



# The effect of the ‘Swim Reaper’ program on water safety awareness, drowning mortality and morbidity among males aged 15–34 years in Aotearoa, New Zealand

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## ABSTRACT

**Background and Objective:** To increase water safety awareness among young males New Zealand introduced the Swim Reaper program in 2016. The program ran annually over summer and in 2018/19 an evaluation was conducted. The objective of this study was to evaluate the impact of the 2018/19 Swim Reaper social media-based campaign on self-reported water safety awareness and identify changes in fatal and nonfatal drowning rates for New Zealand resident males aged 15–34 years before and after the 2016 Swim Reaper program. **Methods:** Online surveys pre (December-2018) and post (February-March-2019) Swim Reaper campaign were used to estimate water safety awareness post-campaign relative to pre-campaign using negative binomial regression adjusted for potential confounders. Interrupted time series (ITS) analysis, adjusted for seasonality, explored changes in drowning mortality, hospital admissions and Accident Compensation Corporation (ACC) claims pre and post program introduction (2016). **Results:** A total of 518 males responded (50.6% post-campaign). There were significant improvements (post vs. pre-campaign) in self-reported water safety awareness. ITS analysis showed a reduction in drowning related hospital admissions post relative to pre-program (RR = 0.47; [95%CI: 0.24–0.90]; p = 0.02). **Discussion:** Young males are an at-risk cohort for drowning and creating behavior change among this group can be challenging. Using a unique, humor-based approach the Swim Reaper program appears to be having some impact on self-reported water safety behaviors, as well as unintentional drowning-related hospitalization rates. Further evaluation, more clearly linked to campaign themes, is required to ascertain direct impact of the program. **Conclusion:** The novelty and reach of the campaign within the context of a prevailing downward trend in drownings may provide support for social media-based programs targeting this hard-to-reach demographic.

## 1. Introduction

Drowning represents a public health issue of importance both globally (Franklin et al., 2020), with an estimated 236,000 lives lost in 2019 (World Health Organization, 2021), and in New Zealand, where an annual average of 188 hospitalizations and 81 preventable fatalities due to drowning have occurred in the five years to 2021 (Water Safety New Zealand, 2022). Compared to other high income countries with well-developed drowning data registries such as Australia and Canada, New Zealand has a relatively high fatal unintentional drowning rate at

1.79 per 100,000 resident population between 2005 and 2014, compared with 1.19 in Australia and 1.32 in Canada for the same period (Peden, Franklin, & Clemens, 2019). New Zealand has recorded significant reductions in fatal unintentional drowning in recent years. Across the same period (2005–2014), fatal unintentional drownings in New Zealand declined by 24.7%, compared with 20.4% reduction in Canada and a 10.2% reduction in Australia (Peden et al., 2019). However, in more recent data, 90 people were found to have fatally drowned in 2021, the highest since 2011 (Water Safety New Zealand, 2022).

Drowning among adolescents and young people is a serious concern.

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Globally, drowning is the second leading cause of unintentional injury-related death among adolescents 10–24 years of age and the third leading cause of disability adjusted life years (DALYs), with males overrepresented compared to females (Peden et al., 2022). This risk persists into early adulthood and is often attributed to a range of risk-taking behaviors that heighten drowning risk. These include diving headfirst into water of unknown depth and swimming outside patrolled areas at surf beaches (Moran, 2011), as well as consuming alcohol around water (Hamilton & Schmidt, 2013), jumping into water (Lawes, Ellis, Daw, & Strasiotto, 2021) and risky boating activities, including avoiding wearing lifejackets (Peden, Demant, Hagger, & Hamilton, 2018). New Zealand is not alone in attempting to reduce drowning rates among this age group (Zealand, 2022).

Behaviors seen on social media may encourage unsafe activities around water, such as YouTube videos depicting jumping from height into water (Moran, 2014) and alcohol advertising depicting aquatic locations (Jones & Gordon, 2013). However, social media may also be an important avenue to reach young people with water safety information (Hamilton, Keech, Willcox-Pidgeon, and Peden, 2022). Harnessing the power of social media, the Swim Reaper program (Water Safety New Zealand, 2022) used public education as a means to create behavior change among adolescent males in New Zealand predominately via Instagram (@iamtheswimreaper) and YouTube, in addition to Facebook and Snapchat in the initial campaign year, as well as some mainstream media coverage and in-situ activations at aquatic locations. The program centers around the ‘Swim Reaper’ a confronting, grim reaper-style character that encouraged unsafe behaviors around water in order to ‘reap some peeps.’ The program deliberately took a dark humor approach to highlight poor decisions around water and was not overtly branded as a water safety program. As the Swim Reaper said: “NZ is amaze! Heaps of mean beaches and swimming holes, and a long line of people willing to do dumb stuff. The perfect mix. Ha! Yeah, so I’m just hanging out all summer, waiting to reap some peeps. Swim dumb and I’ll be seeing you soon.”

The Swim Reaper program began in Summer 2016–17 and since then has amassed 398,000 followers around the world on Instagram. To assess the impact of the Swim Reaper, this study had two aims: (a) to examine the impact of the 2018/19 Swim Reaper campaign on water safety awareness for a range of risky behaviors among New Zealand males aged 15–34 years and (b) identify any differences in fatal and nonfatal drowning rates pre and post the broader Swim Reaper program, which commenced in 2016.

## 2. Methods

We evaluated message awareness from the 2018/19 Swim Reaper campaign using the results of independent online surveys and analyzed

changes in fatal and nonfatal drowning pre and post program introduction in 2016 using routinely collected data.

### 2.1. The Swim Reaper program

The Swim Reaper first appeared in the Summer of 2016/17 (intervention year) (Fig. 1). It was initially targeted at males 15–24 years with the goal of alerting the audience with New Zealand’s most dangerous swimming locations. The Swim Reaper was initially promoted in the first-year campaign via Facebook, Instagram, YouTube and Snapchat, to reach a traditionally hard to reach cohort, and was seen almost 10 million times. Promotion also included online banner ads (promoting the lead slogan “Swim Dumb and You’re Done”) and physical signage at popular aquatic locations. Instagram was a promotion avenue used throughout the lifespan of the program, and it reached 65% of the New Zealand male population aged 15–29 years in its first year (Fig. 2).

Promotion of the Swim Reaper continued with a campaign each Summer until 2021/22. The program’s ethos was to time messages as closely as possible with the activity, with messaging that was environment and activity focused, identifying how risky behavior might impact others. The program used humor as an important factor in message delivery and was the antithesis of ‘telling’ the audience what not to do. Across the years of the program, it achieved significant reach across the target demographic, which was expanded from 15 to 24 years to include 25–34 year old males as a secondary market in 2017/18 (Fig. 1). While initially developed in, and targeted at, a New Zealand audience, the Swim Reaper has also gained an international following, with comments on Instagram posts reflecting profiles from a variety of countries.

### 2.2. Data

#### 2.2.1. Survey data

An independent evaluation of the Swim Reaper campaign was conducted via online surveys in 2018/19. Inclusion criteria was males aged 15–34 years who had used Instagram within the two weeks immediately preceding the survey. Participants were sourced from a panel of potential respondents by a market research company MMRResearch. The survey determined prompted and unprompted awareness of the Swim Reaper before and after the 2018/19 campaign. It also aimed to determine if Swim Reaper had had any effect on perceptions of water safety for males in the target age group for the following behaviors: jumping into unfamiliar waters; overestimating their swimming ability/swimming while fatigued; jet skiing recklessly; and boating in rough weather (see Supplementary Table 1).

The survey tool was developed in partnership between MMRResearch and Water Safety New Zealand (WSNZ) (Supplementary File 1). The surveys were conducted online and could be completed via computer or

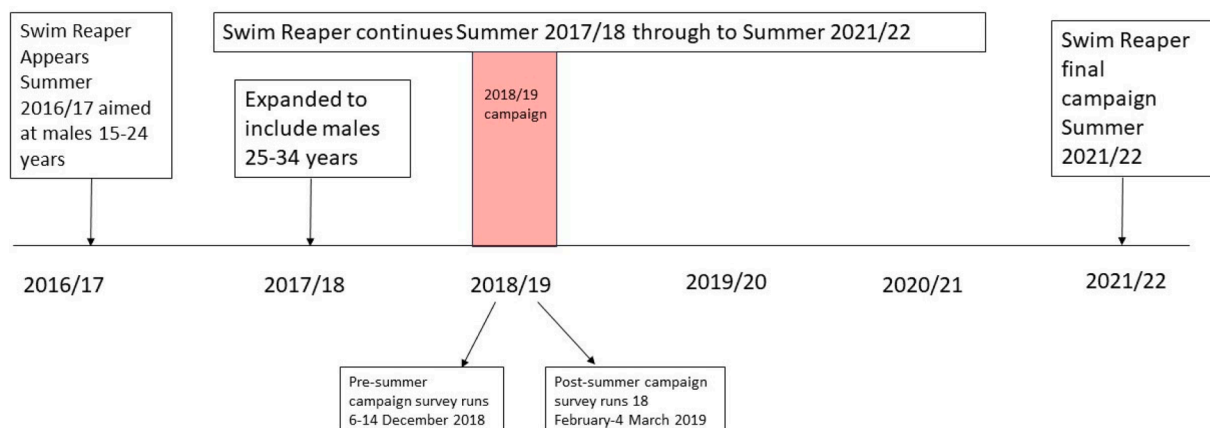


Fig. 1. Timeline of Swim Reaper campaign and associated research.

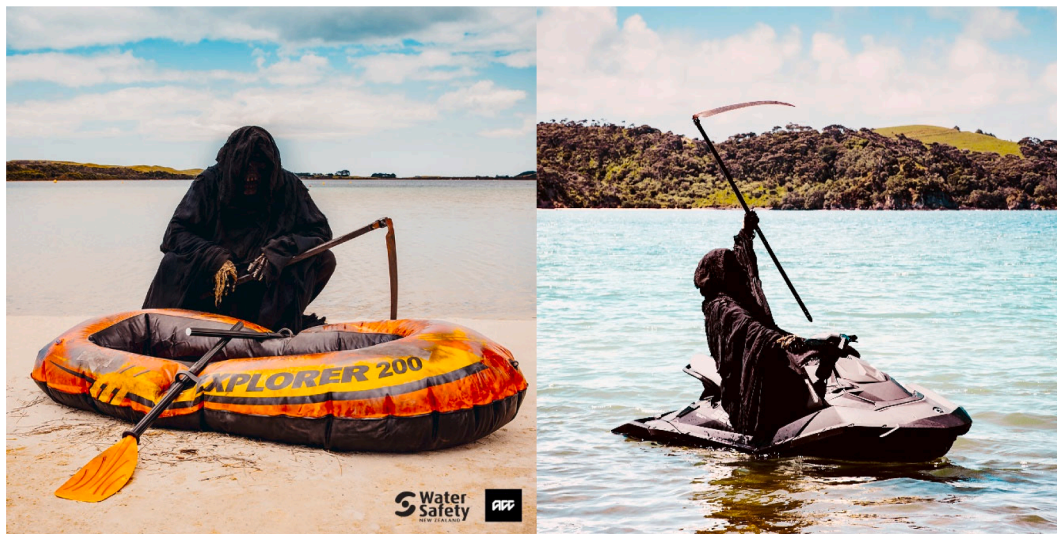


Fig. 2. Selected examples of Swim Reaper visual content regarding boating and jet skiing with (left) and without (right) organisational branding.

mobile device. The 2018 pre-summer campaign survey ran from 6 to 14 December 2018 and the post-summer campaign survey ran from 18 February to 4 March 2019 (Summer through to early Autumn in New Zealand). The target sample was 250 males, 125 for each age group (15–24 years and 25–34 years). To prevent familiarity bias, respondents who took the pre-campaign survey were excluded from taking the post-campaign survey. Oversampling was employed in an endeavor to provide maximum cell sizes for analysis and to counter expected response resistance. Appropriate quotas for region of New Zealand and ethnicity were used to help ensure that the results were nationally representative.

### 2.2.2. Drowning data

The process for acquiring data on fatal and nonfatal drowning in New Zealand has been extensively described previously (Peden et al., 2019; Peden and Richardson, 2022). In brief, WSNZ collates all drowning deaths which occur in New Zealand in DrownBase™. DrownBase™ comprises of data initially collected from the New Zealand Police via a \*Drown keyword search and via media reports. This is supplemented by data from Coroners reports and Ministry of Health information. Data included in this study were correct as of November 4, 2022. Drowning fatalities due to road or air vehicle incidents, homicide, suicide, or of unknown origin (i.e., where it is unknown how the person came to be in the water) were excluded. Given the Swim Reaper program's focus on natural waterways, those deaths which occurred in artificial water bodies (such as home and public swimming pools) were excluded.

Nonfatal drowning data comprises hospitalization and Accident Compensation Corporation (ACC) claims data for medical care. Data on nonfatal drowning-related hospitalizations (defined as admission to hospital resulting in a hospital stay of any duration) were provided by the Ministry of Health New Zealand health information system and include all hospitals in New Zealand. All drowning fatalities that occur in hospital are removed prior to provision of data. ACC (New Zealand's crown entity responsible for administering the country's no-fault accidental injury compensation scheme) claims are provided to WSNZ using information claimants provide when the ACC45 (ACC claim form) is completed. Data used in this study comprise all claims defined as drowning based on free text where the word "drown" appeared or claims coded contact = drowning or where the claim's readcode was 'drown' or 'submersion.' Nonfatal drowning data (hospitalization and ACC claims data) were last updated as of November 4, 2022. For the analysis drownings that occurred in artificial water and water bodies described as "other" were excluded.

### 2.2.3. Population data

New Zealand Population data for the 15–34 year-old male and female age groups based on the 2018 census were extracted from Stats New Zealand (<https://www.stats.govt.nz/topics/population>) for the calculation of drowning and rates.

## 2.3. Analysis

### 2.3.1. Survey data

The outcome under investigation was water safety awareness after the campaign relative to pre-campaign. Water safety awareness was measured via five scenario-based survey questions including: swimming in choppy water while fatigued; jumping off a bridge; speaking up if they thought jumping was dangerous; fishing in a dinghy in potentially inclement weather; and dangerous jet skiing (Table 1 and Supplementary Table 1). These activities were chosen due to being identified as high-risk activities leading to fatal and nonfatal drowning among males in this age group.

For the analysis, a choice of four options were coded into a binary response of safe or unsafe for analysis using the expertise of the authorship group (Supplementary Table 1). Other variables considered in the analysis that might impact on water safety behavior as well as reach by the campaign were demographic characteristics (age, ethnicity, region of residence, having a partner, children in household) and swimming ability.

Analysis of survey data comprised descriptive statistics, as well as univariate and adjusted negative binomial regression analysis. Characteristics of pre- and post-campaign groups were compared using Pearson's chi-squared test. Comparisons between water safety behavior pre and post campaigns rate ratios (RRs) were conducted, using pre-campaign as the reference point. The regression was adjusted for potential confounders: ethnicity, age, region of residence, partnered, children in household, swimming ability, and ever gotten into serious trouble in the water.  $RR > 1$  indicates higher safety awareness post campaign. P values were calculated, with statistical significance deemed  $p < 0.05$ .

## 2.4. Drowning data

We calculated annual drowning rates for males aged 15–34 using New Zealand Census population data. We used a quasi-experimental interrupted time series (ITS) design to explore the impact of the Swim Reaper program on fatal and nonfatal drowning in males aged 15–34 in



New Zealand. It was hypothesized that the program might result in a drop in drowning rates (level change). The ITS analysis was implemented using segmented Poisson regression modeling of monthly counts with three distinct time periods: pre-program, implementation (2016–2017), and post program. The model was adjusted for seasonality by fitting Fourier terms in the Poisson model. Population size was included as an offset variable to adjust for any potential changes in the population over time. The equation from the models can be expressed as follows:

$$\log \mu_t = \beta_0 + \beta_1 t + \beta_2 x_t + \beta_3 \sin\left(\frac{2\pi t}{12}\right) + \beta_4 \cos\left(\frac{2\pi t}{12}\right) + \beta_5 \sin\left(\frac{2\pi t}{6}\right) + \beta_6 \cos\left(\frac{2\pi t}{6}\right) + \log N_t$$

where

$\mu_t$  = Poisson mean count of drowning at time  $t$ .

$\beta_0$  = baseline level at  $t = 0$ .

$t$  = the time elapsed since the start of the study in month.

$x_t$  = a dummy variable indicating the pre-intervention period or the implementation period or the post-intervention period.

$\sin(\frac{2\pi t}{12}), \cos(\frac{2\pi t}{12}), \sin(\frac{2\pi t}{6})$  and  $\cos(\frac{2\pi t}{6})$  = the variables used to adjust for seasonality.

$N_t$  = population at time  $t$ .

Standard errors were adjusted to allow for overdispersion. Differences in drowning rates were calculated as rate ratios with 95% confidence intervals for the implementation and post campaign periods relative to the pre-campaign period. For each of the three ITS analyses (mortality (1992–2021), hospital admissions (2011–2021) and ACC claims (2012–2021) the maximum number of time data points pre and post campaign available in DrownBase were included to maximize power.

All statistical analysis was implemented using Stata software version 17 ([stata.com](http://stata.com)). For the ITS analysis the Stata code from the tutorial by Bernal and colleagues was adapted (Bernal, Cummins, & Gasparrini, 2017).

### 2.5. Ethics approvals

WSNZ has agreements with Coronial Services New Zealand, the National Coronial Information System (Australia) (NZ008) and the New Zealand Ministry of Health (2007–0825) to access data in order to maintain DrownBase™. The protocols of DrownBase access adhere to the principles of the New Zealand Privacy Act 2020. A data access agreement is in place between WSNZ and the ACC to access anonymized ACC data as requested for research. Consent to participate was not gained as data are de-identified, reflects people who are deceased (in the case of the coronial data), and reported in an aggregated manner. Ethical approval for the secondary use of the already collected survey data was granted by the University of New South Wales Human Research Ethics Committee (HC220033).

## 3. Results

### 3.1. Survey findings

A total of 518 males aged 15–34 years responded to the survey, 50.6% ( $n = 262$ ) to the post-campaign survey. Age group was evenly split across total respondents to both surveys, with males 15–24 years accounting for 51.0% ( $n = 264$ ) of the entire sample (Table 1). A higher proportion of 25–34-year-olds responded to the pre-campaign and more 15–24 year-olds responded to the post-campaign survey.

When asked to assess their swimming ability, similar proportions of respondents pre- and post-campaign stated they could hold their own in the water, that is, felt they were reasonably capable swimmers (46.6% of respondents pre-campaign vs. 44.5% post-campaign). Thirty-five

Table 1

Swim Reaper campaign survey participants demographic characteristics, water safety awareness, swimming ability and water safety history by and pre and post campaign and awareness of swim reaper program\*.

		Campaign			p-value
		Pre	Post	Total	
		Number (%)	Number (%)	Number (%)	
Ethnicity	NZ Euro	137 (53.5)	132 (50.4)	269 (51.9)	0.93
	Other	13 (5.1)	16 (6.1)	29 (5.6)	
	Asian	54 (21.1)	59 (22.5)	113 (21.8)	
	Pacific Island Māori	19 (7.4)	18 (6.9)	37 (7.1)	
Age group	15 to 24 years	33 (12.9)	37 (14.1)	70 (13.5)	<0.01
	25 to 35 years	107 (41.8)	157 (59.9)	264 (51.0)	
	35 to 45 years	149 (58.2)	105 (40.1)	254 (49.0)	
Region	Upper Nth Island	143 (55.9)	143 (54.6)	286 (55.2)	0.92
	Lower Nth Island	61 (23.8)	62 (23.7)	123 (23.7)	
	South Island	52 (20.3)	57 (21.8)	109 (21.0)	
Partner/wife	No	169 (66.0)	185 (70.6)	354 (68.3)	0.27
	Yes	87 (34.0)	77 (29.4)	164 (31.7)	
Children in household	No	202 (78.9)	220 (84.0)	422 (81.5)	0.14
	Yes	54 (21.1)	42 (16.0)	96 (18.5)	
Are you able to swim?	I can float and/or doggy paddle	34 (13.3)	30 (11.5)	64 (12.4)	0.77
	I can hold my own in the water	114 (44.5)	122 (46.6)	236 (45.6)	
	I swim laps around my mates	90 (35.2)	87 (33.2)	177 (34.2)	
	No	18 (7.0)	23 (8.8)	41 (7.9)	
Have you ever gotten into serious trouble in the water	No	173 (67.6)	180 (68.7)	353 (68.1)	0.78
	Yes	83 (32.4)	82 (31.3)	165 (31.9)	
Heard of Swim Reaper	No	167 (65.2)	124 (47.3)	291 (56.2)	<0.01
	Yes	89 (34.8)	138 (52.7)	227 (43.8)	
Swimming in choppy water while fatigued <sup>#</sup>	Choosing risky option	79 (30.9)	62 (23.7)	141 (27.2)	0.06
	Choosing safe option	177 (69.1)	200 (76.3)	377 (72.8)	
Jumping off bridge <sup>#</sup>	Choosing risky option	56 (21.9)	39 (14.9)	95 (18.3)	0.04
	Choosing safe option	200 (78.1)	223 (85.1)	423 (81.7)	
Speak up if thought jumping was dangerous	No	53 (20.7)	53 (20.2)	106 (20.5)	0.78
	Yes	196 (76.6)	199 (76.0)	395 (76.3)	
	Don't know	7 (2.7)	10 (3.8)	17 (3.3)	
Fishing in a dinghy in potentially inclement weather <sup>#</sup>	Choosing risky option	63 (24.6)	43 (16.4)	106 (20.5)	0.02
	Choosing safe option	193 (75.4)	219 (83.6)	412 (79.5)	
Dangerous jet skiing <sup>#</sup>	Choosing risky option	40 (15.6)	22 (8.4)	62 (12.0)	0.01
	Choosing safe option				

(continued on next page)

Table 1 (continued)

	Campaign			p-value
	Pre	Post	Total	
	Number (%)	Number (%)	Number (%)	
Choosing safe option	216 (84.4)	240 (91.6)	456 (88.0)	
Total	256 (100.0)	262 (100.0)	518 (100.0)	

\* Respondents who took the pre-campaign survey were excluded from taking the post-campaign survey to prevent familiarity bias.

# Please see [Supplementary Table 1](#) for coding of safe and unsafe options.

percent of respondents (35.2%) to the pre-campaign survey and 33.2% of respondents to the post-campaign survey said they could swim laps around their mates. When combined, the lower ability options of “I can float and/or doggy paddle” and “no” made up 20.3% of the pre-campaign survey cohort and post-campaign survey cohort respectively (Table 1).

Thirty-two percent (31.9%) of respondents combined across both surveys indicated they had previously gotten into a serious situation in the water. Almost one-third of these (30.0%) were due to being caught in a rip, strong currents or were bashed by waves. A further 28.0% said they had experienced a nonfatal drowning.

Respondents were asked if they had seen or heard any posts on social media showing people what can happen to them if they do stupid things around water. Fifty-two percent of respondents said yes pre-campaign, while post-campaign this rose slightly to 54%. For those who had seen social media posts, they were then asked if they remembered what the posts were about. Proportionally, the top three responses were news article/tragedy/drowning, general water safety and Swim Reaper/Grim Reaper. Overall, 18% of post-campaign respondents mentioned the Swim Reaper/Grim Reaper, compared with just 3% pre-campaign. All respondents were shown images of the Swim Reaper and asked if they had heard of this character. Fifty-three percent of respondents indicated they had heard of the Swim Reaper post-campaign, compared with 35% pre-campaign.

The data on water safety awareness, after adjusting for confounders, showed higher awareness in the post campaign cohort, for ‘fishing in a dinghy in potentially inclement weather’ (RR = 1.10 [95%CI: 1.01–1.20]; p = 0.03) and ‘dangerous jet skiing’ (RR = 1.08 [95%CI: 1.02–1.16]; p = 0.01) (Table 2).

The final survey question presented respondents with drowning statistics for males aged 15–35 years and respondents were asked why they thought so many young men were drowning in New Zealand each year. Thirty-three percent of respondents stated stupidity or carelessness, 31% said males were unaware of danger, underestimated the water or didn’t know their limits, while a further 26% said overconfidence or bravado.

Table 2

Swim Reaper campaign; rate ratios from univariate and adjusted regression. (Values greater than 1 indicate higher water safety awareness compared with the reference group).

	Unadjusted		p-value	Adjusted*		p-value
	Pre-campaign RR (95%CI)	Post-campaign RR (95%CI)		Pre-campaign RR (95%CI)	Post-campaign RR (95%CI)	
Swimming in choppy water while fatigued	Ref	1.10 (0.99–1.23)	0.07	Ref	1.09 (0.98–1.22)	0.10
Jumping off bridge	Ref	1.09 (1.00–1.18)	0.04	Ref	1.08 (1.00–1.17)	0.06
Speak up if thought jumping was dangerous	Ref	1.00 (0.92–1.10)	0.94	Ref	1.01 (0.92–1.11)	0.82
Fishing in a dinghy in potentially inclement weather	Ref	1.11 (1.02–1.21)	0.02	Ref	1.10 (1.01–1.20)	0.03
Dangerous jet skiing	Ref	1.09 (1.02–1.16)	0.01	Ref	1.08 (1.02–1.16)	0.01

\* adjusted for ethnicity, age, region of residence, partner, children in household, able to swim, ever gotten into serious trouble in water.

### 3.2. Impact on fatal and nonfatal drowning rates

Drowning mortality rates in males aged 15–34 years in New Zealand have been as high as 7.89 per 100,000 population in 1998, with rates currently sitting at 2.23 per 100,000 in 2021 (the last year of the study period) (Supplementary Table 2). From 1992 to 2021 annual drowning mortality rates declined by 0.16 (95% CI –0.20–0.12) per 100,000 per year. The ITS analysis showed no significant change in drowning mortality rates in 15–34 year-old males after compared to before the swim reaper program (RR 1.06, 95% CI 0.77–1.44) (Table 3, Fig. 3).

From 2011 to 2021 there was no statistically significant change in annual drowning hospital admissions in males aged 15–34 (-0.07, 95% CI –0.28–0.15 per 100,000 per year). During this time period the highest rates were observed in 2012 (5.32 per 100,000) and lowest in 2017 (3.18 per 100,000). The ITS analysis showed a significant change in drowning hospital admissions in 15–34 year-old males after compared to before the Swim Reaper program (RR 0.47, 95% CI 0.24–0.90) (Table 3, Fig. 3).

From 2012 to 2021, annual ACC drowning related claims in males aged 15–34 declined by 12.1 (95% CI –22.3–1.80) per 100,000 per year. Highest annual rates were observed in 2015 with 433.48 per 100,000 and lowest rates in 2020 with 289.40 per 100,000. The ITS analysis showed no significant change in drowning related ACC claims after compared to before the Swim Reaper program (RR 1.06, 95% CI 0.77–1.44) (Table 3, Fig. 3).

## 4. Discussion

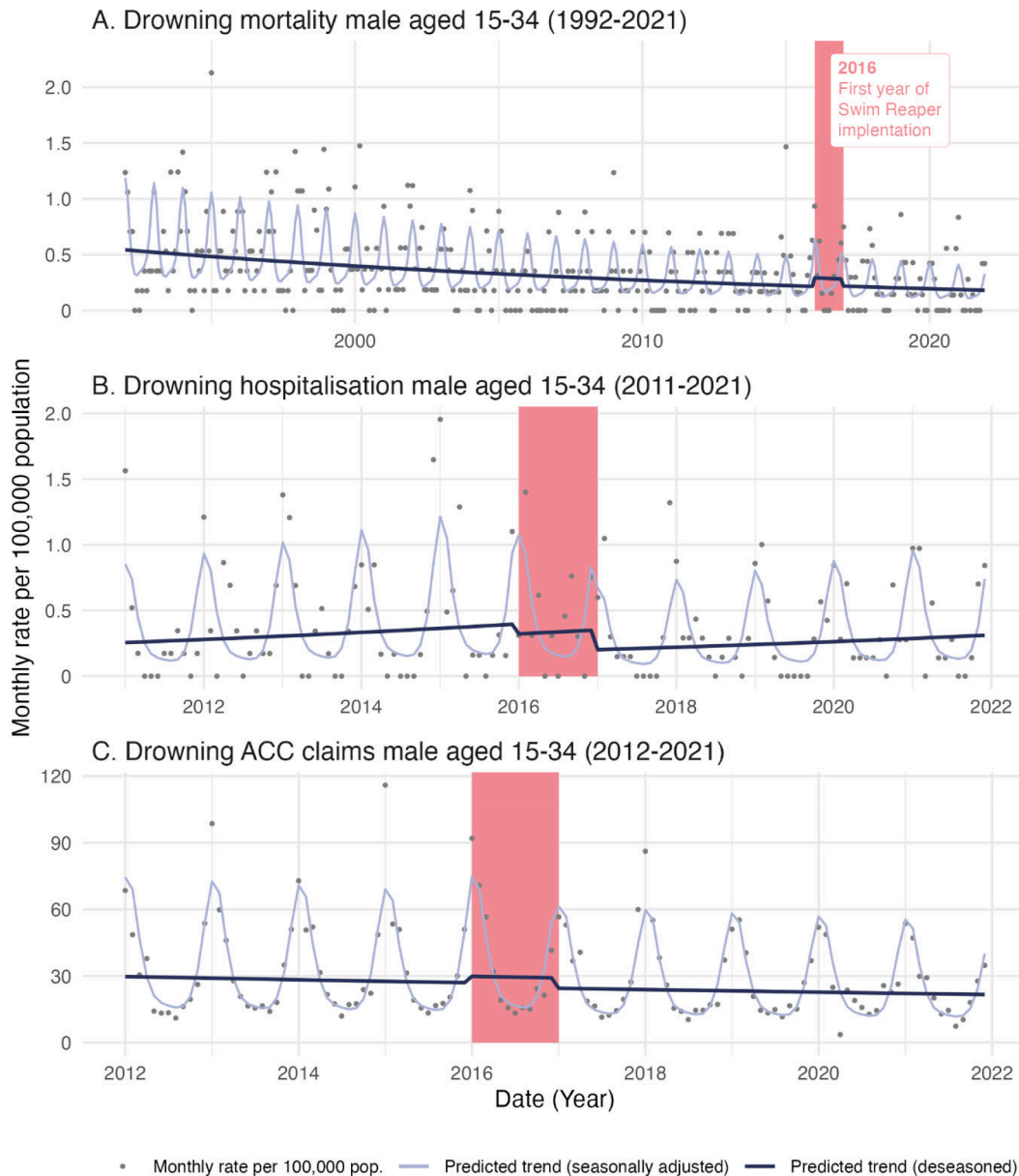
Males aged 15–34 years are a concern with respect to fatal and nonfatal drowning, often due to their participation in a range of risky behaviors in and around water (Moran, 2014; Moran, 2011; Hamilton and Schmidt, 2013; Lawes et al., 2021; Peden et al., 2018). Despite this, a recent systematic literature review identified no evaluated primary prevention interventions to reduce drowning-related mortality and morbidity in young people for either males or females (Peden et al., 2023). We attempted to address this research gap by exploring the impact of the 2018/19 Swim Reaper water safety campaign on water safety awareness for a range of risky behaviors, as well as the impact of the program on fatal and nonfatal drowning rates of males aged 15–34 years in New Zealand.

The Swim Reaper program takes a unique approach to water safety messaging in that the advertising materials are devoid of organizational branding and black humor is used to convey the consequences of unsafe behaviors around the water. There has been limited analysis of the efficacy of water safety messaging and variation of tone and delivery modalities. A study of messages aiming to reach youth swim lesson participants in the United States has suggested alternative modalities are needed which consider the audience’s differing socio-cultural perspective (Ramos & Anderson, 2020). In Australia, campaigns such as ‘Don’t Let Your Mates Drink and Drown’ (Hamilton et al., 2021) and ‘Be a Mermate’ (Royal Life Saving Society - Western Australia, 2022) have used humor to encourage males to avoid alcohol and look out for each

**Table 3**

Results from the time series analysis, displaying the estimated effect of the swim reaper campaign on drowning mortality, hospital admissions and ACC claims, male aged 15–34, New Zealand. All estimates are adjusted for seasonality.

Time	Mortality Rate ratio (95% CI)	p-value	Hospital admission Rate ratio (95% CI)	p-value	ACC claims Rate ratio (95% CI)	p-value
Pre campaign	Ref		Ref		Ref	
Implementation	1.36 (0.86–2.16)	0.19	0.81 (0.48–1.38)	0.44	1.13 (0.90–1.42)	0.31
Post campaign	1.06 (0.77–1.44)	0.73	0.47 (0.24–0.90)	0.02	0.98 (0.73–1.31)	0.90



**Fig. 3.** Interrupted time series regression model adjusted for seasonality, drowning mortality (Panel A); drowning hospital admission (Panel B) and drowning ACC claims (Panel C) male aged 15–34, New Zealand (solid vertical lines indicate first year of Swim Reaper program).

other around the water. However, more evidence is needed to determine the most effective means of creating and maintaining positive behaviors around water in the long-term among high-risk populations. Of relevance to the ‘Swim Reaper’ program is the fact that black humor processing is a complex task and might be perceived differently and only appeal to certain population groups (Willinger et al., 2017).

Experiences from road safety have shown greater long-term efficacy in positive humor based appeals, compared to fear-evoking messaging

when it comes to anti-drink driving (Lewis, Watson, & White, 2008). Comparison based research that explores the impact of different types of messaging on short and long-term behavior change is needed within the context of drowning prevention. Similarly, while this research focused on males as a ‘high-risk’ group for drowning (Moran, 2011; Lawes et al., 2021; Howland et al., 1996), further research is needed to determine if the Swim Reaper’s appeal extends to adolescent females and even older people – both identified as emerging cohorts of concern for drowning

(Peden et al., 2022; Clemens et al., 2021).

Research findings indicate that the 2018/19 Swim Reaper campaign may have had some positive impact on water safety awareness. These are promising findings although further research or alternate approaches may be needed to create sustained behavior change around swimming and help address the relatively high drowning rate in New Zealand, relative to other developed countries (Water Safety New Zealand, 2022).

We found that drowning mortality rates declined from 1992 to 2022, but ITS analysis showed no difference in rates before and after the program. The Swim Reaper program takes a non-traditional approach to water safety, with the Swim Reaper glorifying unsafe behaviors in the hope of claiming drowning victims. Given this departure from traditional water safety messages, it is pleasing to note that fatal and nonfatal drowning rates among 15–34 year-old males did not increase in taking this approach.

Compared to the pre-program reference period, there was a reduction in nonfatal drowning related hospital admissions after the first year of the program of around 14 drowning related hospital admissions in 15–34-year-olds in New Zealand per year. It should be noted, however, that hospital admissions during the post-campaign period were likely impacted by the COVID-19 pandemic-related suppression measures, such as lockdowns, which likely reduced exposure to water and thus drowning risk. This is in contrast to neighboring country Australia, which saw increased fatal drowning numbers (Lawes, Strasiotto, Daw, & Peden, 2021; Royal Life Saving Society, 2022), including in the state of Victoria, which experienced protracted lock downs.

The Swim Reaper program is not currently being promoted, with Water Safety New Zealand opting to take an alternative campaign approach. Close examination of fatal and nonfatal drowning data during the program hiatus period, as compared to the program period, will be vital to identify any changes in drowning rates among the target group in the absence of Swim Reaper. This may be unlikely given generally declining overall drowning rates for 15–34 year-old males in New Zealand, but warrants consideration as discontinuation of the Swim Reaper could lead to increasing drowning rates among this cohort.

It must be acknowledged that the 2018/19 Swim Reaper campaign, and in fact the broader program, was not run in isolation, amid a range of other drowning prevention interventions including Surf Life Saving New Zealand's #SaveTheMales campaign (Surf Life Saving New Zealand, 2022) and lifeguarded beach patrols, as well as regional community water safety programs from organizations such as Drowning Prevention Auckland (Drowning Prevention Auckland, 2022). Consideration should also be given as to whether any other events, such as high-profile drowning incidents, may have occurred between the two survey points that may have impacted responses. Nevertheless, ensuring a range of approaches are employed to improve water safety among young males in New Zealand will be vital to achieving the outcomes outlined in the Wai Ora Aotearoa Sector Strategy 2021–2025 (Water Safety New Zealand, 2021).

## 5. Strengths and limitations

This study is the first of its kind and adds to the limited data evaluating drowning prevention interventions for adolescents and young adults, a topic that has been identified as a gap in the drowning prevention literature (Rahman et al., 2021). However, the findings of this study must be considered in the context of some limitations. Survey findings evaluate the impact after a two-week campaign during the summer 2018–19. As the broader Swim Reaper program commenced in the summer 2016/17, it is possible respondents' water safety behavior was influenced by the Swim Reaper from previous year's campaigns even if they did not recall hearing of the program. Although the

combined pre- and post-campaign participants were evenly split between the 15–24 and 25–34 years age groups, there were significant age group differences in the pre-campaign survey respondents, compared to the post-campaign survey respondents. Further, although the initial year of the program targeted 15–24 year old males, its promotion largely via social media meant it had a broader audience, in fact reaching, 65% of the 15–29 year-old male population in New Zealand. As such, we examined impact on the broader 15–34 years age group. Another limitation is potential bias in self-reported survey data, which could for example occur from recall bias or social desirable responding to interview questions (Chapman and Underwood, 2000; Paulhus, 1984).

Any nonfatal drowning-related hospitalizations or ACC claims from international tourists, international students, and foreign workers were unable to be identified in the routinely collected data, which may impact drowning rates. The COVID-19 pandemic is also likely to have impacted exposure to water and therefore fatal and nonfatal drowning rates in the latter years of the 5-year post intervention period of the interrupted time series analysis, as has been seen in other countries (Lawes et al., 2021; Houser and Vlodarchyk, 2021). The 2018/19 Swim Reaper campaign, and the broader program, was not run in isolation and any reported reductions in the drowning rate may be due to other water safety initiatives, or as part of a broader prevailing downward trend in drowning rates. Drowning rates by region are calculated using residential population data and drowning data based on drowning location not residence. More work is needed to refine population data based on aquatic location exposure and visitation information. Water safety awareness questions asked in the survey did not directly link to the campaign's messages in the implementation year of this study, and the language used made it difficult to determine what were the safe and unsafe choices. These evaluation constraints should serve as impetus to ensure rigorously designed evaluation mechanisms prior to the development and implementation of future campaigns, ideally through the use of standardized questionnaires.

## 6. Implications and contributions

This study contributes to the limited evidence around evaluation of public awareness elevation of drowning prevention interventions, particularly as they relate to adolescents and young adults. Findings indicate the 2018/19 Swim Reaper campaign may have contributed to a self-reported increase in positive water safety behaviors among males 15–34 years in New Zealand, as well as post-program reductions in drowning-related hospitalizations. Humorous, lightly branded campaigns transmitted via social media may be effective in improving safety behaviors around water for males 15–34 years in New Zealand.

## 7. Conclusion

The 2018/19 Swim Reaper campaign may have contributed to safer behaviors among young males aged 15–34 years in Aotearoa, New Zealand. Our analysis did identify a significant change in drowning related hospital admissions in 15–34 year-olds post the 2018/19 Swim Reaper campaign. The novelty and reach of the program may provide support for social media-based campaigns targeting this hard-to-reach demographic. The use of alternative approaches, such as black humor and avoiding overt organizational branding, may also be components of its reach and contribution. However, this warrants further investigation because black humor processing is a complex task and might be perceived differently and only appeal to certain population groups. Further investigation is needed to ensure messages are achieving their aim of improving water safety and reducing drowning risk for young males.



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## Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Simon Williamson (SW) and Felicity Fozard (FF) are employed by Water Safety New Zealand. Water Safety New Zealand provided funding support for the research. Analyses were conducted independent of the funder and authors SW and FF. The authors declare no conflict of interest.

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## Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jsr.2023.11.006>.

## References

- Franklin, R. C., Peden, A. E., Hamilton, E. B., Bisignano, C., Castle, C. D., Dingels, Z. V., ... Sylte, D. O. (2020). The burden of unintentional drowning: Global, regional and national estimates of mortality from the Global Burden of Disease 2017 Study. *Injury Prevention, 26*(Supp 1), i83–i95.
- World Health Organization (2021). Drowning Geneva: World Health Organization; 2021. Available from: <https://www.who.int/news-room/fact-sheets/detail/drowning>.
- Water Safety New Zealand (2022). Drowning Insights 2022. Available from: <https://www.watersafetynz.org/drowning-insights>.
- Peden, A. E., Franklin, R. C., & Clemens, T. (2019). Exploring the burden of fatal drowning and data characteristics in three high income countries: Australia, Canada and New Zealand. *BMC Public Health, 19*(1), 794.
- Peden, A. E., Cullen, P., Francis, K. L., Moeller, H., Peden, M. M., Ye, P., ... Abbasi-Kangevari, Z. (2022). Adolescent transport and unintentional injuries: A systematic analysis using the Global Burden of Disease Study 2019. *The Lancet. Public, 7*(8), e657–e669.
- Moran, K. (2011). (Young) Men behaving badly; dangerous masculinities and risk of drowning in aquatic leisure activities. *Annals of Leisure Research, 14*(2–3), 260–272.
- Hamilton, K., & Schmidt, H. J. (2013). Drinking and swimming: Investigating young Australian males' intentions to engage in recreational swimming while under the influence of alcohol. *Journal of Community Health, 39*(1), 139–147.
- Lawes, J. C., Ellis, A., Daw, S., & Strasiotto, L. (2021). Risky business: A 15-year analysis of fatal coastal drowning of young male adults in Australia. *Injury Prevention, 27*(5), 442.
- Peden, A. E., Demant, D., Hagger, M. S., & Hamilton, K. (2018). Personal, social, and environmental factors associated with lifejacket wear in adults and children: A systematic literature review. *PLOS ONE, 13*(5), e0196421.
- Surf Life Saving New Zealand (2022). #SaveTheMales 2022. Available from: <https://www.surflifesaving.org.nz/stay-safe/beach-safety-messages/savethemales>.
- Moran, K. (2014). Jumping to (fatal) conclusions? An analysis of video film on a social networking web site of recreational jumping from height into water. *International Journal of Injury Control & Safety Promotion, 21*(1), 47–53.
- Jones, S. C., & Gordon, R. (2013). Regulation of alcohol advertising: Policy options for Australia. *Evidence Base: A Journal of Evidence Reviews in Key Policy Areas, 2*, 1–37.
- Hamilton, K., Keech, J. J., Willcox-Pidgeon, S., & Peden, A. E. (2022). An evaluation of a video-based intervention targeting alcohol consumption during aquatic activities. *Australian Journal of Psychology, 74*(1), Article 2029221.
- Water Safety New Zealand (2022). Swim Reaper: Water Safety New Zealand, 2022. Available from: <https://swimreaper.co.nz/>.
- Peden, A. E., & Richardson, K. (2022). Quantifying fatal and nonfatal drowning in children under five in Aotearoa, New Zealand. *Australian and New Zealand Journal of Public Health, 46*(1), 46–51.
- Bernal, J. L., Cummins, S., & Gasparrini, A. (2017). Interrupted time series regression for the evaluation of public health interventions: A tutorial. *International journal of epidemiology, 46*(1), 348–355.
- Peden, A. E., Cullen, P., Bhandari, B., Testa, L., Wang, A., Ma, T., ... Ivers, R. (2023). A systematic review of the evidence for effectiveness of interventions to address transport and other unintentional injuries among adolescents. *Journal of Safety Research, 85* (2023), 321–338.
- W. D. Ramos, A. R. Anderson, A. Beal-Tawfeeq (Eds.), Youth water safety messaging efficacy: A qualitative examination. 2020 NRPA Annual Conference: A Virtual Experience.
- Royal Life Saving Society - Western Australia (2022). Be a Mermate Campaign 2022 [Available from: <https://www.royallifesavingwa.com.au/programs/youth-water-safety/stats-and-facts/be-a-mermate-campaign>].
- Willinger, U., Hergovich, A., Schmoeger, M., Deckert, M., Stoettner, S., Bunda, I., ... Jaeckle, D. (2017). Cognitive and emotional demands of black humour processing: The role of intelligence, aggressiveness and mood. *Cognitive processing, 18*, 159–167.
- Lewis, I., Watson, B., & White, K. M. (2008). An examination of message-relevant affect in road safety messages: Should road safety advertisements aim to make us feel good or bad? *Transportation Research Part F: Traffic Psychology and Behaviour, 11*(6), 403–417.
- Howland, J., Hingson, R., Mangione, T., Bell, N., & Bak, S. (1996). Why are most drowning victims men? Sex differences in Aquatic Skills and Behaviors. *American Journal of Public Health, 86*(1), 93–96.
- Clemens, T., Peden, A. E., & Franklin, R. C. (2021). Exploring a hidden epidemic: Drowning among adults aged 65 years and older. *Journal of Aging and Health, Article 8982643211014770*.
- Lawes, J. C., Strasiotto, L., Daw, S., & Peden, A. E. (2021). When natural hazards intersect with public health: A preliminary exploration of the impact of bushfires and the COVID-19 pandemic on Australian coastal drowning fatalities. *International Journal of Environmental Research & Public Health, 18*(10), 5314.
- Water Safety New Zealand (2022). Drowning Report 2021. Available from: <https://drowningreport2021.watersafety.org.nz/>.
- Royal Life Saving Society – Australia (2022). National Drowning Report 2022. Available from: [https://www.royallifesaving.com.au/\\_data/assets/pdf\\_file/0007/67687/RLS\\_NationalDrowningReport2022\\_SPG\\_LR.pdf](https://www.royallifesaving.com.au/_data/assets/pdf_file/0007/67687/RLS_NationalDrowningReport2022_SPG_LR.pdf).
- Drowning Prevention Auckland (2022). Community [Available from: <https://www.dpanz.org.nz/community/>].
- Water Safety New Zealand (2021). Wai Ora Aotearoa Navigating to a safer future New Zealand water safety sector strategy 2025. Wellington: Water Safety New Zealand. Available from: <https://sector.watersafety.org.nz/>.
- Rahman, A., Peden, A. E., Ashraf, L., Ryan, D., Bhuiyan, A.-A., & Drowning, B. S. (2021). Global Burden, Risk Factors, and Prevention Strategies. Oxford Research Encyclopedia of. *Global Public Health*.
- Chapman, P., & Underwood, G. (2000). Forgetting near-accidents: The roles of severity, culpability and experience in the poor recall of dangerous driving situations. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition, 14*(1), 31–44.
- Paulhus, D. L. (1984). Two-component models of socially desirable responding. *Journal of Personality and Social Psychology, 46*(3), 598.
- Houser, C., & Vlodych, B. (2021). Impact of COVID-19 on drownings patterns in the Great Lakes region of North America. *Ocean and Coastal Management, Article 105570*.

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