

## Supplementary Tables

**Table S1: Full text of river drowning scenarios used in Phase 4 of the Delphi**

Scenario number	Scenario description
1	<i>A 60 year old male is driving a 4wd at night during a storm. He has been consuming alcohol. He has approached a causeway that has been flooded by a nearby swollen river. There were warning signs and depth markers in place but the driver was familiar with the road and had driven through floodwaters on this road previously while driving home. Upon coming to the flooded causeway, which was running higher and faster than usual, the deceased has driven into the water. The force of the water has caused the car to flip, trapping the occupant inside and he has drowned.</i>
2	<i>A 24 year old male was at the river with his friends who were all drinking. The male was not a strong swimmer however, under the influence of alcohol, had been encouraged by his friends to try and swim across the river and back. The river current was stronger than the male expected and it appears the male may have been washed further downstream where he has gotten caught on a snag and has panicked. The male disappeared under the water. His body was recovered 3 days later, 2kms downstream from where he initially went missing. His friends tried to rescue him but could not locate his body in the murky water.</i>
3	<i>A 72 year old male was alone on his four metre powered boat as he headed out onto the river for a day of fishing. The man was neither wearing a lifejacket, nor was he carrying one on board the vessel. He had not checked the condition of his boat in sometime and had no working radio. The boat capsized when the man leaned over to untangle his fishing line. Witnesses say he struggled to stay afloat and was found drowned some hours later by a passing boat.</i>
4	<i>A 3 year old girl was at the river with her family and two other families. The girl was left in the care of older children while her family packed the cars in preparation to leave. After a short while, her parents noticed that she was missing. She was found drowned in the river near where the family left from and marks on the river bank suggested that she fell in.</i>
5	<i>A group of males between the ages of 25-54 years were celebrating a function on a party boat on an urban river. Just after midnight, several members of the group were extremely intoxicated and without the captain's knowledge, decided to jump off the roof of the boat. The three males jumped in but one hit the water awkwardly and did not resurface. His friends tried to dive to find him but were unable to find his body among the fast moving current and dark of night. Friends on-board notified the captain who threw flotation aids to the two men in the water. The body of the third man was discovered around daybreak the next morning by police divers.</i>
6	<i>A recently retired 70 year old male took his dog for a walk through bushland to his local creek. It was a warm day and as part of his usual routine the man and his dog both entered the water for a swim to cool down. The man was throwing sticks onto the creek bed for the dog to retrieve and swim back out to him. It appears the man suffered a massive heart attack and collapsed into the water and drowned. At coronial investigation, the autopsy revealed significant heart disease for which the man had not previously been treated for.</i>
7	<i>A woman in her mid-40s was found drowned in a river nearby her house after having been reported missing by her husband some hours earlier. She had decided to walk home from drinks with friends at a restaurant about 1.5kms from her house and appears to have fallen into the river due to a combination of alcohol intoxication, poor visibility due to the cloudy night and slippery and uneven ground on the river bank.</i>

8	<p><i>A group of young people (both males and females aged between 18 and 30 years of age) went to a remote area in a national park for a camping trip over a public holiday long weekend. The group camped close by a river and on their second day, they went into the river for a swim. One member of the group, a young male aged 22 was not a strong swimmer. He tried to stay close to the bank but recent heavy rains upstream had created a stronger than normal current which slowly pulled him further away. He then stepped off a sharp drop off in the river bed and could no longer touch the bottom. He panicked and went under the water. By the time his friends got to him and got him out of the water he was not breathing. Being unfamiliar with their location, a lack of signage and patchy mobile phone coverage resulted in significant delays before emergency assistance arrived. Unfortunately by the time emergency services arrived, the man was deceased.</i></p>
9	<p><i>A group of young males in their late teens and early twenties were at their local river taking turns to jump into the water from a rope swing they had brought with them and attached to a tree. After jumping off the rope swing and doing tricks into the water for about half an hour, several of the males dared each other to jump off an old railway bridge that went across the river. The drop was about 10 metres from the bridge to the water. The males who were willing to jump went out onto the bridge and took it in turns to jump. One of the males fell awkwardly and did not resurface. His friends tried to find his body but could not do so as the river was extremely deep and visibility under the water was poor. His body was eventually found by divers three days later. Injuries to his body suggest he may have hit debris not visible under the water when he jumped. There was the suggestion of alcohol intoxication but the body was too decomposed for blood alcohol to be determined at autopsy.</i></p>
10	<p><i>An older male in his 60s was fishing alone from the river bank, at an isolated location. It was a rainy winter's day and he was wearing multiple layers including a bulky jumper and jacket. He slipped on the wet and muddy river bank and ended up in the water. The man's skills and fitness had reduced over time. He was found drowned in the river after his wife reported him missing when he didn't return home.</i></p>

**Table S2: Strategies that require more evidence (i.e. assessed as <50% effective or very effective in Phase 2 of the Delphi) (n=32)**

<b>Proposed drowning prevention strategy for rivers</b>	<b>% effective or very effective</b>
<b>Personal behaviours</b>	
Have each person participating carry their cell phone so they can contact emergency response if necessary	31.0
<b>Knowledge</b>	
River tidal conditions	48.3
Environmental hazards - pollutants	13.8
Surrounding terrain	31.0
<b>Public awareness and advocacy</b>	
Campaigns against peer pressure	41.4
Advertising in TV programs at popular times for children	27.6
Fish with a friend campaigns	44.8
Training of communities along rivers in search & rescue	41.4
Train staff in awareness of persons who could become a rescue - Intoxicated, out of shape, young and old	48.3
<b>Signage</b>	
Increase signage and warnings during the snowmelt period	31.0
Warning signs - with lights & sirens	44.8
Warning of unstable river banks	44.8
Warning notices about using rivers as toilets	20.7
Signage showing ice markers / restrictions / depth	34.5
<b>Engineering</b>	
Improved / standardized boat design	41.4
Provision of piped water to riverside communities	48.3
Lighting for common night time areas where walking near the river edge are undertaken	37.9
The highlighting of exit places (ladders & steps) by painting the background white or some fluorescent colour that stands out in the dark	44.8
Make green belt along the river to prevent landslide which can cause drowning	27.6
Explore environmental changes to reduce dangerous currents, whirlpools, etc	41.4
Removal of rope swings from trees beside the river	17.2
Use of CCTV to capture and deter those who engage in risky behaviour	20.7
<b>Flooding</b>	
Use technology to block flooded roads	44.8
Keep the depth of the river optimum by removing sediment sand from the river bed to prevent flood	37.9
<b>Alcohol</b>	
Restriction on alcohol sales	34.5
<b>Other</b>	
Community leadership and empowerment	41.4
Know seizure disorder safety	44.8
If it is going to be an extreme snowmelt period have local media do stories on river safety	44.8
Flow velocities available in an app or at the river site for river users to choose where to paddle / recreate safely	41.4
Risk assessment for rope swings	27.6
Water extraction areas	41.4
Use of a rating system for all signage that is an assessment at specific locations *	28.6

\* This strategy was newly introduced at Phase 3 but generated low levels of support for its perceived effectiveness and was removed prior to Phase 4.

**Table S3: Strategies that showed promise (i.e. assessed as between 50-60% effective or very effective in Phase 2 of the Delphi) (n=29)**

<b>Proposed drowning prevention strategy for rivers</b>	<b>% ranked effective or very effective</b>
<b>Lifejackets</b>	
Wear a lifejacket while swimming/wading	55.2
<b>Personal behaviours</b>	
If going out in a boat, tell someone your put in/take out and route	55.2
Never try to rescue someone if you are not a trained person	51.7
<b>Public awareness and advocacy</b>	
Raise awareness of the dangers of never swimming alone	58.6
Public education re surveillance children and those unable to swim	51.7
Raise awareness of the dangers of submerged obstacles	51.7
Messaging targeting males and risk taking	58.6
<b>CPR and Rescue</b>	
Junior lifeguard/rescue programs	55.2
<b>Personal skills</b>	
Guided swimming lessons in rivers	55.2
<b>Signage</b>	
Informational safety panels at popular areas	51.7
Warning signage about the danger of driving through floodwaters at areas prone to flooding	51.7
Warning notices telling those boating to put on their lifejacket before climbing into a boat	55.2
Water safety info posted at common entry points	58.6
Signage advising of river conditions (blanket signage and/or advising of current river conditions)	51.7
<b>Engineering</b>	
River flow controls	51.7
The moving of pathways / walkways away from the river edge so that if a walker stumbles they do not immediately fall into the river	58.6
Pool style fencing around homes where children may be at risk e g farms	58.6
Safe access to piped water collection points	58.6
Build safe boat or launch station	55.2
<b>Flooding</b>	
Relocation of persons/communities in flood risk areas	58.6
Incorporation of safety messages in driver training	51.7
Use markers on roads to show flood depth	58.6
Clear demarcations of flood lines and limited building below flood lines	55.2
Avoid water entry in the hours after storms to avoid sudden increases in current and/or water depth	58.6
<b>Alcohol</b>	
Breathalysing skippers of boats on rivers	58.6
No alcohol zones around rivers	51.7
<b>Other</b>	
Attending day care/school	55.2
Monitoring and clearing of debris	51.7
Cold water strategies	51.7

**Table S4: Original strategies from Delphi participants in Phase 4, with numbers explaining how they were merged in Table 3**

Original strategies	Number
Apply a common risk rating system for rivers where people frequent	1
Choose suitable lifejackets for use on watercraft including stand up paddleboards, motorboats etc	2
Wear a lifejacket when river flows are fast and cold	3
Use a lifejacket when an occupant of a water vessel and ensure it is properly fitted and maintained; include awareness campaigns and behaviour change strategies	4
Lifejacket loaner programs near popular river access points	5
Lifejacket wear for children	6
Lifejackets campaign	7
Avoid open water at night	8
Enter and exit the water safely, including checking signage at entrance to river	9
Signage at key dangerous entry points	10
Signage at popular stretches and blackspots (high drowning risk)	11
Highly visible signs warning of local hazards at popular swimming destinations	12
Swim/recreate/wash bathe only in designated safe places	13
Check conditions before recreating or getting in the water	14
Provide protected river sites for aquatic activity (e.g. swimming/diving)	15
Safe watering sites for people and animals	16
No swimming or recreating near culverts and weirs at times of heightened risk	17
Caregivers maintaining active supervision with children five years and under (constant visual supervision, within reach)	18
Don't engage in water recreation alone in a river alone	19
Provide safe places away from rivers for pre-school aged children (e.g. day care/crèche)	20
Barriers between child play areas and rivers	21
Strategies to survive cold water immersion	22
River safety education including recognition and awareness of river hazards including tidal conditions	23
Educating parents of river drowning risks and prevention strategies	24
Knowledge on what to do if caught in river currents	25
Educational strategies – specific alerts in high risk areas where there is a large population at risk	26
School based river safety education	27
Raise public awareness about risk, river safety and drowning prevention in at-risk communities	28
Don't enter unfamiliar waterways	29
Do not enter the water if a storm is likely or there is lightning or thunder present	30
If you are caught in a current, do not panic or swim against it, just float and call for help immediately	31
If participating in known hazardous events (river rafting, white water boating) have a local guide present	32
Boater safety knowledge	33
Safety training for all boater personnel in CPR, calling for rescue and search and rescue	34
Boating skills	35
Community wide rescue and resuscitation skills with a particular focus on those living in communities near high risk rivers or people residing in regional and remote locations	36
Knowledge and skills to perform basic rescues (in water, out of water)	37
Social marketing campaigns for Raise awareness on the risk of drowning from alcohol	38
Alcohol and drowning risk campaigns	39
Public education re alcohol in proximity to water	40
Utilize social marketing to mount campaign against consuming alcohol near rivers	41
Avoid alcohol prior to and during any riverine excursions or water exposure	42

Regularly positioned Public rescue equipment available reach and flotation devices assistance devices (rescue ring, throw ropes, reach poles)	43
Learn to swim with a focus on survival swimming skills including self-rescue skills to enable unaided movement to water's edge	44
Implementation of free/low-cost swim lessons as part of physical education programs and grants in under-served areas	45
Safe and accessible infrastructure such as bridges, for crossing rivers	46
Responsible design (barriers, rescue equipment) around urban riverside entertainment precincts	47
Limiting access to river at locations with high risk of drowning (barriers)	48
Fences and barriers to prevent people jumping from bridges	49
Risk assessment and management of areas where people jump in	50
Urban design for runoff retention to reduce high river flow and flooding	51
Close flooded roads and/or use physical barriers (such as booms) at road crossings at high risk of flooding	52
Manage river flooding risk through engineering/environmental modification	53
Avoid flooded roads if there is/are alternative road(s)	54
Prohibiting/restricting alcohol use in high risk areas	55
Avoid use of alcohol while boating	56
Consistent per se legislation for alcohol similar to operating a motor vehicle	57
Restriction of alcohol usage around hire and drive vessels such as houseboats and party boats	58
Establish effective early warning systems for notifying at-risk citizens when rivers are flooded and those catchment and river users likely to be effected by dam releases	59
Consistent flood warning on local/national radio/TV/media	60
Flood and weather warnings	61
Community risk mapping and assessment to formulate targeted prevention programs by identifying risk factors, risk locations and risk groups by research	62
Identification of at-risk flooding communities and roll out of mitigation strategies such as swimming lessons, distribution of personal flotation devices (PFDs), flood safety awareness	63
Assessment of flood road safety as part of floodplain risk management	64
Include river drowning prevention in national and local water safety plans	65
Sustainable land use to prevent flooding	66