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## Can You Float? Part I - Perceptions and Practice of Unsupported Flotation Competency among Young Adults

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## Can You Float? Part I - Perceptions and Practice of Unsupported Flotation Competency among Young Adults

### Cover Page Footnote

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 is much appreciated.

### Abstract

The capacity to maintain the airway through buoyancy control when immersed in water is critical in preventing drowning (Stallman, Moran, Quan & Langendorfer, 2017). In this first phase of the *Can you Float?* study, perceived and real unsupported flotation competency of a group of students (n=37) with known water proficiency was examined. Using a modified version of Borgs Rating of Perceived exertion (RPE), participants were asked to estimate exertion levels before and after a practical test of five stationary floating tasks of increasing difficulty ranging from treading water to motionless floating. Most participants (82%) were able to tread water for 2 minutes but only one third (31%) could perform a motionless float for the same duration. In all tasks students underestimated the level of exertion required. Reasons for, and implications of, this underestimation are discussed and recommendations for the teaching of unsupported flotation competency in water safety programs are made.

*Keywords:* drowning prevention, water safety, flotation, treading water, water competency, real and perceived competency

### Introduction

The capacity to maintain the airway through buoyancy control when immersed in water is critical in preventing drowning (Stallman, Moran, Quan, & Langendorfer, 2017). While such a statement appears axiomatic and its inclusion is thus foundational in many water safety programs (e.g., American Red Cross, 2009; AUSTSWIM, 2009; Lifesaving Canada, 2011; Royal Life Saving Society – UK, 2012), evidence about flotation competency remains elusive. Conventional wisdom suggests that flotation competency is a precursor to the acquisition of propulsive movement in water and therefore an integral component of learning to swim, yet little research evidence is available to support this belief. Furthermore, perceptions on how well people can float and how well they think they can float have not been explored. The infrequent use of personal flotation devices (PFDs) among boating drowning victims (e.g., Cummings, Mueller, & Quan, 2011; Quistberg, Quan, Ebel, Bennett, & Mueller, 2014; United States Coast Guard, 2014) would suggest a reality gap in public perceptions of the need for floating competency - unsupported or otherwise.

Some studies shed light on the critical importance of flotation in the context of drowning prevention. In a study of survivors of drowning incidents, survivors identified being unable to float, a major threat to their life (Stallman, Junge, & Blixt, 2008). Several studies have reported on flotation as a component of water competency with some contradiction. Junge and colleagues (2010) found that most children (94%, n=70) taking part in a study of water competence who had swum 25m and thus deemed to be 'swimmers' were unable to stop and float. In the initial *Can You Swim?* Study of university students ( $N = 373$ ), most (76%) could comfortably swim more than 300 m nonstop, but only 40% could float for 15

minutes and more than one third (35%) could not stay afloat for more than 2 minutes (Moran, Stallman, Kjendlie, Dahl, Blitvich, Petrass, et al., 2012). Furthermore, Kjendlie and colleagues found that turbulent water conditions caused a 24% decrement in floating performance among 11 year old children (Kjendlie, Pedersen, Thoresen, Setlo, Moran, & Stallman, 2013). Contrary to popular belief, Moran (2014a) reported that lightweight clothing did not effect floating efficiency among physical education students ( $N = 37$ ) during a 5-minute flotation test.

The demands on buoyancy and flotation competency in a life-threatening water emergency are likely to be many and varied. In the confines of a tepid swimming pool, maintaining the airway in overhead depth water is the primary concern. In open water, surface conditions, water temperature, wind, waves and currents contrive to make maintaining the airway highly problematic. To maintain the airway in a potential drowning situation, a range of flotation competencies, subdivided into unsupported and supported techniques, may be required. In some emergency circumstances, where immersion is sudden and unintentional, reliance on unsupported flotation (of self or others) may be the only means of maintaining the airway and providing time to facilitate rescue or escape. In other instances, where water immersion is intended, the use of external buoyancy aids (such as PFDs) or other improvised sources of buoyancy (such as plastic containers, wetsuits, surfboards) will help reduce the threat of drowning (Cummings, Mueller, & Quan, 2011; Quan, Mangione, Bennett, & Chow, 2017; Quistberg, Bennett, Quan, & Ebel, 2014; Quistberg, Quan, Ebel, Bennett, & Mueller, 2014). Competency in, and perceptions of, supported flotation via PFD use are beyond the scope of this first phase of the *Can you Float?* study and will be considered in the second phase.

Open water survival may be further exacerbated by the contrasting need to conserve energy where rescue is not imminent, or expend energy where hypothermia is life-threatening. Two contrasting flotation competencies may assist in addressing these demands. In a life-threatening situation where energy conservation is at a premium, motionless floating may be a life-saving option. Where energy conservation and prolonged immersion are not a primary consideration, treading water by using various forms of arm and leg movement is another form of stationary surface competency. Apart from maintaining the airway, treading water also provides for good all-round visibility, provides a form of resting, or stopping to seek or summon help, and may offset the onset of hypothermia (Stallman et al., 2017).

Some studies have reported that floating required less energy than treading water (Graham, 1977; Fritzvold, 1986) and a head out position may reduce heat loss (Hayward, Collis, & Eckerman, 1973; Hayward, Eckerson, & Collis, 1975). For a comprehensive discussion of hypothermia and survival techniques in open water, readers are referred to *Essentials of Sea Survival* (Golden & Tipton, 2002). In summary, flotation requirements in a drowning prevention context vary

according to the situational demands placed upon a person by varied task and environmental constraints.

In terms of water safety education, therefore, it would appear prudent to place a great deal of emphasis on the acquisition of flotation competencies. We are, however, not currently well informed by research on what people know, think, and do about flotation competency as a preventative measure. The purpose of this first phase of the *Can You Float?* studies was thus twofold: first, to examine the nature and extent of unsupported floating competency among young adults, and second, to explore the relationship between real and perceived competency of unsupported flotation competency - a fundamental drowning prevention capacity.

### **Method**

The study design chosen for this first phase of the *Can You Float?* Project was 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 the study were a cohort of young adult students enrolled in either a Bachelor of Physical Education [BPE] or a Bachelor of Sport, Health and Physical Education [BSHPE] degree program. Both programs included an aquatics education and water safety component. Each participant's water competency was tested before the flotation study commenced to ensure participant safety (i.e., either participants had passed the foundation aquatics program in their first year of BPE study or had passed an entrant assessment in the first week of study of BSHPE). In the first phase of the study on unsupported flotation, four participants did not complete part of the practical activity and were withdrawn from the final analysis resulting in  $N = 39$  participants included in the analyses.

### **Procedures**

The practical component was completed during the summer term (March-April, 2017). A heated (24 degrees C) outdoor pool (25m x 15m with a 2m deep end) was used to conduct the practical testing. As was the case in previous studies in the *Can You Swim?* studies conducted by the author and colleagues (Moran 2014a, 2014b, 2015; Moran et al., 2012; Goya, Teramoto, Matsui, Shimongata, Doi, & Moran, 2011; Petrass, Blitvich, McElroy, Harvey, & Moran, 2012), participants were asked to complete a questionnaire prior to the pool-based activities. 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.

Prior to attempting the floating tasks, participants completed a series of introductory activities that included entering the deep end of the pool (2m) via a compact jump followed by a 30-second float ('float first' to simulate minimising cold water shock, see Barwood, Bates, Long, & Tipton, 2011), a sprint 25m swim (to simulate rapid short distance escape) and a 5-minute endurance swim using strokes of their choice (to simulate swimming a distance to escape). These activities were designed to familiarise the participants with the water conditions as well as to simulate activity that they may engage in prior to utilising flotation competencies in an emergency aquatic situation. After completing the 5-minute continuous swim participants were given a 1-minute rest before attempting the flotation activities.

Five flotation activities of varying degrees of difficulty ranging from treading water using arms and legs to motionless float without using arms or legs were chosen to test floating competency. Each activity was timed to a maximum of two minutes and achieved duration was recorded in whole seconds. The protocols for each activity are reported in Table 1.

**Table 1.** Protocols for Flotation Activities

| Task | Activity   | Result |
|------|--|--------|
| 1    | <u>Tread Water Using Arms and Legs</u><br>Time: 2 mins maximum in deep water or until rules are broken<br>Rules: must not touch bottom or side of pool during activity<br>Record: time in seconds (e.g., 60 secs)                        |        |
| 2    | <u>Tread Water – No Legs</u><br>Time: 2 mins maximum in deep water or until rules are broken<br>Rules: must not touch bottom or side of pool during activity. Must keep legs crossed and immobile<br>Record: time in seconds             |        |
| 3    | <u>Tread Water – No Arms</u><br>Time: 2 mins maximum in deep water or until rules are broken<br>Rules: must not touch bottom or side of pool during activity. Must keep hands linked behind back and immobile<br>Record: time in seconds |        |
| 4    | <u>Tread Water – Holding Rubber Brick</u><br>Time: 2 mins maximum in deep water or until rules are broken<br>Rules: must not touch bottom or side of pool during activity  |        |

|   |  |  |
|---|--|--|
|   | Must hold brick in 2 hands, must not drop brick<br>Record: time in seconds   |  |
| 5 | <u>Motionless Float - No Arms or Legs</u><br>Time: 2 mins maximum in deep water or until rules are broken<br>Rules: must not touch bottom or side of pool during activity<br>Must not use arms or legs during float<br>Record: time in seconds |  |

**Survey Instrument.** Background information was collected via a self-complete questionnaire based on the original *Can You Swim?* study (Moran et al., 2012) prior to engaging in the pool-based activities. As was the case in previous studies, the questionnaire sought information on socio-demographic characteristics (including age and sex) and whether they had been taught how to float. 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 whether participants could tread water (with use of arms and legs) and perform a motionless float (without use of arms or legs), and if so for how long.

Further questions sought information on how confident they felt about treading water and motionless floating without flotation aids in deep open water (*very comfortable/comfortable, anxious /very anxious*). To determine their perceptions of flotation, participants were asked whether they *agreed* or *disagreed* with six statements about flotation (for example, *floating in clothes is more difficult than floating in swimwear*).

Finally, participants were asked to predict their exertion rating for three of the five floating activities considered representative of a range of demands (tread water, tread water with weight, motionless float) using the modified version of Borg's Ratings of Perceived Exertion (Borg, 1982, 1998) previously developed for water safety studies on clothing (Moran 2014a, 2015). The 15-point scale (6-20) includes exertion categories from *very, very light* (6-7), *very light* (8-10), *fairly light* (11-12), *somewhat hard* (13-14), *hard* (15-16), *very hard* (17-18), and *very, very hard* (19-20). Prior to the commencement of the pool-based activity, participants were familiarised with the modified version of the RPE scale via an information sheet that provided indicators of physical exertion in a water survival context (Moran, 2015). Upon completion of the practical activities, all participants were asked to re-assess the levels of exertion required to tread water using arms and legs, tread water holding a one kilo rubberised brick, and a motionless float without using arms or legs.

As was the case in previous studies, content validity was determined from the input of three drowning prevention experts, familiar with the *Can You*

*Swim?* studies and Borg's RPE scale, who were asked to critique the application of the modified RPE scale to the proposed flotation activities. To establish reliability of the research instruments, the draft questionnaire and practical tests were pilot tested with a group of 12 students not taking part in the main study and repeated 4 weeks later. Correlational analyses indicated that no subsequent changes were required for the final survey or practical tests.

### **Data Gathering and Analysis**

All data were double entered and cleaned in Microsoft Excel and transferred to SPSS (Version 24, Armonk, NY, USA) for statistical analysis. Descriptive statistics were reported via numbers and percentage, and measures of central tendency used included mean (*M*), standard deviation (*SD*), and standard error (*SE*). Chi-square tests were used to determine relationships between independent variables (such as sex) and dependent variables (such as floating competency).

In order to determine whether the (a) dependent sample *t*-test or (b) Wilcoxon paired single ranks test was appropriate, an assessment of the estimated population normality of the pre- and post-test differences was undertaken. 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, the *t*-test was deemed the most appropriate test to assess the significance of the differences between the pre- and post-test values for each of the five flotation activities undertaken.

### **Results**

The participants ( $N = 39$ ) were young adults (17 – 22 years of age) with most (56%) aged between 17 - 20 years of age. More than half (54%) were female ( $n = 21$ ), and most (55%) self-reported they could swim 200m or more. Most (64%) had been taught to swim and, of those who were taught, commercial swim schools (44%), high schools (28%), and primary schools (16%) were the main providers. When asked had they been taught to float, only one third (33%) reported that they had been taught. When analysed by gender, no significant differences were evident in estimates of swimming competency although fewer males than females (males 6%, females 14%) estimated they could swim more than 400m.

### **Estimated Motionless Floating Competency**

When asked to estimate their floating competency, Table 2 shows that most students (74%) thought that they could float in the deep end of the pool without using their arms and legs. One third (35%) of students estimated that they could float motionless without using arms and legs for one minute, more than one quarter (28%) thought they could float motionless for more than 5 minutes.

Most (56%) felt *comfortable* about motionless floating in the closed confines of a pool, but more (51%) felt *anxious* about doing this in open water.

**Table 2.** Self-estimates of Ability to Motionless Float by Gender

|  | Total    |       | Male     |       | Female   |       |
|--|----------|-------|----------|-------|----------|-------|
| <b>Can you motionless float?</b>                       | <i>n</i> | %     | <i>n</i> | %     | <i>n</i> | %     |
| Yes  | 29       | 74.4% | 12       | 66.7% | 17       | 81.0% |
| No   | 10       | 25.6% | 6        | 33.3% | 4        | 19.0% |
| <b>If yes (<i>n</i> =29), how long for?</b>            |          |       |          |       |          |       |
| 1 min  | 10       | 34.5% | 4        | 33.3% | 6        | 35.3% |
| 2-5 min  | 11       | 37.9% | 4        | 33.3% | 7        | 41.2% |
| >5 min   | 8        | 27.6% | 4        | 33.3% | 4        | 23.5% |
| <b>How do you feel about doing this?</b>               |          |       |          |       |          |       |
| Comfortable/Very comfortable                           | 22       | 56.4% | 11       | 61.1% | 11       | 52.3% |
| Anxious/Very anxious                                   | 17       | 43.6% | 7        | 38.9% | 10       | 47.6% |
| <b>How do you feel about doing this in open water?</b> |          |       |          |       |          |       |
| Comfortable/Very comfortable                           | 19       | 48.7% | 10       | 55.5% | 9        | 42.8% |
| Anxious/Very anxious                                   | 20       | 51.3% | 8        | 44.4% | 12       | 57.1% |

No significant differences were evident when estimates of being able to float without using arms and legs were analysed by gender, although males were more likely than females (males 33%, females 24%) to estimate greater duration (>5 minutes). Although not statistically significant, quantitatively more females than males expressed anxiety about having to perform motionless floating in either pool conditions (females 48%, males 39%) or in open water (females 57%, males 44%).

### Estimated Treading Water Competency

When asked to estimate their capacity to tread water, all participants thought they could tread water, with most (87%) predicting that they could tread water for more than two minutes, and one third (32%) predicting they could tread water for more than five minutes (Table 3). Most students (82%) felt comfortable about undertaking this task, although some (18%) expressed anxiety. No significant differences in estimated treading water competency were found between males and females.

**Table 3.** Self-estimates of Skill to Tread Water by Gender

|                             | Total    |      | Male     |       | Female   |       |
|-----------------------------|----------|------|----------|-------|----------|-------|
| <b>Can you tread water?</b> | <i>n</i> | %    | <i>n</i> | %     | <i>n</i> | %     |
| Yes                         | 39       | 100% | 18       | 46.2% | 21       | 53.8% |

|  | No | -     | -  | -     | -  | -     | - |
|--|----|-------|----|-------|----|-------|---|
| <b>If yes, how long for?</b>             |    |       |    |       |    |       |   |
| 1 min                                    | 5  | 12.8% | 2  | 11.1% | 3  | 14.3% |   |
| 2-5 min                                  | 22 | 56.4% | 10 | 55.6% | 12 | 57.1% |   |
| >5 min                                   | 12 | 30.8% | 6  | 33.3% | 6  | 28.6% |   |
| <b>How do you feel about doing this?</b> |    |       |    |       |    |       |   |
| Comfortable/Very comfortable             | 32 | 82.1% | 14 | 77.8% | 18 | 85.7% |   |
| Anxious/Very anxious                     | 7  | 17.9% | 4  | 22.2% | 3  | 14.3% |   |

### Beliefs about Flotation and Water Safety

When questioned on the importance of flotation in water safety, most respondents gave favourable responses to four of the six statements (Table 4). Most disagreed that learning floating competencies was not as important as learning to swim (72%); that floating was more energy sapping than swimming (77%); that treading water was better than floating (59%), and that body weight determined floating competency (80%). In contrast, most students gave incorrect responses to two statements relating to the effect of clothing on flotation with most students agreeing that floating in clothes was more difficult and that clothes dragged you under when trying to float (92% and 77% respectively).

No significant differences were evident when student beliefs of floating competency were analysed by gender, although quantitatively more males than females thought learning to float was not as important as learning to swim (males 39%, females 19%), that floating was more energy sapping than swimming (males 33%, females 14%), and more thought that the weight of clothes dragged you under (males 83%, females 71%).

### Practical Flotation Tests

In the practical testing of flotation, most students (82%) were able to tread water using arms and legs for the maximum time allowed of two minutes (Table 5). Table 5 also shows that progressively fewer participants were able to complete the increasingly more demanding floating competencies for the maximum time of 2 minutes. In addition, progressively more students could only complete the activities with increased demands for 30 seconds or less. More participants found treading water without use of the arms more challenging than the treading water without use of the legs (tread water no arms  $\leq 60$  seconds, 49%; tread water no legs  $\leq 60$  seconds, 30%). In the most demanding activity (motionless float), less than a third (31%) of the students could compete the motionless float for the maximum time limit of 2 minute and two thirds (67%) could only manage one minute or less. Although not quite statistically significant ( $\chi^2(4) = 8.821, p = 0.066$ ), quantitatively more females than males were able to tread water for the full duration of 2 minutes (females 95%, males 67%).

**Table 4.** Beliefs about Flotation and Water Safety by Gender

|   | Agree                |                        | Disagree             |                        | Total                 |                          |
|---|----------------------|------------------------|----------------------|------------------------|-----------------------|--------------------------|
|   | Male<br><i>n</i> (%) | Female<br><i>n</i> (%) | Male<br><i>n</i> (%) | Female<br><i>n</i> (%) | Agree<br><i>n</i> (%) | Disagree<br><i>n</i> (%) |
| Learning to float is not as important as learning to swim       | 7<br>(38.9%)         | 4<br>(19.0%)           | 11<br>(61.7%)        | 17<br>(80.9%)          | 11<br>(28.2%)         | 28<br>(71.8%)            |
| Floating in clothes is more difficult than floating in swimwear | 17<br>(94.4%)        | 19<br>(90.5%)          | 1<br>(5.6%)          | 2<br>(9.5%)            | 36<br>(92.3%)         | 3<br>(7.7%)              |
| Floating is more energy sapping than swimming                   | 6<br>(33.3%)         | 3<br>(14.3%)           | 12<br>(66.7%)        | 18<br>(85.7%)          | 9<br>(23.1%)          | 30<br>(76.9%)            |
| Treading water is better than floating for drowning prevention  | 9<br>(50.0%)         | 7<br>(33.3%)           | 9<br>(50.0%)         | 14<br>(66.7%)          | 16<br>(41.0%)         | 23<br>(59.0%)            |
| Body weight determines whether you can float or not             | 4<br>(22.2%)         | 4<br>(19.0%)           | 14<br>(77.8%)        | 17<br>(81.0%)          | 8<br>(20.5%)          | 31<br>(79.5%)            |
| The weight of clothing drags you under when trying to float     | 15<br>(83.3%)        | 15<br>(71.4%)          | 3<br>(16.7%)         | 6<br>(28.6%)           | 30<br>(76.9%)         | 9<br>(23.1%)             |

**Table 5.** Flotation Tests

|                                       | ≤ 30 seconds |       | ≤ 60 seconds |       | ≤ 90 seconds |       | ≤ 120 seconds |       |
|---------------------------------------|--------------|-------|--------------|-------|--------------|-------|---------------|-------|
|                                       | <i>n</i>     | %     | <i>n</i>     | %     | <i>n</i>     | %     | <i>n</i>      | %     |
| Tread water<br>(use arms and legs)    | 1            | (3%)  | 5            | (13%) | 1            | (3%)  | 32            | (82%) |
| Tread water<br>(no legs)              | 6            | (15%) | 6            | (15%) | 4            | (10%) | 23            | (59%) |
| Tread water<br>(no arms)              | 12           | (31%) | 7            | (18%) | 1            | (3%)  | 19            | (49%) |
| Tread water<br>(hold brick)           | 9            | (23%) | 10           | (26%) | 4            | (10%) | 16            | (41%) |
| Motionless float<br>(no arms or legs) | 18           | (46%) | 8            | (21%) | 1            | (3%)  | 12            | (31%) |

### Perceptions of Exertion When Performing Flotation Tasks

Participants were asked to estimate the exertion required to complete three of the flotation tasks - treading water, tread water holding a rubber brick, and the motionless float - before and after the practical tests using the modified version of Borg's RPE scale for water competency evaluation (Moran, 2015). Table 6 shows that most participants made very low pre-activity estimates of exertion (a rating of ≤10 classified as *very*, *very light* to *light*) in the treading water (89%), treading water holding weight (64%), and motionless float (57%).

Post-activity estimates increased for each of the activities with more participants giving a higher rating (a rating of ≥11 classified as *fairly light* to *very*, *very hard*) for treading water (pre-activity 11%, post-activity 34%), treading water holding weight (pre-activity 36%, post-activity 78%), and motionless float (pre-activity 44%, post-activity 83%). Table 6 shows also that, after completing the tasks, most participants (69%) classified the motionless float as *hard* (14-16), *very hard* (17-18), or *very, very hard* (19-20). No significant differences were evident in either the pre-task or post-task RPE scores when analysed by gender.

Paired samples comparison of pre- and post-task ratings of perceived exertion found significant differences in pre- and post-task estimates in all three floating activities (Table 7).

Pre- and post-activity mean estimates increased for each flotation task with the greatest differences being reported in the more challenging treading water with weight and motionless float.

### Discussion

The primary purpose of this first phase of the *Can You Float?* study was to explore the relationships between real and perceived unsupported floating competency among young adults. Perceptions of swimming and flotation

competence and confidence were surveyed via a questionnaire prior to practical testing of a series of five stationary flotation tasks. These tasks ranged from the relatively easy task (for an adult population of competent swimmers) of treading water using arms and legs through increasingly more demanding activities culminating in a motionless float without use of arms and legs. Pre- and post-testing evaluation of exertion levels were used to compare perceptions of flotation task difficulty.

Results suggest that, among this group of confident and competent swimmers, fewer had been taught flotation skills than swimming skills (33% floating, 64% swimming), but all reported that they could tread water (100%) and three quarters (74%) thought they could float motionless. When asked about the level of confidence in their floating capacity, most participants expressed confidence in being able to tread water (82%), but fewer were confident in the capacity to float motionless (56%). More participants expressed anxiety when asked how they felt about motionless floating without support in open water (51% anxious, 49% comfortable). The higher level of anxiety about their floating competency in the open water context may be the consequence of not having been taught floating, not having experienced buoyancy demands in an open water situation, or both. On the basis of this finding it is recommended that flotation not only be thoroughly taught at all developmental levels but, where developmentally appropriate (Robertson, 1989), simulation of open water conditions – rough water, cold water, currents and waves should be experienced. At more advanced learning stages, practice in open water with appropriate safety provisions is recommended.

The results of the practical tests suggest that most participants (82%) could tread water for 2 minutes, a similar proportion to that predicted prior to testing (87%). This result is encouraging as treading water is usually used when wishing to remain stationary with the head above the surface, and it has been argued by Stallman and colleagues that it “is one of the most versatile and essential of water competencies” (2017, p. 7). Most participants were able to tread water using arms only (59%) but only half (49%) could tread water using legs only. This is surprising given that participants in this study were considered water competent. One reason for this may be that the most efficient form of legs only treading water - the eggbeater kick - is technically difficult and may not be taught or emphasised in current water safety programs. Further research on the feasibility of teaching eggbeater kick in water safety education and drowning prevention would be valuable.

**Table 6.** Pre- and post-activity Ratings of Perceived Exertion (RPE) for Flotation Activities

| RPE Score | Pre-activity Tread water |          | Post-activity Tread water |          | Pre-activity Tread water (with weight) |         | Post-activity Tread water (with weight) |     | Pre-activity Motionless float |     | Post-activity Motionless float |  |
|-----------|--------------------------|----------|---------------------------|----------|--|---------|---|-----|-------------------------------|-----|--------------------------------|--|
|           | n/%                      | n/%      | n/%                       | n/%      | n/%                                    | n/%     | n/%                                     | n/% | n/%                           | n/% |                                |  |
| ≤6        | 22 (56%)                 | 13 (33%) | 6 (15%)                   | 2 (5%)   | 9 (23%)                                | 3 (8%)  |   |     |                               |     |                                |  |
| 7-8       | 4 (10%)                  | 9 (23%)  | 8 (21%)                   | 1 (3%)   | 3 (8%)                                 | 1 (3%)  |   |     |                               |     |                                |  |
| 9-10      | 9 (23%)                  | 5 (13%)  | 11 (28%)                  | 6 (15%)  | 10 (26%)                               | 3 (8%)  |   |     |                               |     |                                |  |
| 11-12     | 2 (5%)                   | 6 (15%)  | 3 (8%)                    | 7 (18%)  | 7 (18%)                                | 5 (13%) |   |     |                               |     |                                |  |
| 13-14     | 1 (3%)                   | 1 (3%)   | 6 (15%)                   | 10 (26%) | 2 (5%)                                 | 9 (23%) |   |     |                               |     |                                |  |
| 15-16     | -                        | 4 (10%)  | 4 (10%)                   | 7 (18%)  | 4 (10%)                                | 5 (13%) |   |     |                               |     |                                |  |
| 17-18     | 1 (3%)                   | 1 (3%)   | -                         | 3 (8%)   | 3 (8%)                                 | 7 (18%) |   |     |                               |     |                                |  |
| 19-20     | -                        | 1 (3%)   | 1 (3%)                    | 3 (8%)   | 1 (3%)                                 | 6 (15%) |   |     |                               |     |                                |  |

**Table 7.** Summary of differences between Pre- and Post-activity RPE's for Flotation Activities

|                           |               | <i>m</i> | <i>SD</i> | <i>SE</i> | <i>t</i> | <i>p</i> |
|---------------------------|---------------|----------|-----------|-----------|----------|----------|
| Tread water               | Pre-activity  | 8.13     | 3.113     |           |          |          |
|                           | Post-activity | 9.21     | 3.700     | .413      | -2.608   | 0.013    |
| Tread water (With weight) | Pre-activity  | 10.28    | 4.114     |           |          |          |
|                           | Post-activity | 13.05    | 4.000     | .444      | -6.001   | <0.001   |
| Motionless float          | Pre-activity  | 10.59    | 4.500     |           |          |          |
|                           | Post-activity | 14.05    | 4.425     | .705      | -4.913   | <0.001   |

Perhaps most noticeable of the results was the disparity between prediction and performance in the motionless float. Pre-test estimates of floating duration without use of arms and legs were more optimistic than the actual performance with only one third (31%) able to motionless float for 2 minutes compared with two thirds (66%) who had anticipated that they could float for 2 minutes or more. Furthermore, almost half (46%) were only able to float motionless for 30 seconds or less, a time not likely to afford much protection in real emergency. On the basis of this finding, it is recommended that more attention be given to motionless floating in the teaching of water safety, even though recent research (Barwood, Burrows, Cessford, & Goodall, 2016) has suggested that where hypothermia is life-threatening, the use of a leg kick to stimulate circulation may be of benefit in 'float first' short term cold water immersion.

As has been reported with respect to estimates of exertion in the performance of clothed water competencies (Moran, 2014a, 2015) and in relation to exit competencies (Moran, 2104b), most participants made very low pre-activity estimates of exertion (a rating of  $\leq 10$  classified as *very, very light* to *light*) prior to practical assessment and then significantly higher estimates post-exercise. Most participants predicted low levels of exertion prior to treading water (79%), treading water holding weight (64%), and motionless float (57%). In contrast, post-exercise levels were considerably higher (ratings of  $\geq 11$ ) for treading water (pre-activity 11%, post-activity 34%), treading water holding a weighted brick (pre-activity 36%, post-activity 78%), and motionless float (pre-activity 44%, post-activity 83%).

This disparity in pre- and post-test exertion estimates suggests that not even competent swimmers can accurately predict survival demands of an essential task such as maintaining the airway via floating skills. It is recommended that, as well as placing greater emphasis on flotation competency to remedy practical weaknesses already outlined, accurate assessment of personal competency (identified by Stallman and colleagues [2017] as Competency 13) should accompany all teaching of flotation. Being able to accurately assess one's flotation capacity may also inform critical thinking around water safety, a competency identified by Stallman and colleagues (2017) as Competency 12, i.e., Recognize and avoid risk, and judgment of risk and action.

### **Limitations**

While the first phase of the *Can you float?* study offers valuable insights into what people know, think, and can do in relation to unsupported flotation, several limitations should be considered before applying the findings to water safety education. First, the flotation competencies were developed for an adult group with known water competency. Further investigation and application is required to determine whether they are suitable for younger age groups and among those

with lesser 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 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.

### Conclusions

This is the first study of its kind to explore the relationship between real and perceived flotation competency. The results suggest that 1) flotation competency is not as widely taught as swimming competency, which may account for the gap between real and perceived floating capacity; and 2) pre-test estimates of motionless floating capacity were overly optimistic, and most participants underestimated the exertion required in completing the more demanding floating activities. On the basis of this evidence presented here, it would appear prudent to investigate further the flotation component of existing water safety programs and develop more holistic teaching strategies that include activities to challenge participants to realistically assess their competency levels. In doing so we may equip others to avoid potential underestimation of risk and overestimation of their perceived competency – a critical combination present in so many preventable drowning incidents.

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