

INJURY PREVENTION RESEARCH UNIT

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PRESENTATIONS: RISK FACTORS

RISK FACTORS FOR NON-DROWNING INJURY IN RECREATIONAL SWIMMING

ABSTRACT

Swimming is a popular recreational activity and is the leading cause of aquatic injury in New Zealand, costing \$8m p.a. in compensation claims. While many postulated risk factors have been identified in the literature, few have been confirmed through analytic studies. The aim of this study was to measure the independent effect of a number of commonly postulated factors, as a means of facilitating the development of targeted interventions.

An unmatched case-control study was undertaken, with the source population swimming events: i.e. events in which a person is substantially immersed in water for the purpose of swimming or bathing. Information on events was obtained from compensation claimants aged 5 to 65 years. For cases claimants were asked about the swimming event responsible for their claim, while for controls claimants were asked about a recent non-injury swimming event. Data collection was by telephone interview. Questionnaires were completed for 997 case and 1,165 control events.

The commonest injury was laceration, the commonest body region the head/neck, and the commonest cause collision. Regression analyses were undertaken, with adjustment for confounding factors and a single model was fit to the data. Significant risk factors in the final model included ability to swim 200 metres comfortably in open water (2.24; 95% Confidence Interval: 1.77, 2.82), unfamiliarity with the water body concerned (1.51; 1.19, 1.92) and first entry from a height greater than 1 metre (2.81; 1.78, 4.42). Significant protective factors included swimming once or more a month versus less than once a month (0.66; 0.48, 0.90).

This study has identified several factors which may be targeted in the development of interventions aimed at reducing the risk of injury in recreational swimming, particularly swimming ability, experience and entry to the water. The study has also confirmed some commonly promoted water safety messages, while questioning others.

PRESENTATION PAPER

Introduction

Swimming is a popular recreational activity and is the leading cause of compensation claims for aquatic injury in New Zealand, costing \$8m per annum.¹ While many postulated risk factors have been identified in the literature, few have been confirmed through analytic studies.² The aim of this study was to measure the independent effect of a number of commonly postulated factors, as a means of facilitating the development of targeted interventions.

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The factors of interest were gender, age, ethnicity, swimming ability, swimming experience, reason for swimming, type of water body, familiarity with water body, first entry (height, depth of water, clarity of water), alcohol consumption, swimming alone, swimming at night, wearing clothing, water flow (rivers), swimming between the flags (beaches), checking depth of water, checking for hazards, swimming aids, flotation devices and warning signs.

Methods

An unmatched case-control study was undertaken, with the source population being swimming events (occasions): i.e. events in which a person is substantially immersed in water for the purpose of swimming or bathing, commencing from the moment the person approaches the water and ceasing the moment the person leaves the immediate vicinity of the water. Included were competitive swimming and diving, snorkelling, being rescued, wading, slipping or falling from structures and entry by any means (e.g. diving, jumping, walking).

Excluded were deaths, work-related activities, swimming associated with boating or surfing, organised games (e.g. water polo), undertaking a rescue and being pushed or falling into water when not intending to swim.

Data on case and control events were obtained from compensation claimants aged 5 to 65 years, who had lodged a claim with the Accident Compensation Corporation (ACC) - administrators of New Zealand's compulsory, no-fault accident compensation scheme, in the period November 2004 to April 2005.

For case events (hereafter referred to as cases) claimants were asked about the swimming event responsible for their claim, while for control events (controls) claimants were asked about a recent non-injury swimming event. To reduce recall bias the swimming event had to have occurred within four weeks prior to interview. All data collection was by telephone interview. Questionnaires were completed for 997 case and 1,165 control events.

Table 1. Nature and circumstances of injury (cases)

	Number	Percentage	
Type¹	Haematoma, bruising, swelling	313	33
	Cut, laceration	233	26
	Sprain, strain	233	24
	Damage to teeth	121	13
	Graxing, abrasion	70	7
	Fracture	56	6
Body region¹	Head, neck	476	50
	Lower limb	373	39
	Torso	199	21
	Upper limb	106	11
Circumstances	Collision	577	60
	Object/person in water	198	21
	End/side of pool/water body	169	18
	Bottom of pool/water body	150	16
	Fall	117	12
	Poolside/ground	74	8
	Into water	43	4
	Struck by wave	63	7
	Stood on sharp object	36	4

¹Multiple responses were permitted.

Results

In 54% of cases and 57% of controls the swimmers were male. The mean age of cases was 21.8 years and the mean age of controls 22.2 years. In 81% of cases and 80% of controls the swimmers were New Zealand European, and in 13% of cases and 11% of controls the swimmers were Maori.

For the cases, the commonest injury was a haematoma, bruising or swelling; the commonest body region injured was the head/neck; and the commonest cause of injury was a collision (Table 1).

Separate regression analyses were undertaken for each of the 23 factors investigated, with adjustment for potential confounding factors.

A multivariate regression model was then fit to the data. On the basis of the initial analyses, swimming alone or out of sight of others and swimming at night in unlit water were omitted from the multivariate model. Water flow and swimming between the flags were also omitted from the model because they were restricted to events occurring at rivers and beaches.

Table 2. Multivariate model

		Odds Ratio	(95% CI)
Demographic			
Gender	Female	1.00	
	Male	0.95	(0.77, 1.16)
Age group (years)	Less than 15	1.00	
	15-24	1.16	(0.86, 1.55)
	25-44	0.58	(0.43, 0.77)
	45 or more	0.59	(0.42, 0.83)
Ethnicity	Non-Maori	1.00	
	Maori	1.25	(0.92, 1.69)
Swimming ability and experience			
Able to swim 200 metres in open water	No/don't know	1.00	
	Yes, feel anxious/very anxious	1.30	(0.92, 1.83)
	Yes, feel comfortable	2.24	(1.77, 2.82)
Frequency of swimming	Less than once a month	1.00	
	Once a month or more	0.74	(0.52, 1.05)
Event			
Main reason for swimming	Other (exercise, training, competition)	1.00	
	Recreation	1.54	(1.16, 2.03)
Type of water body	Swimming Pool	1.00	
	Natural water body	0.57	(0.44, 0.74)
Familiarity with water body	Very familiar/Familiar	1.00	
	Not very familiar/Extremely unfamiliar	1.51	(1.19, 1.92)
First entry			
Height of first entry	Less than 1 metre	1.00	
	1 metre or more	2.81	(1.78, 4.42)
Depth of water on first entry	1 metre or more	1.00	
	Less than 1 metre	1.35	(1.09, 1.69)
Water cloudy on entry	Not cloudy	1.00	
	Cloudy	1.41	(1.06, 1.88)

Table 2. Multivariate model cont.

		Odds Ratio	(95% CI)
Reckless behaviour, precautions & environment			
Wearing clothing	No	1.00	
	Yes	0.77	(0.61, 0.96)
Wearing swimming aids/flotation devices	Neither	1.00	
	Either	0.45	(0.36, 0.57)
Warning signs present	No	1.00	
	Yes	0.52	(0.41, 0.66)

In the initial analyses, swimming in a fast or moderately fast flowing section of a river was shown to increase the risk of injury (OR=2.82; 95% CI: 0.98, 8.10), while no effect was obtained for not swimming between the flags at a beach [OR(adjusted for age and BAC)=0.97; 95% CI: 0.60, 1.57]. A further five factors were discarded because they made no contribution to the model: uncontrolled entry, checking for submerged objects, checking for submerged swimmers, blood alcohol concentration and knowing or checking the depth of water before first entry. A total of 14 factors were retained in the final model (Table 2).

Discussion

Of the 14 factors remaining in the model, eight were shown to be associated with increased risk of non-drowning injury: age, ethnicity, swimming ability, reason for swimming, type of water body, familiarity with water body, height of first entry, depth of water at first entry and clarity of water at first entry. Four were shown to be associated with reduced risk of injury: frequency of swimming, clothing, swimming aids/flotation devices and warning signs. The finding that wearing clothing while swimming reduced the risk of injury is counterintuitive and may have resulted from our classification of 'shorts' as clothing. This factor will be re-examined. No effect was obtained for gender but this factor was retained in the model. This finding may have resulted from a gender bias in the population from which controls were sampled. Factors ruled out by the analysis are alcohol consumption, checking for depth and submerged hazards, swimming alone and swimming at night.

The findings suggest that 5-14 year olds, Maori, recreational swimming, swimming pools and first entry are factors that should be targeted for intervention. Common water safety measures relating to familiarity, swimming aids, flotation devices, signs, swimming between the flags (beaches) and avoidance of fast flowing water (rivers) are reinforced by these findings.

Of particular interest is the contrast between swimming ability and swimming experience. Whereas swimmers who felt comfortable about swimming 200 metres in open water were at more than twice the risk of injury compared to those who were unable to swim this distance, those who swam once a month or more were at a 25% lower risk of injury than those who swam less than once a month. These contrasting findings may provide the basis for an intervention that takes account of 'over-confidence' and lack of experience.

Conclusion

This study has identified several factors which may be targeted in the development of interventions aimed at reducing the risk of non-drowning injury in recreational swimming, particularly swimming ability, experience and entry to the water. The study has also confirmed some commonly promoted water safety messages, while questioning others.

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References

1. ACC Injury Statistics 2005 (First Edition), www.acc.co.nz
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