

Quan, L. (2014). Personal flotation devices. In J.J.L.M. Bierens (Ed.) *Handbook on drowning: Prevention, rescue, and treatment*. (2nd ed.) (pp. 225-229). Heidelberg: Springer-Verlag.

Quistberg, D.A., Bennett, E., Quan, L., & Ebel, B. (2014). Low personal flotation device use among adult recreational boaters: A qualitative study of risk perception and behavior factors. *Accident Analysis and Prevention, 62*, 276-284. DOI: 10.1016/j.aap.2013.10.015

Quistberg, D.A., Quan, L., Ebel, B.E., Bennett, E., & Mueller, B.A. (2014). Barriers to life jacket use among adult recreational boaters. *Injury Prevention*, *20*, 244-250.

Royal Life Saving Society Australia (n.d.). *Senior Swim and Survive Active Award 7*. Retrieved from: http://www.swimandsurvive.com.au/content_common/pg-active-award-7.seo

Royal Life Saving Society – UK (2012). *Lifesaving manual for instructors*. Broome, Warwickshire: RLSS.

Shapiro, S.S. & Wilk, M.B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, *52*(3/4), 591-611.

Stallman, R.K., Moran, K., Quan, L., & Langendorfer, S. (2017). From swimming skill to water competence: Towards a more inclusive drowning prevention future, *International Journal of Aquatic Research and Education*, *10*(2), 1-35. Art. 3. DOI: 10.25035/ijare.10.02.03

U.S. Coast Guard, Department of Homeland Security (US) (2015). *Recreational Boating Statistics – 2015*. Washington, DC: United States Coast Guard. Retrieved from: https://www.uscgboating.org/library/accidentstatistics/Recreational-Boating-Statistics-2015.pdf

Water Safety New Zealand (2012). *Drowning Report 2012*. Wellington: WSNZ. Retrieved from: https://cdn-flightdec.userfirst.co.nz/uploads/sites/watersafety/files/Drowning_reports/2012-New-Zealand-Drowning-Report.pdf

World Health Organisation (2014). *Global Report on Drowning: Preventing a leading killer*. Geneva: WHO.