

Swimming Skills Literature Review

A FINAL report for
Royal National Lifeboat Institution (RNLI)



Evaluation Services

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Introduction

Background

The Royal National Lifeboat Institution (RNLI) commissioned Cloud Chamber to undertake a literature review related to the contribution of swimming skills and aquatic survival training to drowning prevention among children and young people. This work will inform the [Swim Safe programme](#), a 45 minute safety advice and open water tuition programme for 7 to 14 year olds, delivered by the RNLI in partnership with the Amateur Swimming Association (ASA). The review will also inform other RNLI community safety programmes and initiatives.

Methodology and research questions

Research questions

The following research questions were developed in conjunction with the RNLI at a scoping meeting held on 18th July 2016:

- Do swimming skills protect people from risk of drowning in open water?
- What methods best deliver swimming skills?
- How do other countries approach this issue?

Method

The drowning prevention literature is wide ranging, internationally focused and methodologically challenging. The review therefore placed some criteria on what studies should be included:

- Our search centred on evidence from high income countries. While good evidence can be found from the developing world (notably Bangladesh), this review primarily informs provision in the UK so we focused our attention on places with similar governmental structures, culture and social issues to maximise the relevance of the work. Similarly, our review of drowning prevention strategies is also limited to selected Western, English-speaking countries for practical reasons
- We focused primarily (but not exclusively) on issues relating to open-water drowning incidents, which is in line with the main scope of the RNLI's operations and the aims and objectives of the Swim Safe programme
- Our review has been age-focused with our primary groups of interest being children, young people and young adults
- We have tried to relate the review to features of the Swim Safe delivery model, i.e. an experiential model undertaken in open water.

While it may be obvious to many readers of this review, it is worth mentioning specifically one of the most significant challenges of conducting research in this area: that the victims of drowning themselves are not able to help us understand the specific context of their individual deaths; explore their swimming skills (or water competence); and or judge the likelihood that such skills may have made a difference in the tragic incidents in which they lost their own lives.

We adopted a simple methodology for this assignment:

- Scope the research questions
- Agree search terms with RNLI
- Systematically search the literature
- Consult with experts to sense-check findings and signpost us to additional evidence

Figure 1 shows our initially agreed search terms mapped against the research questions. These terms were used as a starting point for the literature search. Specifically, we tested terms individually and in different combinations, and searched key word combinations across multiple databases. Key word combinations, databases searched and the number of articles returned are shown in Figure 2.

Figure 1: Initial search terms

Research question	Key words	
Do swimming skills protect people from risk of drowning in open water?	Drowning or Drowning prevention Water safety Program or intervention Swimming	Young people or Children or Adolescent Open water Swimming lessons Swimming education
What methods best deliver swimming skills?	Aquatic skills or aquatic competence Water competence	Safety education Evaluation
How do other countries approach this issue?	Drowning or Drowning prevention Water safety Policy Legislation Attitudes to risk Culture	Open water Best practice Awareness campaigns Education EU, G8, US, Canada, New Zealand, Australia

Figure 2: Number of returned articles by key word combination and database source

Search term	CINAHL Complete	Pubmed	Scopus	Web of Science
“Drowning prevention”	231	190	150	96
“Water Safety” & Drowning		178	107	46
Open water drowning	3	2,979*	142	154
“Open water” & “Drowning Prevention”		18	20	17
Swimming lessons	14	207	201	176
Swimming education	44	7	5	3
Water safety program	0	10	141	79
Aquatic skills	1	13	17	9
Open water swimming**				
Swimming lessons	0	207	201	176
“Drowning prevention” evaluation	0	122	17	11

* Mainly medical literature, ** Only returned results related to competitive open water swimming

A broad collection of articles was collected and reviewed as part of this exercise. Subsequent identification of literature was done through examining references and bibliographies of these articles. We also undertook searches of Google and Google Scholar to identify grey literature

(evaluation reports, strategies, interventions etc.). Our literature review includes 74 sources of evidence including academic articles and reports.

The academic literature was very limited for research question 3: 'how do other countries deal with this issue?'. In this case we relied on searches among the publications of key drowning prevention bodies, search engines, and our consultations with drowning prevention experts.

We contacted ten international experts in drowning prevention from Australia, New Zealand, the US, Norway and Bangladesh. We received responses from six of those ten individuals, interviewed four and two declined to be interviewed. Details of the interviewees are detailed in Appendix A.

Structure of this report

Our presentation of the literature in this report is structured as follows:

- Section 2 presents context relevant to the review including drowning statistics and trends, the policy context and information about RNLI interventions the review will inform
- Section 3 examines the links between swimming skills and drowning prevention / drowning risk
- Section 4 considers the evidence on which methods best deliver swimming skills
- Section 5 discusses approaches to drowning prevention in other high income countries
- Section 6 sets out our conclusions based on the available evidence

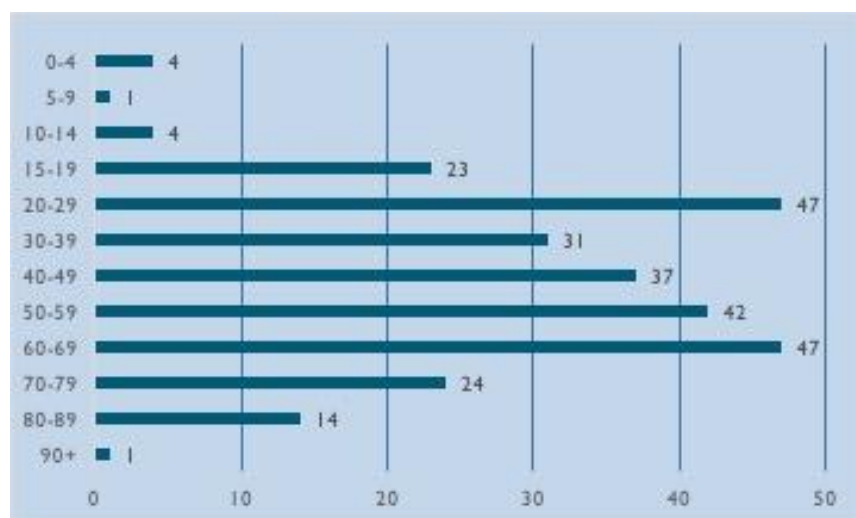
Context

There are over 300 water-related deaths in the UK. The number of water-related deaths from accidents or natural causes has decreased over the last three years from 381 in 2013, to 338 in 2014 and 321 in 2015 (Walker, 2016, 2015). However, drowning still remains one of the leading causes of unintentional death in the UK and is considered highly preventable (National Water Safety Forum, 2015).

As is the case in many countries across the world, males are significantly over-represented in drowning statistics. In the UK in 2015, 72% of people who died from accidental or natural water-related causes were male (National Water Safety Forum, 2016). The majority of fatalities (30%) were coastal (occurred at the coast, beach, or shore) and 27% occurred in rivers (Walker, 2016). Water-related deaths are strongly linked to leisure and recreation activities. In 2015, the activity most associated with fatalities was walking or running (25% of fatalities) while swimming accounted for 9% of all fatalities (National Water Safety Forum, 2016).

The 20-29 and 60-69 age group accounts for the greatest number of fatalities in 2015 (47 respectively). Children and young people (aged 0-19) accounted for 12% of fatalities in 2015. Within 0-19 year olds, more fatalities occurred in the 15-19 age category (23), four 10-14 year olds and five children aged between 0 and 9 lost their lives in 2015. Full data is shown in Figure 3.

Figure 3: Accidental & natural cause fatalities in the UK in 2015 by age group



Note: N=275 as 46 cases had insufficient information on age and gender. Source: National Water Safety Forum (2016)

Internationally, 372,000 people die from drowning every year and those most at-risk are aged under 25. This group accounts for 50% of deaths globally, with drowning being one of the 10 leading causes of death for people aged 1-24 in every region of the world. Developing countries have drowning rates over three times higher than in high income countries (World Health Organization, 2014).

Policy context

Globally, drowning is considered by the World Health Organisation (WHO) to be “a highly preventable public health challenge that has never been targeted by a global strategic prevention effort” (World Health Organization, 2014). The World Drowning Report sets out the evidence on drowning from both the developed and developing world, and calls for greater collaborative action

to reduce an 'intolerable death toll'. One of the interventions noted as effective in reducing drowning fatalities is to "teach school-age children basic swimming skills, water safety and safe rescue skills."

This increased global coordination effort has coincided with the UK's first drowning prevention strategy, published in 2014 as part of the National Water Safety Forum (NWSF). NWSF is an association of organisations with responsibilities for water safety including the RNLI, ASA, RoSPA, RLSS UK and others. The strategy aims to "reduce accidental drowning fatalities in the UK by 50% by 2026 and reduce risk amongst the highest risk populations, groups and communities ([National Water Safety Forum, 2015](#))."

RNLI Interventions

A principal driver of our review has been the RNLI / ASA Swim Safe programme. The review also has implications for a number of other RNLI interventions, notably 'Hit the Surf' and 'Respect the Water'. In the remainder of this section we briefly introduce these interventions, but it should be noted that one of drivers of the studies selected for the review were chosen with reference to the Swim Safe programme. So for instance, some of the literature regarding awareness campaigns have been omitted. There are however lessons to be drawn that contribute to that activity nonetheless.

The Swim Safe programme

The Swim Safe programme is run by the RNLI in partnership with the ASA. The programme is a 45-minute safety advice and open water tuition programme for 7 to 14 year olds based at several locations around the UK. It began as a pilot in 2013 and expanded in 2014 to include additional sites (including one inland site).

The intervention is open to any 7 to 14-year-old who is already able to swim 25m, and includes:

- Practical Swimming skills and survival strategies – delivered in an open water environment and includes treading water, the help position, the huddle position, the personal survival stroke, rotation and self-rescue & safe entry and exit; and
- Key safety messages – delivered on shore, key safety messages for 2016 included the importance of supervision, the dangers of cold water swimming, how to call for help and choosing a safe place to swim

The programme also expanded to cover school provision in 2015, contributing to the water safety element of the Physical Education Key Stage 2 National Curriculum, which all maintained-schools are subject to.

Hit the surf

In 2015, the Hit the Surf programme was delivered to over 10,000 children from 380 schools across the UK and Jersey. The programme covers topics such as the role of a lifeguard, key beach hazards to look out for, the meaning of beach safety flags and what to do if you find yourself in trouble in the water. The Hit the Surf programme has now been delivered to over 49,000 children since its inception in 2005.

Respect the Water

Respect the Water is the RNLI's national drowning prevention campaign and will play an important role in helping to halve coastal fatalities by 2024. Its role is to encourage safe enjoyment of the coast

while reminding people about key risks such as cold water shock and falling in unexpectedly. The key message for 2015 was 'British and Irish waters are dangerously unpredictable'. A multi-media campaign ran throughout the Summer.

Do 'swimming skills' protect people from risk of drowning in open water?

Swimming skill or ability, in the context of drowning prevention, is about more than just the physical or technical ability to swim. It should also encompass broader notions of knowledge (i.e. water safety knowledge) and affective disposition (i.e. attitudes and perceptions). This position was advocated by [Brenner et al., \(2006\)](#) who use this broader view in their construction of the concept of **water competence**.

The ability to swim well in a closed-water/pool environment does not necessarily translate to the open water with its associated adverse environmental conditions (such as swell, currents, and cold water). The variable and unpredictable nature of open water environments means that water safety knowledge is an important factor in reducing drowning risk (for example swimming in lifeguarded areas, being able to identify a rip current, or swimming in pairs). It is also clear that individual attitudes to risk, judgement and perceptions play a role in reducing the risk of drowning.

We have therefore structured this section around the notion of water competence, namely:

- Aquatic motor skills
- Water safety knowledge
- Affective disposition

Aquatic motor skills

While the physical skill of swimming (aquatic motor skill) might be seen as axiomatic to drowning prevention efforts, its capacity to protect is not well understood ([Moran et al., 2012](#)). Much of this misunderstanding stems from the ways in which we define and culturally understand the physical ability to swim.

Only a handful of studies in the research literature have robustly explored the link between aquatic motor skills and actual rates of drowning. These studies explore the link either through the reported ability to swim of drowning victims, or whether drowning victims had received swimming lessons.

Reported swimming ability

In the UK, efforts to monitor drowning incidents do not routinely include information on reported swimming ability. Neither the Water Incident Database (WAID), maintained by the National Water Safety Forum, nor the RNLI's own Fatality Recording Database (FReDA), routinely collects such data.

Addressing this gap, recent RNLI research sought to analyse fatal incidents among various different at-risk groups ([Greenstreet Berman, 2014](#)). Monitoring data was supplemented by RNLI incident reports, free text comments from life-boat crews, newspaper and media reports, and contextual information (e.g. sea water temperatures). Among young people, additional information on swimming ability was captured. In only three cases was swimming ability reported (1 strong swimmer and 2 with minimal swimming ability). In 38% (n=34) of incidents, it was concluded that swimming ability may have influenced survival. Although reported swimming ability was unknown, the authors examine contextual conditions (distance from shore, currents, swell, sea temperature), to make the assertion that swimming ability may have influenced the outcome. This is opposed to

cases (41%, n=34) where the reported context made it unlikely that swimming ability was an issue (e.g. falling from height, craft-related, medical).

The Canadian Red Cross routinely monitors drowning incidents and analysis of data between 1991 and 2013 found that among all age groups who died while participating in swimming, 22% (n=213) were weak swimmers, and 17% (n=160) were average or intermediate swimmers. Swimming skill was unknown for 22% of the cases and for 49% individuals were identified as swimmers, but their level of skill was unknown (Canadian Red Cross, 2016).

In the US, a national study (Cody et al., 2004) was conducted examining childhood drowning. Based on 496 cases from Child Death Reviews in 17 US States between January 2000 and December 2001, researchers report that 73% of victims aged between 5 and 9 did not know how to swim, and 30% of victims aged between 10 to 14 did not know how to swim. In a similar national study, the Canadian Red Cross (2003) examined Coroner's data from nearly 6,000 drownings between 1991 and 2000 and found 32% of drowning victims aged between 5 and 14 years old, participating in swimming activities at the time of drowning, did not know how to swim or were weak swimmers.

These studies highlight that there are significant gaps in knowledge on reported swimming ability, and present no clear pattern in reported ability and drowning.

Swimming lessons

In the literature, swimming lessons have often been used as a proxy of swimming ability in examining the links to drowning risk. Brenner et al., (2009) examined the effects of swimming lessons and ability on drowning fatalities in a case-control study. Researchers identified cases of drowning (through medical examiners or coroner's offices) and conducted interviews with the next-of-kin. Interviews with a matched control group were then undertaken, with statistical analysis to compare the two groups. The study focused on two age groups; 1-4 years old and 5-19 years old. Researchers found a protective effect of swimming lessons on the risk of drowning in children aged 1-4 years (88% reduction in the risk of drowning although with a large confidence interval). This result controls for confounding variables that are statistically associated with higher risk of drowning (such as education, risk taking and race). In the older age group (5-19), no such association was found. The study also investigated the effects of informal swimming lessons and found no association with the risk of drowning.

The study concludes that there is likely to be a protective effect of swimming lessons among 1 to 4 year olds, although the magnitude of the effect could not be determined with any accuracy (it could be as little as 3% or as much as 99% because of the small number of cases participating in formal swimming lessons).

There are a number of studies that directly demonstrate links between swimming lessons and reducing drowning fatalities in a developing country environment. However, these findings are not directly translatable because of significant differences in context between developing and developed countries. See box 1 for some examples of the studies conducted.

Box 1: Swimming lessons and drowning prevention in a developing country context

In a developing country context, several studies do demonstrate a link between swimming and drowning prevention. In a case-control study of 133 cases of drowning in rural China, Yang L et al., (2007) found statistically significant associations between lack of “proper swimming lessons” and drowning risk among 1-4 year old children. Evidence from Bangladesh (Rahman et al., 2012) tested the mortality rates of almost 80,000 participants in a ‘Swim Safe’ style intervention (basic swimming, water safety, and safe rescue skills for children aged 4 to 12 years) versus a matched control group and found a lower risk of mortality among swim safe participants (although this was subject to self-selection bias, cross contamination and lack of randomisation).

The lack of evidence in a developed-world context is reflective of the relatively small number of drownings, lack of data, and methodological challenges in linking swimming lessons to drowning fatalities. Again, significant conceptual limitations are present in examining evidence of this type which we now go on to discuss.

Limitations

The number of studies that directly link actual rates of drowning with measures of swimming (reported and using swimming lessons as a proxy) are severely limited for a number of reasons.

The emphasis of pedagogical practice in swimming lessons (in high income countries) tends to be on stroke development, often to the detriment of a wider set of safety skills such as survival floating, treading water, and resting strokes (Quan et al., 2015). This has not always been the case; over time swimming lessons have gradually shifted from drowning prevention toward stroke development for recreational and competitive activities (Quan et al., 2015). The issue, conceptually, is that a lack of emphasis on survival and water safety within formal lessons means that their use as a proxy for underlying swimming ability is limited, and therefore associations with rates of drowning somewhat meaningless.

Some experts advocate that the primary goal of swimming lessons should be drowning prevention (Stallman, June and Blixit, 2008) and several attempts have been made to define the optimal set of motor skills to minimise the risk of drowning. The American Red Cross (Quan et al., 2015) developed an operational definition of the psychomotor skills required to be competent in drowning situations, following consultation with US and international organisations and other key informants. Stallman et al., (2008) develop a model of teaching swimming derived from the causes of drowning. The authors surveyed drowning reports, interviewed drowning survivors, and observed simulated drowning victims alongside reviewing swimming programmes from 18 different nations. The authors establish 8 key skills following establishment of three key principles. The set of skills promoted by both of these authors is shown in

Figure 4.

Figure 4: Operational definitions of water competence

American Red Cross (2015)	Stallman et al (2008)
<ul style="list-style-type: none"> ○ Entry with total submersion; ○ Recovery to the surface and float or tread for at least 1 min ○ Turn 360° and orient toward an exit point ○ Level off and move on front and/or on back position for at least 25 yards; ○ Exit from the water 	<ul style="list-style-type: none"> ○ Entry (i.e., jump or dive) into deep water ○ Upon submersion, regain surface, level off and swim ○ Surface dive and swim underwater with comfort ○ Acquisition of at least two rudimentary strokes, one on the front, one on the back ○ Breathe in a relaxed way and in a manner coordinated to the demands of the stroke ○ Change body position in the water (i.e., roll over from front to back and back to front) ○ Change direction of travel (i.e., turn left and right both on front and back) ○ Remain afloat

As a result of the emphasis on stroke development, swimming ability is frequently evaluated in terms of distance swum, stroke used and time taken (Brenner et al., 2006) and almost exclusively in stable pool conditions. This presents issues within the context of drowning prevention where the influence of currents, tides, and temperature mean that measuring swimming ability in these terms is not likely to reflect the realities of a drowning situation.

Open water conditions often mean that skills learnt in pool environments are diminished. Kjendlie et al., (2013) test the transfer of swimming skills from indoor, calm conditions to outdoor environments. The study examines the differences in swimming, floating and entry skills of a group of 11-year old children (n=66) in calm versus simulated open water environments (by means of a wave machine). Children were tested in a 200m time trial and results suggest that performance was 8% lower in open water compared to calm conditions. Children were also tested on floating, diving and rolling skills and had decrements of 16%, 21% and 24% respectively. Other contextual realities of drowning situations mean that traditional notions of ‘can swim’ may be inaccurate. Among a group of physical education students, Moran (2012) compares water proficiency (25m sprint, 5-minute swim and 5 minute float) while wearing swimwear vis-à-vis clothing. Wearing the latter significantly reduced swim speed (33%), and swim endurance (28%) although no deterioration in floating ability was noted. Furthermore, Connolly (2014a) posits that pool-only swimmers are at greater risk of drowning than frequent open water swimmers and advocates that the provision of more information on responses to cold water shock in particular are welcome.

Culturally, swimming ability is often thought of in binary terms. People often say “Yes, I can swim” or “No I can’t swim” (Langendorfer, 2011); or say that they are a strong swimmer or a weak swimmer. Defining swimming competence in these terms doesn’t account for the wider range of contextual, environmental, and personal dynamics which mean that ‘strong swimmers’ can still drown. Following water competence-based constructs, scholars are going further in advocating the view that “swimming skill or competence is not a static or permanent capacity possessed by any individual” (Langendorfer, 2011). It is rather a ‘dynamical’ construct or an “emergent or potentially transient systemic behaviour” that is a function of interactions between individual characteristics (e.g body mass, fitness, stroke efficiency), perceived goals, and environmental factors (e.g. water temperature, current, water conditions) (Langendorfer, 2011). This puts further doubt on the use of reported binary and proxy measures of swimming skill in our understanding of the role of swimming skills in a drowning prevention scenario.

There is also doubt about the validity of self or proxy-reported measures of children's swimming skill. [Mercado et al., \(2016\)](#) test such measures against observed independent assessments among children and adults. One pertinent finding was that reporting 'yes' to 'ever taken swim lessons' did not correlate with observed swim skills.

Related areas of research

Other research focuses on specific water safety messages, or swimming advice in the context of drowning prevention. [Barwood et al., \(2016\)](#) advocate the message 'float first, then kick for your life' following an accidental short-term cold water immersion. This is based on physiological testing of leg-only exercise on the symptoms of cold water shock among 17 individuals. Other authors discuss the exit problem ([Connolly, 2014b](#)), whereby swimmers are able to swim to what they think is safety but are unable to exit the water. This problem was tested among a group of 37 college-aged physical education students ([Moran, 2014](#)). The study tested their ability to exit the water under varied conditions including exit challenge (shallow water, deep water with a flush edge, deep water with a ledge), clothing (swimwear, clothing, buoyancy jacket) and task (following a 5-minute swim or while fresh). All participants were able to exit the water (shallow or deep) when not fatigued, or after a swim (wearing either a buoyancy aid or clothing). However, many failed to exit over a 0.41m ledge after swimming in clothing (35%) or in a life jacket (49%). There were gender differences in the results (males were more able to exit than females) although results suggest that males underestimated their ability to exit deep water.

Water safety knowledge

Knowledge in the context of drowning prevention can refer to localised site-specific knowledge of water conditions (currents, tidal patterns), as well generic water safety knowledge. Within this latter category, there are several ways in which such knowledge is conveyed to audiences. For younger people water safety knowledge is disseminated in the following ways:

- As part of swimming lessons (e.g. the American Red Cross Learn to Swim programmes that emphasise water safety knowledge)
- Within the classroom and educational visits (e.g. the RNLI's Outreach activities)
- Awareness campaigns (e.g. the UK's Drowning prevention week)

This review found no evidence that links efforts to increase knowledge of water safety to actual reductions in drowning. The literature focuses on intermediate measures of knowledge retention which are discussed in the next section where we consider how swimming skill training is best delivered.

The literature related more broadly to water safety knowledge has included attempts to reach consensus on open water safety messages. Many governmental and non-governmental have been concerned with promoting water safety among children and adults. This attention has led to a plethora of water safety messages, and an international taskforce on open water drowning prevention sought to consolidate this diverse range of messages into globally acceptable (non-boating related) water safety messages ([Moran et al., 2011](#) & [Quan et al., 2012](#)). The authors describe a Delphi-technique that prioritised 16 key safety messages under two themes based on expert consensus, best practice and literature (see

Figure 5).

Figure 5: Key open water safety messages

Keeping yourself safe:	Keeping others safe:
<ul style="list-style-type: none"> ○ Learn swimming and water safety survival skills ○ Always swim with others ○ Obey all safety signs and warning flags ○ Never go in the water after drinking alcohol ○ Know how and when to use a life jacket ○ Swim in areas with lifeguards ○ Know the weather and water conditions before getting in the water ○ Always enter shallow and unknown water feet first 	<ul style="list-style-type: none"> ○ Learn swimming and water safety survival skills ○ Swim in areas with lifeguards ○ Set water safety rules ○ Always provide close and constant attention to children you are supervising in or near water ○ Know how and when to use a life jacket, especially for children and weak swimmers ○ Learn first aid and CPR ○ Learn safe ways of rescuing others without putting yourself in danger ○ Obey all safety signs and warning flags

Affective dispositions

Affective dispositions include the attitudes and perceptions that help to prevent drowning scenarios (such as risk aversion, perceptions of swimming ability, etc.). We found no studies that specifically linked measures of affective disposition with risk of drowning. Instead, the literature focuses on issues around supervision, misperceptions of in-water competence and attitudes to risk.

Supervision

Several studies argue that involvement in formal swimming lessons can lead to overconfidence and misinterpretation of child swimming ability by parents, carers and supervisors. This leads to a lack of adequate supervision which is associated with increased risk of drowning among children.

Research from the UK and internationally tells us that supervision plays a pertinent role in fatal drowning incidents. Research commissioned by the RNLI suggests that lack of supervision was a factor in drowning fatalities between 2010 and 2013, noting that fatalities that occurred under while supervision decreasing with age (Greenstreet Berman, 2014). Historically, Kemp and Sibert (1992) examined drowning and near-drowning incidents among children aged under 15 using British Paediatric Surveillance Unit data between 1988 and 1989. Mortality was higher in open water locations (78%) and lower in pools (6%). Most of the children (83%) were unsupervised at the time.

Evidence from other countries also suggests the link between supervisory practices and drowning. In Australia, insufficient supervision was a factor in 72% of unintentional drownings between 2000 and 2009 (Petrass et al., 2011a). In a national study of childhood drowning behaviours, Cody et al., (2004) obtained data from child death review teams across 17 US states. They obtained a nationally representative sample (n=496, 89% of all accidental drowning fatalities) and found 88% of children, aged 14 and under, who had drowned were unsupervised at the time.

Morrongiello et al., (2013) tested parental beliefs about their 2-5 year old child's drowning risk, perception of swimming ability and supervision needs following the completion of a 10-week course of swimming lessons. The study compares one group of parents who receive detailed feedback against another group who received no regular feedback. Data compared included a drowning prevention beliefs questionnaire, a supervision needs in outdoor drowning risk situations questionnaire, and a swim ability checklist (which was independently assessed by swimming instructors) across two time periods. The study found that parental accuracy in assessing children's swimming ability was relatively poor (even though it improved over time); the ability of children to

keep themselves from drowning was over estimated; and that parents who had experienced a near-miss incident of drowning were more aware of drowning risks.

[Morrongiello et al., \(2014\)](#) revisited their 2013 study and increase the follow-up time period and length of intervention (addressing weaknesses in the previous study). Within a 36-week intervention delivered over an 8-month period, the earlier finding is sustained, whereby “perceived improvements in swim ability can produce the undesirable effect of parents becoming more confident that young children are capable of keeping themselves safe near water, which is unlikely at these young ages.”

[Moran and Stanley \(2006a\)](#) conducted a study with parents of children enrolled in toddler swimming lessons in the Auckland area of New Zealand. Questionnaires were completed by 555 parents across 18 swim schools and compared against a control group of 327 parents whose toddlers were not enrolled in swimming lessons (constructed from 23 early childhood centres located in close proximity to the swim schools). A higher proportion of swim school parents thought that swimming lessons were the best way to prevent toddler drowning (57% c.f. 47%); and it was better to develop swimming ability than to rely on adult supervision (35% c.f. 30%).

In a study focusing on Australian Toddler swimming instructors, [Blitvich et al., \(2012\)](#) surveyed 133 instructors across 35 swim schools in the Melbourne area and found that instructors believed the main outcome of toddler swimming classes was to make children safe around water. This runs contrary to key Australian water safety advocates (RLSSA and Austswim) who do not support the idea of safety as an outcome of pre-school aquatics, arguing that it perpetuates common myths among parents regarding lowered drowning risk following swimming lessons.

The literature also questions the quality of supervision practices specifically within open water locations. In a study of New Zealand beachgoers (n=865), [Moran \(2009\)](#) found worrying instances of poor supervisory behaviour including 29% of adults who did not stay close to their young children (<5) while in the water, and almost half (46%) who only watched their 5-9 year-old children from the beach instead of in the water. Males were more likely to report confidence in their own swimming ability and underestimate the risk of drowning for 5-9 year olds compared to females. There was also some evidence that males had a greater tendency to believe that supervision was the responsibility of others (e.g. lifeguards) compared to females (28% c.f. 19%).

[Moran \(2010\)](#) supplements self-reported measures of behaviour with observations of child supervision in a beach setting. Among a total of 544 observations, one quarter of children (24%) were not considered to be adequately supervised. Of the 130 care givers failing in their supervisory duties, just under a third were sunbathing (30%), just over a quarter talked to others (28%), and a further quarter (27%) were using mobile phones.

Combining observation and self-reported measure of supervisory practices, [Petrass et al., \(2011b\)](#) observed children (aged between 1 and 14) engaged in play at 18 popular beach locations in Australia. 114 parent-child pairs were observed and surveyed. The authors found that over half (52%) reported direct watching of 5-9 year olds rather than supervision in the water and 17.5% of adults believed that lifeguards were best placed to supervise their children. Corroborating the findings of [Moran \(2010\)](#), this is concerning given the difficulties associated with recognition of drowning by beach lifeguards: [Harrell \(2006\)](#) reports that scanning for drowning competes with other activities; that there are deficiencies in scanning at the end of shifts; and that scanning deteriorates with lifeguard fatigue after 30 minutes. Lifeguards make assumptions based on age, commonly believing children over the age of 5 are less at-risk than younger swimmers. Lack of

teamwork between groups of lifeguards are also said to lead to deficiencies in scanning regimes. The experience levels of lifeguards also play a role in detection rates. [Page et al., \(2011\)](#) found that experienced lifeguards are five times more likely to detect drowning compared to inexperienced lifeguards.

Perceptions of competence and estimation of risk

Another area of inquiry concerning the affective dispositions in the context of drowning prevention has been around perceptions of competence and estimation of risk.

Gender

[Gulliver and Begg \(2005\)](#) interviewed young adults (aged 21), participants of the Dunedin Multidisciplinary Health and Development Study, about their usual water-related behaviour and incidence of near-drowning. The authors found that males reported a higher exposure to risk behaviours, greater water confidence, exposure to unsafe locations and more near drowning incidents compared to females.

In a survey of over 3,000 adult beachgoers, [McCool et al., \(2008\)](#) found that young people and males were more likely to self-report strong swimming skill, swim in at-risk locations and had a lower perception of drowning risk although the study was subject to some methodological limitations (including a focus on weekends only, and use of self-reported measures).

[Moran \(2011\)](#) reports analysis of the 2003 New Zealand Water Safety survey and found that males (n=1,171) are significantly more likely than females (n=1,031) to engage in unsafe swimming behaviours (ignored safety directions, swum alone, dived into unknown depth, swum unsupervised, swum after alcohol/drugs, swum in prohibited area, swum when cold/tired, swum outside patrol area and dived into shallow water).

Within the ‘can you swim?’ international research project, [Moran et al., \(2012\)](#) investigated self-estimated versus actual water competence, alongside risk perception, among 373 collegiate physical education students from four countries (Norway, Australia, New Zealand and Japan). The authors found a weak correlation between perceived and actual swimming ability, although no significant differences were found between males and females – contrary to findings elsewhere in the literature. Findings for individual countries have been reported separately in addition (e.g. see [Petrass et al., \(2012\)](#) for findings related to Ballarat, Australia)

[Morgan et al., \(2009\)](#) examined gender differences in self-reported water and drowning risk exposure at surf beaches. The authors surveyed 406 surf-beach bathers and reported that males are more frequent visitors to surf beaches, spent longer in (deeper) water, did so alone, and were more likely to consume alcohol. Males had greater confidence in identifying rip currents and their ability to return to shore, suggesting male overconfidence leading to underestimation of risk.

Distance perception and public awareness

Among a group of physical education university students (n=21), [Button et al., \(2016\)](#) investigated distance perception in an open water environment. The group generally underestimated distances over open water, particularly at shorter distances (<400m) where over half of participants underestimated the distance (59%).

In the UK, recent opportunistic research was undertaken into public perceptions of rip currents ([Gallop et al., 2016](#)). In a survey of 187 adults and children, authors reported knowledge and

awareness of the dangers of rip currents, where they occur and how to escape rip currents was high. However, there were some worrying misconceptions found in the results; only 11% knew why rip tides were dangerous (because of panic), with 44% incorrectly saying that currents 'suck you under', frequently using the incorrect term 'undertow'. Although respondents knew the theory of identifying a rip current, on a practical test 40% chose the rip current as the safest place to swim.

Ethnicity, Cultural influences and international travellers

[Golob et al \(2013\)](#), review the literature on ethnic influences on drowning. Authors report that while drowning statistics are not systematically recorded in many countries by ethnicity, there is growing evidence that there is some association between ethnic and racial minorities and drowning, drawing on evidence from the USA, Australia, New Zealand and The Netherlands ([Golob et al., 2013](#)). The authors state that "unintentional drowning rates are not equal across ethnic and racial population groups, and that ethnic and racial minority group members have higher drowning rates in comparison with a nation's population as a whole." They suggest that sociocultural factors influence this trend, citing reduced opportunity to acquire swimming and water safety skills and the influence of culture and belief in shaping behaviour in and around the water. This poses questions for water safety programmes, who may not always account for these social or cultural differences in designing and delivering interventions.

Among young people, [Gilchrist and Parker, \(2014\)](#) examine drowning rates among people aged under 29 in the US between 1999 and 2010. The authors find (excluding Hispanics) the overall drowning rate for American Indians/Alaska Natives (AI/AN) was twice the rate for whites, and the rate for blacks was 1.4 times the rate for whites.

The movement of people, in light of the above evidence, presents challenges to particular countries where there might be regular migration or influxes of migrants. [Moran and Willcox \(2013\)](#) survey 'new arrivals to New Zealand (n=570) and find that 43% had never participated in aquatic recreation previously but now over 70% took part in aquatic recreation. Just under half reported they had not been taught to swim (47%) and over three fifths had never received any water safety education (63%).

Another at-risk group explored in the literature are international visitors, with the risk of drowning borne from lack of knowledge of local conditions and understanding of safety instructions (e.g. signage). For example [Peden et al. \(2016\)](#) find that the incidence of drowning for international travellers among all Australian fatalities between 2002 and 2012 was 4.3% (123 / 2870 drowning fatalities).

What methods best deliver swimming skills?

Set against the construct of water competence, we examine the evidence around interventions that have sought to increase aquatic motor skills, water safety knowledge and affective dispositions (perception and risk) with a view to reducing drowning. We also present results from a search of programmes and initiatives that seek to promote water safety messages within an open water environment.

Findings from the academic literature

In a recent study from 2014, [Petrass and Blitvich \(2014\)](#) measured swimming, water safety knowledge and attitudes of 132 young Australian adults and formally tested their practical swimming ability. Participants were re-measured following a 12-week swimming and water safety intervention program. The intervention combined personal swimming, survival and rescue skills along with water safety knowledge applicable to variable aquatic contexts. Pedagogically, the intervention involved participative learning where students exchanged ideas in small groups, engaged in discussion, and took responsibility for their own learning. Students attended two one-hour sessions per week, one focusing on practical aspects and the other regarding theoretical aspects.

While the authors found low levels of water safety knowledge pre-intervention, the intervention significantly changed participant knowledge and swimming ability. In terms of changes in swimming ability, there were no statistically significant differences between male and female participants which contrasts with other research (already referenced) which points to established male overestimation of swimming.

Measures related to attitudes did not change as a result of the intervention. These were measured by way of a 5-point Likert scale against series of 12 attitude statements (e.g. 'it's safe to swim following consumption of alcohol'). No statistically significant difference between pre and post intervention attitudes was detected.

One pertinent finding from this study was that previous participation in formal swimming lessons (and/or swimming in the school curriculum) at a young age had no significant impact on water safety knowledge in young adults. This suggests that the knowledge gained in such early lessons is not carried into young adulthood.

Limitations of the study included the fact that the programme was delivered as part of university studies, meaning motivation to perform might be higher compared with the general population of young adults, as well as being a group with likely above average levels of activity. Findings may not transfer to the general population as a result.

In a systematic review of interventions associated with drowning prevention in children and adolescents, only two studies using swimming lessons and water safety were included ([Wallis et al., 2015](#)). One study was authored by [Asher et al., \(1995\)](#), who investigated the differences between two cohorts of pre-school children (aged 24 – 42 months) who received swimming and water safety instruction for either 8 or 12 weeks (Seattle, USA) in a pool setting. The intervention included three aspects: out of water safety behaviour; swimming ability; and in-water safety skills. Using a randomised design, with survey instruments repeated across four time periods, the researchers measured swimming ability, deck behaviour, water recovery, and swimming to the side after jumping into the pool. Both groups demonstrated increased swimming ability across the course of lessons,

and improvements in two water safety skills. The study used simulated instances of drowning (falling into a pool) which do not account for the significant conditions of an open water environment.

The other study in the [Wallis et al., \(2015\)](#) review was a US study by [Gresham et al., \(2001\)](#). Targeting 6-9 year-olds, the Think First for Kids (TFFK) program aimed to increase water safety knowledge among a broader set of safety concerns (e.g. motor vehicle crashes, sports, falls). Teachers and school nurses delivered the intervention over a 6-week period. The TFFK curriculum integrated maths, literacy and science objectives with the safety component (violence prevention, gun safety and conflict resolution; playground, recreation and sports safety; bicycle safety; water safety; vehicle and pedestrian safety; and the anatomy and function of the brain and spinal cord). The intervention was tested using a Randomised Control Trial (RCT) methodology among 15 schools (8 intervention; 7 control) on a range of self-reported pre and post-test surveys. Water safety assessment included knowledge of safety rules; awareness of preventing water-related injury and drowning; and individual responsibility in prevention. The study found that water safety knowledge improved from pre to post-intervention (statistically significant improvements in water safety measures across all grades of the study). The limitations included a focus on self-reported rather than observed behaviour change; and that the post-test completed shortly after end of intervention and therefore longer-term outcomes not known/whether sustained.

In a more recent study from Greece, [Terzidis A et al., \(2007\)](#) implemented a school-based systematic water safety education programme among 5-15 year olds. A baseline questionnaire was distributed to three grade categories (n=759, adjusted for age-specific cognitive differences) that assessed knowledge and attitudes with regard to water safety and drowning prevention. An educational package was then presented to a sub-set of schools (matched against another school with similar demographic characteristics). The study found that kindergarten/first grade pupils in intervention schools scored significantly higher than control schools. Knowledge increases were less evident among elementary school pupils, and high school pupils showed no improved in knowledge and minimal increase in attitudes. This suggests that very young pupils were more receptive of water safety knowledge being delivered in a classroom, compared to older pupils with the caveats of the following limitations of the study (self-reported information; and evaluation conducted close to intervention completing).

Other studies have focused on specific target groups of pupils. In an Australian study aimed at 5-14 year olds and parents, [Beattie et al., \(2008\)](#) evaluated the Water Safety in the Bush programme. The study aimed to assess the effectiveness of community-tailored and swimming and life-saving programmes in remote Australia but were hampered by a low-response and over-reliance on parental opinions (which other research shows can be biased) and a lack of systematic evidence collection on swimming ability using standardised measures.

In a US based study, [Lawson et al., \(2012\)](#) evaluated a water safety curriculum in a low-income, minority focused, urban youth summer camp. Targeting pre-kindergarten and third grade students (n=166), the *Danger Rangers Water Safety Curriculum* was delivered daily for 4 hours over 1 week of a 6-week programme with different curricula for each age-group. In a pre/post design (at an interval of 3-weeks post intervention) parents had provided baseline information on their child's swimming ability, use of sunscreen, history of swimming lessons, and prior clinic/hospital visits for near drowning. Participants were administered pre-test on the first day to assess general baseline knowledge of water safety. Three weeks after the post-test a retention test was completed to see if participants had retained their water safety knowledge. Parents were also asked at the end of water-

safety week to recount observations of their child's interest in water safety and *Danger Rangers*. The participants were 50% male, 27.5% Hispanic, 68.7% African American, and 3.8% bi-racial. Children were divided into three groups (pre-K/kindergarten, first and second grade, and third grade) and each group saw significantly higher knowledge scores at the post-test ($p = .0097$, $p < .0001$, and $p < .0001$, respectively), with minimal decline in scores at the 3-week retention exam. Similar results were seen in students' ability to list safety rules. The study demonstrated that children possessed more knowledge of water safety after receiving this curriculum and that the increase was maintained over a period of three weeks. The limitations of the study included the pre-test being too easy for the pre-K/kindergarten groups therefore affecting results; and being overly focused on knowledge, rather than change in behaviours as well as a reliance on self-reported measures. Overall, this provides some evidence of the programme impacting positively on pupil's knowledge of water safety but limited information on how this translates to behaviour change; also no information on which elements of the curriculum/intervention were the most successful in terms of yielding the greatest impact.

Research discussed earlier in this review outlines the importance of parents to water safety (through providing adequate supervision). [Moran and Stanley, \(2006b\)](#) developed a 10-week parental education programme in conjunction with toddler (2-4 year old) swimming lessons in Auckland, New Zealand. In a pre/post design, the authors tested parental knowledge and beliefs and found statistically significant improvements in knowledge of the most common sites for toddler drownings; that toddlers required more, not less supervision after swimming lessons; and more participants disagreed that swimming lessons were the best way to prevent toddler drownings.

Desk research into interventions

We investigated the focus, delivery models, and evidence of effectiveness for interventions that are routinely conducted and closely relate to the Swim Safe delivery model. A table of findings and links is located in Appendix B. From our analysis of this data we conclude that:

- Most of the interventions delivered in this space are from Australia and New Zealand. We found no comparable examples anywhere else. In the case of the US, our consultations with leading academic figures in the drowning prevention world told us that the US was less focused on practical experiential-based instruction and water safety knowledge delivery
- No robust evaluation evidence exists in support of the approaches and models delivered elsewhere. Where information does exist, it focuses on volumetric measures (one intervention) and is limited by sample size (one intervention)

How do other countries approach this issue?

There have been attempts internationally to collectively work together to reduce drowning. This includes the World Health Organisation's world drowning report which sets out 10 key actions across both developed and developing countries to better prevent drowning ([World Health Organization, 2014](#)). In addition, efforts have been made by the International Lifesaving Federation (ILF) and the American Red Cross to provide a framework for drowning prevention efforts. The drowning chain/cycle of survival is one such framework. It outlines the four main factors that can independently lead to a drowning fatality ([International Lifesaving Federation, 2015](#)). These are:

- Lack of knowledge, disregard or misjudgement of the hazard
- Uninformed, unprotected or unrestricted access to the hazard
- Lack of supervision or surveillance; and
- An inability to cope once in difficulty

All four of these factors feature in the strategic and legislative approaches to drowning prevention in Australia, Canada, New Zealand and the USA. In this section, we review policy approaches to drowning prevention across these four English-speaking high income countries and outline approaches in the UK and Ireland, before drawing comparisons and conclusions.

Australia

Of the four countries in our review, Australia has developed the most comprehensive policy response to drowning prevention. In the Australian Water Safety Strategy 2016-2020, there is ministerial level support for drowning prevention efforts providing a framework for the whole nation to follow ([Australian Water Safety Council, 2016](#)).

The strategy aims to effect an overarching reduction in drowning deaths of 50% between 2016 and 2020. It recognises three key drivers for drowning reduction:

- A life-stages approach (recognising that certain age-groups are susceptible to different drowning risk and suit different intervention approaches);
- Targeting high-risk populations (inland waterways, beaches, strengthening the aquatic industry); and
- Focusing on key drowning challenges (such as alcohol and drugs, high risk populations, disaster and extreme weather, as well as boating, water craft and recreational aquatic activities)

The strategy acknowledges the often under-emphasised importance of near-fatal drownings, and aims to reduce non-fatal as well as fatal drowning incidents. Estimates in the report suggest that, in Australia, non-fatal drowning has a high incidence with 1 fatal drowning for every 1.8 near-fatal drownings. There are significant neurological impairments that can result from near-fatal drownings, presenting traumatic experiences both for victims and their families alongside impacts on wider health and social care services.

The strategy is based on seven pillars (activities which contribute to drowning prevention) of which education is one. Education mechanisms that are reinforced throughout the strategy include key life stages, parents, school education, vocational training, and public awareness. Other pillars include the need for advocacy, collaboration, and evidence-based research related to epidemiology, risk and monitoring and evaluation. There is recognition of the importance of safe venues (supervision,

signage, physical barriers and public rescue equipment) alongside a skilled and passionate drowning prevention workforce. Policy should be evidence-based and adequately communicated and enforced (e.g. pool legislation).

While education forms as integral part of all the strategy areas, we focus on prevention activities based on age, as per the terms of this literature review. Figure 6 details the planned measures to reduce drowning prevalence among 0-4, 5-14 and 15-24 year olds.

For the 0-4 age group, there is a focus on legislative measures, resuscitation, and adult supervision to prevent drowning. The focus for the 5-14 age group is clearly on swimming skills and water-safety education including formal systems to track and evaluate survival skills. For 15-24 year olds, the focus shifts to targeting based on risk-taking behaviours, while still recognising the role of education programmes and the need for more research to understand risk factors and measurement of effectiveness.

Figure 6: Australian Drowning Prevention Strategy - Life-course approach for children and young people

Key objectives 0-4	Key objectives 5-14	Key objectives 15-24
<ul style="list-style-type: none"> ○ Strengthen child drowning prevention programs that raise awareness of the importance of adult supervision, pool fencing, water familiarisation and CPR ○ Increase local and state government-based systems that ensure compliance and enforcement of pool fencing ○ Promote community-wide rescue and resuscitation skills ○ Focus attention on the full burden of children drowning, including non-fatal drowning ○ Promote secure safe play areas 	<ul style="list-style-type: none"> ○ Promote compulsory swimming and water safety education for school-aged children to parents, schools, industry and policy makers ○ Create and evaluate systems to benchmark children's survival swimming skills 	<ul style="list-style-type: none"> ○ Target risk-taking behaviours in young people, particularly the use of alcohol and other drugs while boating or swimming in unpatrolled beaches, rivers and backyard swimming pools ○ Promote participation in lifesaving education programs during secondary school years and through community groups working with young people ○ Continue to conduct research into the underlying risk factors for drowning and measure the effectiveness of programs targeting drowning prevention in young people

The concept of survival swimming has gained traction in Australia. Similar to the notion of water competence (discussed earlier in this review), the principal organisations involved in the training of swimming instruction (Austswim and Swim Australia) are obliged to include water safety within their entry level training courses. This adheres to, and goes beyond, the requirements of Service Skills Australia's Sport, Fitness and Recreation Training Package ([Service Skills Australia, 2015](#)) which sets minimum standards around:

- Instruction of water familiarisation, buoyancy and mobility skills
- Instruction of water safety and survival skills
- Instruction of swimming strokes
- Performing basic water rescues

Notwithstanding the contribution of workforce reform in the shape of national sector standards, there are still ways to go to reduce rates of drowning particularly as drowning is such a multi-faceted issue. Contributing to the educational aspects of the national water safety strategy, the Royal Life Saving Society Australia (RLSSA) has produced an education-specific issues research paper that presents an evidence-based view of how to best ensure that every child receives an adequate swimming and water safety education (Royal Life Saving Society Australia, 2012).

In this approach, the authors argue for change based on evidence of the gaps in swimming and water safety provision in Australia. RLSSA proposes that the national swimming and water safety standard (Level 4 of the Swim and Survive Programme) be developed and be achieved by all Australian children by the end of primary school. This is shown in Figure 7 alongside the key actions needed for it to be successful.

Figure 7: Proposed swimming & water safety standard and selected actions to deliver the standard

Proposed swimming & water safety standard	<ul style="list-style-type: none"> ○ Swim 50m continuous freestyle with correct/ efficient technique ○ Swim 25m continuous survival stroke of any nature (breaststroke, backstroke or sidestroke) ○ Float for 2 minutes ○ Perform a survival sequence dressed in swimwear, shorts and a t-shirt ○ Scull, float or tread water for 2 minutes 	<ul style="list-style-type: none"> ○ Swim slowly for 3 minutes changing survival strokes each minute ○ Throw a rescue flotation aid to a partner at 5 metres distance and instruct the partner to kick to the edge ○ Answer questions about dangers in different aquatic environments
Key actions (selected)	<ul style="list-style-type: none"> ○ Strengthen an integrated approach to swimming and water safety education including promoting the importance of water-safety based programmes; adding structure and consistency to water safety; and lobby for re-inclusion of swimming and water safety in primary school curriculum ○ Improve access to children from all backgrounds ○ Develop capacity of the workforce through increasing number of teachers who hold swimming and water safety qualifications, improve access to resources, and increase availability in remote and rural areas; ○ Strengthen capacity of the private sector to provide swimming and water safety education through: research; public private models of delivery; and facilitating collaboration between private sector and school based learning ○ Enhance capability for review of swimming and water safety education through expansion of RSSLA benchmarking programme; and exploring a national benchmarking certificate ○ Increasing understanding among parents of their role in water safety through: research; promotional and instruction materials and the development of programmes 	

Note: Excluded from this table is work around advocacy and influencing, positive discrimination in the workforce, and strengthening the role of the aquatics industry

This strategy is however currently at odds with reality; there has been a diminished value and place for aquatics within the Australian Health and Physical Education curriculum and this is causing concern for efforts to prevent drowning (Lynch, 2015).

There have been attempts in Australia to integrate swimming lessons including water safety within initial teacher education (ITE) programmes (Lynch, 2014). In a collaborative partnership model, ITE students gain practical experience of swimming tuition gaining accreditation with the Australian Swimming Coaches and Teachers Association. The programme was able to target children with non-swimming backgrounds who may have ordinarily been excluded from learn-to-swim programmes (consultation with the author).

Canada

This review found no established national strategy for drowning prevention for Canada, although a recent consultation on the content of/interest in establishing a national level framework is underway (Canadian Drowning Prevention Coalition, 2016).

Efforts in Canada seem to revolve around two key activities undertaken at the provincial level: building an evidence-base, surveillance and monitoring of the drowning issue; and advocating change to reduce drowning incidence through provincial Child Death Review (CDR) Panels. Individual provinces routinely collect data on incidents (based on coroner's data) and regularly analyse epidemiological and risk factors related to drowning (ref). Building on this, CDRs investigate the circumstances of child deaths and make public health recommendations based on findings. Ontario provides an example of strategy development taken within CDRs and advocates stronger messaging to youth aged 15 to 18, messaging to parents (mainly regarding supervision) and establishing a byelaw to establish four-sided pool fencing (British Columbia Coroners Service Child Death Review Panel, 2014).

The one exception to this is the case of Manitoba, where a coalition of organisations in the region have recently published a drowning prevention strategy (2015-20). It takes an approach of targeting particular high-risk groups including toddlers (age 1-4), boaters, aboriginals, men (18-24 and 65+), and newcomers to Canada. The activities (strategic pillars) that take place in delivering intervention to these groups include leadership and policy development; surveillance, research and evaluation; and capacity building through awareness, education and training (Manitoba Coalition for Safer Waters, 2015).

New Zealand

In New Zealand, Water Safe is the national umbrella body responsible for water safety and drowning prevention and has been since its establishment in 1949. Water Safe New Zealand recently published a Water Safety Sector Strategy (2020) which aims to reduce drowning to zero (Water Safety New Zealand, 2015).

The strategy advocates that every New Zealander should have the opportunity to develop water safety knowledge and survival skills. It targets males and parental knowledge and attitudes (personal responsibility) in particular, and sets out a number of specific targets to achieve this: reducing drowning deaths from 77 to 50; hospitalisations from 172 to 100 or fewer; male drowning deaths are halved; preschool drownings reduce from 6 to 0. It proposes the following strategic actions:

- Implement a sector policy agenda that identifies assets, strengths, and development needs to improve sector effectiveness. Sector policy uses data and research to understand the problem and establishes agreed positions for key issues to underpin consistent policies and resources
- Implement a national engagement and communications strategy. The vision is for a connected sector that shares information, leverages collaborative action and encourages thought leadership.

New partners are engaged alongside sector media, advocacy and communications efforts to build public and political support for water safety.

- Implement a plan to ensure development of water safety knowledge and survival skills for every new Zealander and the development of national standards
- Implement prevention, education and awareness programmes that target males and parents focused on achieving attitudinal and behavioural change
- Resource and allocate exiting preventative and rescue assets and training according to their greatest impact, and obtain additional resources and allocate to initiatives with greatest impact

While not yet updated in line with the revised overarching sector strategy, Water Safe New Zealand have published further detail specifically in terms of education through its Water Safety Education Framework ([Water Safety New Zealand, 2008](#)).

The focus of the framework is on building knowledge, skills, attitudes and behaviours to be safe in or around water. It provides a coordinated, education-based structure to develop national water safety initiatives and campaigns. It uses evidence including best practice and research in the development of initiatives and in monitoring and evaluation efforts.

The document recognises water safety as a continuum that includes a wider set of considerations than swimming skills alone, and emphasises that competence is dynamic and can vary by activity and environment. Reflective of notions of water competence and wider preventative measures, the framework consists of six 'essential elements of water safety' (supervision; knowledge and skills; attitudes and behaviour; equipment; environment; critical decision making and risk management) and proposes a set of competencies against each to measure an individual's overall level of water safety competence.

The framework also references the cultural significance of water to the Maori, and highlights that drowning rates are still high among that group and advocates targeting of water safety education. The framework emphasises the importance of culturally-sensitive provision given the multi-cultural nature of New Zealand as well as advocating targeting of other high-risk groups and scenarios (on the basis of demographics, aquatic environment, activity, attitude e.g. alcohol, behaviours – supervision of children under 5).

Water safety and swimming is included in the New Zealand curriculum, in that "it is expected that all students will have had opportunities to learn basic aquatics skills by the end of year 6" ([New Zealand Ministry of Education, 2016](#)). This requirement however does not explicitly account for the important concepts of water competence and there are reported to be significant issues around funding that mean that schools aren't always able to deliver ([Robertson, 2010](#)).

Water Safe NZ comprises both national activity-based organisations (swimming, yachting, boating etc), government (police), non-profit organisations (many of whom are youth focused) and a regional organisation concerned with drowning prevention (Water Safe Auckland).

Swimming New Zealand is the principal organisation offering swim instructor education in New Zealand. Their entry level programme (Swimming New Zealand Swim Teacher Award (SNZ STA)) reflects the requirements of the National Certificate in Recreation and Sport - Aquatics (Swim Education) Level 3, which includes water safety components. Water safety is featured in the highest level of certification available through Swimming New Zealand (Diploma in Swim teaching) but does

not appear to feature in mid-level certification (Swimming New Zealand Swim Teacher Award (SNZ STA)) which focuses more on stroke development.

USA

In the USA, there is no overarching strategy for drowning prevention. Only relatively recently have organisations come together to collaborate on issues related to drowning prevention. Earlier this year (May 2016), Water Safety USA launched as a coalition of leading organisations that promote water safety including the American Academy of Pediatrics, American Red Cross, Centers for Disease Control and Prevention, US Coast Guard and the United States Lifesaving Association, among others (Water Safety USA, 2016).

One of the main activities of Water Safety USA is to select a water safety topic each year and coordinate messaging efforts around that topic, usually in spring prior to the busy summer season. Other activities include identifying 'evidence-based strategies to promote water safety and to promote the collection and analysis of reliable, standardised data to assist in development and more effective targeting of prevention programs and strategies'.

Within swimming curricula, drowning prevention features heavily in the programmes of the American Red Cross (according to US experts consulted). In its learn-to-swim programme, every level includes training in basic water safety and helping others in an emergency, alongside stroke development as advertised on the Red Cross programmes website: www.redcross.org/take-a-class/swimming

Consultation with experts also told us that, in the case of Washington State, a focus of prevention efforts had been in legislating for the wearing of Life Preservers. There is legislation in force governing pool fencing and signage across many jurisdictions across the US, but these vary at a state or local level with differing requirements for private and public pools. Federal legislation mainly extends to the Virginia Graeme Baker Pool and Spa Safety Act 2007 which governs pool and hot tub drain cover requirements.

United Kingdom

As noted in the context section of this report, the UK's National Water Safety Forum published a UK Drowning Prevention Strategy in 2014 bringing together key organisations with a strong interest in reducing water-related fatalities (National Water Safety Forum, 2015).

The strategy advocates a partnership approach to "reducing accidental drowning fatalities" through ensuring consistent guidance for the safe enjoyment and management of activities in, and around, the water. The aim is to reduce 'accidental drowning fatalities' by 50% by 2026, and reduce risk amongst the highest risk populations, groups and communities. The strategy identifies certain groups, geographies and environments where there is an increased risk of drowning. This includes:

- Wales and Scotland carry a disproportionate burden of water-related deaths compared with England and Northern Ireland
- Fatal incidents tend to cluster in tourist and visitor hotspots
- Almost two in three fatalities (62%) occur at in-land locations, compared with one-third in coastal locations
- Through every age group, men are the most at-risk accounting for 8 in 10 deaths with a distinct peak in late childhood and early adulthood

- Drinking alcohol has been associated with 1 in 3 fatal incidents between 2010 and 2013

The following short term targets (over 36 months) have been established within the strategy:

- Every child should have the opportunity to learn to swim and receive water safety education at primary school and where required at Key Stage 3
- Every community with water risks should have a community-level risk assessment and water safety plan
- To better understand water-related self-harm
- Increase awareness of everyday risks in, on and around water
- All recreational activity organisations should have a clear strategic risk assessment and plans that address key risks.

A wide variety of water safety knowledge and survival skills are taught within established learn to swim programmes within the UK, e.g. programmes offered by the ASA and STA. The inclusion of swimming lessons and water safety within national curricula in the UK varies in each devolved nation and is open to interpretation in some cases. While in Scotland there is no requirement for swimming instruction or water safety, in England, there is a requirement to provide swimming during Key Stage 1 and Key Stage 2 (KS2) ([Department for Education, 2013](#)). In addition, the curriculum states that children should be able to:

- Swim competently, confidently and proficiently over a distance of at least 25 metres
- Use a range of strokes effectively
- Perform safe self-rescue in different water-based situations

In Northern Ireland, Pupils there is a statutory requirement for KS2 pupils to be enabled to ([Council for the Curriculum, Examinations & Assessment, 2014](#)):

- Develop basic swimming and personal survival skills
- Understand the importance of personal hygiene in relation to pool use
- Progress from using a swimming aid to developing their confidence and competence in being able to swim without the use of any aids using recognised swimming strokes.

Meanwhile the requirement in Wales at KS2 is to ([Welsh Assembly Government, 2008](#)):

- develop skills of water safety and personal survival
- swim unaided for a sustained period of time

Ireland

Ireland is distinct among the countries featured in this review, as it has a dedicated statutory body that is responsible for water safety: Irish Water Safety (IWS). IWS has been in existence since 1945 in a number of guises (as part of the Irish Red Cross, with the Department of Local Government, and within the National Safety Council) and was made an independent statutory body in 1999. IWS has responsibility for education, rescue service training, awareness campaigns, identifying high-risk groups, and work with a range of organisations to reduce drowning.

In September 2012, the IWS published its strategic development plan (2012-2017) whose mission was “through education and training, promote a stronger safety culture, attitude and behaviour for people on, in or near water” (Irish Water Safety, 2012).

The strategic development plan is built around five strategic goals, with numerous supporting objectives all delegated to a committee with IWS. The five strategic goals are as follows:

- To promote the public awareness of water safety
- The promotion of measures, including the advancement of education, related to the prevention of accidents in water
- The provision of instruction in water safety, rescue, swimming, resuscitations and recovery drills
- The promotion of efficient and standardised lifeguard services and the establishment of national standards for lifeguards, lifesaving and water safety
- Conduct our business in accordance with codes of practice and guidelines for statutory bodies

The approach is wide-ranging (e.g. relates to messaging, life-jacket use, lifeguard training, rescue services) so we only highlight education related interventions to provide comparability against other countries. Actions include:

- More children trained in open water (*Strategic goal 2, objective 2*)
- Analyse drowning statistics to identify / target at-risk groups (*Strategic goal 2, objective 5*)
- Work with government to promote awareness of water safety in all levels of the Irish educational system (*Strategic goal 2, objective 7*)
- Provide instruction in water safety, rescue, swimming and recovery drills – increased numbers in weekly classes (*Strategic goal 3, objective 9*)

Within the Irish Primary Curriculum (Government of Ireland, 1999) there is a strand of aquatics activity, including hygiene, water safety, entry to and exit from the water, buoyancy and propulsion, stroke development, water-based ball games, and understanding and appreciation of aquatics (dangers, safety, flotation among other topics).

Discussion

Concepts of water competency were recognised and promoted within proposed national standards in Australia and New Zealand, but not in the US and Canada where no national standards have been proposed.

Focus on water safety and competence has been included quite consistently in key organisations involved in learn-to-swim programmes in all four countries. However, the extent to which water safety featured in school curricula was limited. Although featured in Australia, there has been a decreased emphasis, and the requirements in New Zealand do not feature wider concepts of water competence.

Targeting of interventions to high risk populations or activities is a common feature among most countries. It is based on significant amounts of evidence that shows drowning risk or incidence is higher among certain different demographic or ethnic groups (notably males, non-white Europeans, and young adults). For example, there is evidence that black people in the US are have a higher incidence of drowning compared to white people (1.4 times higher) and that incidence leaps to 10 times higher for swimming pool drowning incidences (Gilchrist and Parker, 2014). In Canada, age-

standardised rates of drowning are significantly higher among men of Asian, African or Hispanic heritage (in Ontario living in rural areas) compared to men with European/West European heritage (Gallinger et al., 2015). In New Zealand, in a cross-sectional study of beachgoers (N = 3371) males, Maori, and 16 to 29 year olds reported higher incidences compared with other groups (McCool et al., 2009)

The differences in approach can be accounted for, in part, by the extent to which an outdoors culture thrives in particular countries. This is the case for Australia and New Zealand and is reflected in the preamble to their respective strategy documents, and may account for the increased systematic emphasis on drowning prevention.

There are commonalities with the UK approach to strategy to other countries, with an umbrella body providing a coordination effort of interested parties. While consideration of at-risk groups and the need to target interventions are included as context, the extent of specific actions (with clearly demarked responsibilities/accountability) is not a feature of UK strategy.

This contrasts with the situation in the Republic of Ireland, where there is a statutory body taking the lead on water safety. There is a clear committee structure and assignment of very specific actions under a wide-range of objectives although its clearly a benefit to have one organisation both leading and delivering efforts to prevent drowning (as it not the case in other countries).

Conclusions

In this section, we provide some concluding thoughts. In a separate **position statement** [to follow], we explore the implications of this research for the Swim Safe programme, RNLI community safety initiatives more broadly, as well as in the context of the UK drowning strategy.

Do swimming skills protect people from risk of drowning in open water?

There is limited evidence of the links between swimming skills and risk of drowning. However, we suspect that this is likely to be due to the methodological challenges of measurement, variable definitions of swimming ability, and cultural biases related to swimming, rather than a complete absence of a positive link. Key international organisations and leading academics, despite the limited evidence, still consistently recommend learning to swim and the teaching of water safety as key drowning prevention measures.

The related literature surrounding the research question also highlights some important issues:

- Supervision practices are a pertinent factor in drowning scenarios and there are important links between parental supervision practices and swimming lessons that warrant further consideration
- Certain groups systematically across most developed nations experience higher levels of drowning incidence.
- Swimming skills learnt in closed water conditions are often not transferrable to open water environments
- Proxy measures of swimming ability are likely to be biased.

What methods best deliver swimming skills?

Interventions that run on a regular, or permanent basis (as opposed to the frequent one-off interventions we found referenced in the academic literature) lack evaluation evidence extending both to issues of process and cost effectiveness, as well as the measurement of outcomes (i.e. drowning incidence).

Within the academic literature, there is evidence to show that the knowledge, awareness and objective measures of swimming skill do increase post intervention, but there is little research into how these intermediate measures related to drowning incidents, nor is there evidence of how this might be sustained or translated between different life stages. There is also evidence of positive effects on attitudes and behaviours although there are some limitations around study design, reliance on self-reported measures, and applicability to Swim Safe.

While evidence of effectiveness is not apparent in our review of programmes delivered internationally, it is nonetheless interesting to compare approaches in those countries to the approach of the Swim Safe intervention. In other programmes there tends to be a greater emphasis on targeting high risk populations, for example. There are also a number of interventions which directly involve parents within the delivery model, although there is no evidence to suggest if this has positive effects.

How do other countries approach this issue?

Alongside international collaborative effort to reduce drowning, other countries, notably Australia and New Zealand, are more comprehensive in their approach to drowning prevention. Both

countries have overarching, evidence-based strategies, that seek to bring together interested parties to reduce the drowning threat. In the US and Canada, the approach is focused more on messaging with collaborative efforts only just taking off.

The extent to which school curricula feature water safety and a broader definition of swimming skills is limited or absent in all four countries we researched. Notable also in approach, is the extent to which all four countries systematically target at-risk populations based on evidence.

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Appendix A: Consultees

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Appendix B: Intervention Research

Little Lifesavers

Organisation	Surf Lifesaving Australia
Target age group	5-13 years
Aims and objectives	Build confidence in the water and teach children how to be safe
Delivery model	Use of games/educational activities delivered by trained lifesavers. States that they will be introduced to board paddling, wading, dolphin diving, beach sprints and flags as well as some rescue techniques, patient care, CPR.
Evidence of effectiveness	No evaluation evidence
Costs/VFM/Wider legacy/economic value	\$110 (4 day programme); \$130 (5 day programme)
Sources	http://lifesaving.com.au/littlelifesavers/

On the Same Wave

Organisation	Surf Lifesaving Australia
Target age group	Does not specify age
Aims and objectives	Aims to reduce beach fatalities and injuries amongst Queensland's migrant and refugee population. Further aims to achieve greater harmony between all beach users and promote a culture that the beach is there to share. It further aims to develop inclusive practices within the SLSA and individual life saving clubs to more effectively recruit members from a broader population demographic
Delivery model	Education workshops at school' breach education classes featuring trained lifesavers and lifeguards; information sessions for migrants and refugees; promotion of surf safety messages at community events and festivals
Evidence of effectiveness	Some evidence from 2006 but listed metrics/evidence are more outputs/process outcomes e.g. OTSW program outreach involving 46 schools and community groups visited, 819 lifesaving awards gained (including surf awareness awards, Bronze medallions, resuscitation and first aid awards), and 1754 students participating in surf education sessions. No evidence on actual effectiveness of the programme on the migrant/refugee population
Costs/VFM/Wider legacy/economic value	Not available
Sources	http://ilsf.org/drowning-prevention/library/embracing-cultural-diversity-

	within-surf-life-saving-australia
<i>CALD BeachSAFE Program</i>	
Organisation	Surf Lifesaving Australia
Target age group	Aimed at those from multi-cultural/CALD background - no specific age range given
Aims and objectives	Aims to provide information on wave types, rip currents, sea creatures and lifesavers
Delivery model	Aims to develop skills through fun activities including board riding, surf negotiation, swimming and beach activities 1 x 2 hour session (1 hour classroom based presentation and 1 hour beach based activities) - can also be customised to the group
Evidence of effectiveness	Not available
Costs/VFM/Wider legacy/economic value	Not available
Sources	http://lifesaving.com.au/littlelifesaverscald/
<i>Surfkids</i>	
Organisation	Surf Lifesaving Queensland
Target age group	5-7
Aims and objectives	Aim to educate children to be safe and confident beach-goers. Also involves parents who may be unsure about the coastal environment
Delivery model	6-week programme; run on Saturday mornings. No further information on delivery mode
Evidence of effectiveness	No evaluation evidence
Costs/VFM/Wider legacy/economic value	\$100
Sources	http://surflifesavingwa.com.au/community-education/childrens-programs-1/surf-babies-and-surf-kids
<i>SurfBabies</i>	
Organisation	Surf Lifesaving Queensland
Target age group	2-4
Aims and objectives	Aim to educate children to be safe and confident beach-goers. Also involves parents who may be unsure about the coastal environment
Delivery model	6 week programme; run on Saturday mornings No further information on delivery mode was available
Evidence of effectiveness	No evaluation evidence
Costs/VFM/Wider legacy/economic value	\$100
Sources	http://surflifesavingwa.com.au/community-education/childrens-programs-1/surf-babies-and-surf-kids

Sealord Swim for Life

Organisation	Water Safety New Zealand
Target age group	All children
Aims and objectives	Aims to ensure that every child in New Zealand has the opportunity to learn the core life skills of swim and survive (active in 12 of 17 regions)
Delivery model	Varied - can be adapted/delivered differently by different providers. Uses a passport system where children are encouraged to achieve key milestones in reaching the goal of swimming 200m.
Evidence of effectiveness	Evidence on numbers of children that have achieved each milestone on the passport (see http://www.sealordswimforlife.org.nz/what-is-sealord-swim-for-life/#stats). Also some case studies on success stories are available, but no other evaluation evidence is apparent
Costs/VFM/Wider legacy/economic value	No information on cost
Sources	http://www.sealordswimforlife.org.nz/

Paddle Safe

Organisation	Government of Tasmania
Target age group	All ages and family groups
Aims and objectives	Covers corrects paddling techniques; weather reports and where to obtain them; life jackets and safety equipment; tides and currents; the effect of offshore winds and effects of cold water
Delivery model	One-off sessions lasting 1.5 hours (see http://www.mast.tas.gov.au/wp-content/uploads/2015/11/A4-Flier-December-2016-Sessions.pdf)
Evidence of effectiveness	No evaluation evidence
Costs/VFM/Wider legacy/economic value	Free
Sources	http://www.mast.tas.gov.au/wp-content/uploads/2015/11/A4-Flier-December-2016-Sessions.pdf

Open Water Learning Experience

Organisation	Life Saving Victoria
Target age group	5-16
Aims and objectives	LSV's Open Water Learning Experience (OWLE) program creates 'Everyday Lifesavers' out of Victorian students, by teaching them practical and engaging water safety, lifesaving and emergency response skills. The OWLE program is designed to empower students to make safe aquatic related decisions while enjoying their local waterway. The OWLE program is ideal to enhance school swimming and water safety or camp programs.
Delivery model	Different delivery options e.g. half day (2 hours) or full day (3.5 hours). Some examples of what the 1/2 day/full day programme involves at this link ¹

¹ <http://lsv.com.au/wp-content/themes/abomb/pdf/education/OWLE%20Metro%20Activity%20Descriptions%202015.pdf>)

Evidence of effectiveness	No evaluation evidence
Costs/VFM/Wider legacy/economic value	Not available
Sources	http://lsv.com.au/education/owle/

Under five waterwise

Organisation	Water Safety New Zealand
Target age group	0-5
Aims and objectives	Awareness campaign with production of resources that provide guidance on staying safe with water; including a book to read to children
Delivery model	All online resources. (http://www.watersafety.org.nz/resources-and-safety-tips/downloadable-resources/under-fives-be-waterwise-resources/)
Evidence of effectiveness	No evaluation evidence
Costs/VFM/Wider legacy/economic value	No details
Sources	http://www.watersafety.org.nz/resources-and-safety-tips/downloadable-resources/under-fives-be-waterwise-resources/

Kia Maanu Kia Ora and Swim and Survive resource

Organisation	Water Safety New Zealand
Target age group	Different levels of programme for different abilities
Aims and objectives	Aims to develop a range of swimming techniques and survival skills for personal safety' aims to understand and recognise the dangers associated with water environments
Delivery model	Three levels (Beginners' level 2 and level 3) and a clear set of resources and guidelines on what should be taught at each level (http://www.watersafety.org.nz/resources-and-safety-tips/education-initiatives/maori/kia-maanu-kia-ora-safety-resources/) Also provides additional resources on lifejacket survival; snorkelling and boat entry/exit
Evidence of effectiveness	No evaluation evidence
Costs/VFM/Wider legacy/economic value	No details
Sources	http://www.watersafety.org.nz/resources-and-safety-tips/education-initiatives/maori/kia-maanu-kia-ora-safety-resources/

Swim and Survive

Organisation	Royal Life Saving Society Australia (RLSSA)
Target age group	6 months - 14 years
Aims and objectives	Aims to provide children with solid foundation skills in swimming, survival and basic rescue skills
Delivery model	Three programme titles: 1) Wonder (6-36 months) a water familiarisation program for parents and their children 2) Courage (3-5 yrs) builds water confidence for pre-school aged children 3) Active (5-14 yrs) - swimming and water safety programme. Further detail on each programme structure can be found here: http://www.swimandsurvive.com.au/content_common/pg-swim-and-survive.seo

Evidence of effectiveness	No evaluation evidence
Costs/VFM/Wider legacy/economic value	No details
Sources	http://www.swimandsurvive.com.au/

The Before School Swimming and Water Safety Pilot Program

Organisation	Life Saving Victoria
Target age group	Years 5/6 in Victoria (Australia)
Aims and objectives	<p>"Aims to teach key water and safety and survival swimming skills to empower them to recreate safely and confidently in, on, or around the water. Ultimately aims to reduce the number of aquatic related drowning deaths of children in Victoria.</p> <p>Objectives of the pilot programme were:</p> <ol style="list-style-type: none"> 1) Enhance the personal resilience of Victorian students by increasing their swimming skills and water safety knowledge. 2) Determine the feasibility of the Before School Swimming and Water Safety Program delivered by qualified swim teachers, in partnership with Victorian schools and community aquatic facilities. 3) Determine a cost effective model for presentation to Government to ensure sustainability of the Before School Swimming and Water Safety Program"
Delivery model	<p>"One school completed a 10-day intensive programme. The second school took part once a week for 10 weeks. Structure comprised 10 lesson plans with each containing a low, intermediate and high level skills. Each lesson has a major survival swimming skill focus aimed at enhancing the child's personal safety, including floating and treading water, rescue strategies, movement skills, lifejacket use and CPR, and each lesson built on skills that were introduced in the previous lesson. The final lesson was completely scenario based, with students practicing all skills and knowledge learnt throughout the Program in real life scenarios that were relevant and engaging."</p>
Evidence of effectiveness	<p>Evidence from the pilot programme (68 students; 32 parents, 12 teachers) found that following outcomes were achieved 1) Enhancing personal resilience - 89% of students improved in at least one of the practice skills tests. Increase in the distance students could swim; increase in correct responses to eight water safety questions. This evidence relies on small sample sizes, and only focused on a pilot programme.</p>
Costs/VFM/Wider legacy/economic value	<p>Cost per students to participate in a 10 lesson programme varied from \$127 to \$217</p>
Sources	<p>http://lsv.com.au/wp-content/themes/abomb/pdf/education/Before_School_Swimming_Trial_Report.pdf</p>

Swim to Survive

Organisation	Lifesaving Society (Canada)
Target age group	Grade 7 (Swim to Survive) upwards including adults
Aims and objectives	<p>Swim to Survive teaches the essentials needed to survive an unexpected fall into deep water</p>
Delivery model	<p>The programme is based around three key survival skills: Roll into Deep water; Tread water for 1 minute; and Swim 50 meters.</p> <p>There are three variants of the programme: (1) <i>Swim to Survive</i> focuses on the minimum skills required to survive as defined above. (2) <i>Swim to Survive Plus (+)</i></p>

Evidence of effectiveness	expands to cover how to roll, tread and swim with clothes on, how to help a friend in deep water without putting themselves in danger and basic physical fitness concepts through interval training and a fitness swim. It aims to counter the risk-taking behaviours commonly found among young people (males in particular)
Costs/VFM/Wider legacy/economic value	(3) <i>Family Swim to Survive</i> Swim to survive uses the same methods and principals as Swim to Survive, but incorporates adults as well as children. No evaluation evidence
Sources	No details http://www.lifesavingsociety.com/swim-to-survive.aspx
