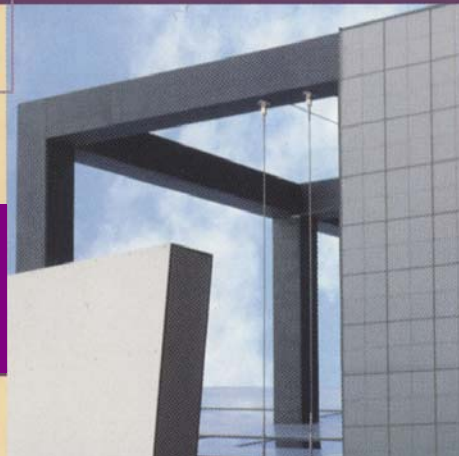


UNINTENTIONAL DROWNING AT AUSTRALIAN SURF BEACHES: PROBLEM DEFINITION AND PROPOSED REDUCTION STRATEGIES

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Abstract

This paper reviews a range of elements relevant to unintentional drowning at Australian surf beaches. Following an introduction to the setting, the key terms related to the setting, the injury type, and associated activities are defined. The operation of risk factors in the setting is explained and proposed strategies to address and reduce this type are then outlined. The paper concludes with a recommendation for further research into this injury problem.

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UNINTENTIONAL DROWNING AT AUSTRALIAN SURF BEACHES: PROBLEM DEFINITION AND PROPOSED REDUCTION STRATEGIES

Personified through images of the *bronzed aussie*, the coastline, and in particular the surfing beach, holds a significant place in the Australian psyche. Moreover, coastal beaches are a commonly recognised image and primary attraction for many of the five million international tourists attracted to Australia each year. Although data on specific use-levels for coastal beach and surf swimming are not available, George Hill, the Manager of Queensland Surf Life Saving reports that more than 18 million people visit Australian beaches each year (personal communication via e-mail, 15/9/2000). High user-levels are not surprising given that the Australia Bureau of Statistics (ABS) data indicates that over 15 percent of Australians list swimming as a recreational pursuit, making this activity the second most popular in Australia after walking (ABS, 1999).

Beaches and surrounding coastal features such as rock platforms and headlands provide for multiple recreational opportunities including surfing, swimming, fishing, fossicking, and sunbathing. Coastlines also contain many physical hazards. These hazards include intense ultraviolet radiation (resulting in sunburn), sharp beach litter (Grenfell & Ross, 1999), and poisonous marine animals such as the blue ringed octopus (Bullock, 1980). Many recreational activities undertaken in coastal settings are characterised by inherent risks, for example, decompression illness in scuba diving (Wilks & Davis, 2000), hypoxia in snorkelling (Edmonds & Walker, 1999), and collision induced fatalities in jet skiing (Swinburn, 1996).

While these and other coastal-related injury problems remain important areas for further research, this paper focuses on unintentional injuries and deaths during swimming and surfing activities where water submersion (causing drowning or near-drowning) is the direct, underlying or associated cause.

DEFINITION OF TERMS

Coastline and beaches

Australia's coastline is defined here as the transition zone between land and the open sea. Features of this coastline include headlands, rock shelves, beaches and related geological formations. The coastal beach is used as an access point for most water-based recreational activities. Short (1993, p. 1) defines this coastal feature as:

...a wave deposited accumulation of sediment, usually sandy but possibly cobbles and boulders, lying between the upper limit of wave swash and extending out across the surf zone to the depth to which the average waves can move sediment shoreward.

Being an island continent, Australia's array of beaches is both extensive and widespread (see Table 1 for an overview). For example, over sixty percent of the New South Wales 1590 km coastline is sandy and this contains 721 identifiable beaches (Short, 1993). Some of these beaches are accessible by paved road (e.g., Bondi) where as others are accessible only by foot or boat (e.g., Burning Palms in the Royal National Park). In addition to these variations in location and access, each beach will present its own specific, unique and often dynamic set of hazards contingent upon the combination of geological, topological, hydrological, climatic and ecological conditions.

Table 1: Number, Accessibility and Patrol of Surf Beaches in Australia¹

Surf Beaches	Number	% (of total)
Total number	7098	100
Accessible	4698	66
Patrolled ²	300	4

¹ Source: Surf Life Saving Australia (2000)

² Patrolled by volunteer lifesavers or professional lifeguards (at minimum over Summer weekends)

Water Submersion Injury (Drowning or Near-drowning)

Collin's medical dictionary (1987, p.161) defines drowning as "the act of inhaling liquid". Drowning can be subdivided into two types; the majority of drownings are classed as wet drowning, where liquid is inhaled into the lungs (Macpeherson, 1999). The other type is dry drowning, where air passages become restricted through the subject being underwater, though no water is inhaled into the lungs. MacPherson explains that although saltwater (coastal) and freshwater drowning produces different physiological reactions within the body, both methods of drowning carry similar prognoses for patients. Importantly, the draft National Injury Prevention Action Plan reports that for every drowning, between four and ten near-drowning victims are hospitalised with up to ten percent of these cases suffering neurological damage (Health and Aged Care, 1999a, p. 24).

The commonly used coding system for identifying causes of injury related death is the International Classification of Diseases Supplementary Classification (ICD) of external causes of injury and poisoning (E) codes (Smith & Langley, 1998). These codes allow cases to be delineated according to, among other things, whether the drowning was accidental or intentional, involved equipment or watercraft, or was attributable to elements within the natural setting. Although these codes provide a very useful starting point to investigate drowning epidemiology, Smith and Langley acknowledge the potential for misclassification, especially where the event can be attributed to other apparent causes (e.g., code E816 - MVA traffic accident - where the occupants drown following their motor vehicle leaving the road and entering the water). The effect of this misclassification is to underrepresented the total number of cases where drowning was the primary or associated cause of death.

Swimming and Surfing Activities

The beach forms the coastal launch spot for the majority of swimmers and surfers. Both these recreational groups use these beach settings to swim among the ocean swell and to ride the waves. Surfers and swimmers can use equipment during these aquatic activities (e.g., surfboards, flippers, wetsuits); however, often beach swimmers will be completely unaided. The number of participants in these activities will vary by season, with warmer conditions conducive to higher user numbers over summer seasons. As many people take holidays over this period, a larger absolute number of less experienced swimmers and surfers would be present on beaches in the warmer months.

COASTAL DROWNING IN AUSTRALIA

Mackie (1999) provides a summary of drowning in Australia drawn from ABS data for the period 1992 to 1997 (prior to 1992 the ABS did not record drowning location). This study identified cases classified under six E codes (830, 832, 910, 954, 964, and 984) plus non E code cases with a "drowning flag"; the drowning flag is used in cases where drowning was not the primary cause of death. Over this six-year period, 2673 people drowned in Australia with 1551 (58%) of these classified as accidental non-boating drownings. Mackie reports that non-boating drownings occurred at a rate of 1.44 per 100 000 persons per year standardised to 1996 population data. As drowning often occurs at a young age, the per-capita valuation of this type of premature death is high relative to other health mortality problems (e.g., heart disease) (see Health and Aged Care, 1999a, pp. 23-24).

Of all Australian drowning deaths reported by Mackie (1999), 346 occurred in an ocean/estuary (tidal site) with a further 162 at a surfing beach. Age distributions show broadly similar patterns for these two drowning locations - each modal point is in the 15-24 years age category. Other statistical measures were not reported for this data (e.g., median, mean, and standard deviation), though a visual inspection of each data set reveals relatively few drownings on the 0-4 and 5-14 age categories. Numbers of drownings then rise for the 15-24 age category and remain relatively constant up to the 45-54 age category. Drowning falls in the 55-64 age category and again rises in the 65+ age category. Gender distribution was similar for both drowning locations; males comprised 90% of ocean/estuary deaths and 89% of surfing beach deaths. No breakdown of gender by age category was reported.

The distinction made in the ABS data between surf beach and ocean/estuary (upon which Mackie (1999) based his study) may prove to be arbitrary when considering targeted injury countermeasures. That is, many risk factors will be common to both ocean/estuary drownings and surf beach drownings. However, combining these two categories would include drownings caused through factors not directly relevant to the core theme of this paper (e.g., supervised scuba diving fatalities). Considering this, the following discussion focuses on those 162 unintentional deaths that occurred at a surf beach.

The age and gender distributions for 162 surf beach drownings provide important data for specifying prevention strategies. However, the *rate* of drowning within age and gender groupings would provide a clearer picture of the actual drowning problem. Take for example the high drowning propensity of young males. This finding might be partially explained through higher participation rates of young male relative to young females (both in terms of the frequency of beach visits and the actual exposed time through swimming). Nonetheless, given that no reliable measures of surfing beach participation/ exposure rates are available, discussion of exposure levels is a mute point at present.

Mackie's (1999) report indicates that on average 27 surf beach drownings occurred per year from 1992-1997. Similar to most other drowning scenarios, beach drowning follows a seasonal pattern peaking in the Summer months (ABS, 2000; Mackie, 1999). To specify and analyse prevention strategies, current trends require confirmation through linking and checking available drowning data (e.g., ABS, Coroner, hospital admissions, and SLISA). This process will provide reliable information regarding the actual location and specific drowning cause for each case (see Ashby, 1997).

RISK FACTOR OPERATION FOR COSTAL DROWNING

Epidemiological data is limited in the context of surf beaches. Nevertheless, many potential risk factors for surf beach drownings can be identified, although the specific role of many in drowning is still to be determined (see NHMRC, 1996).

Haddon's matrix (1972) associates risk factors with an injury event in three temporal periods: before the event, during the event, and following the event. Within these time periods, risk factors that influence the event are categorised as relating to the person, the activity, or the conditions. This matrix approach can be used to provide an improved understanding of the problem of surf beach drowning.

The *pre-event* stage refers to the time before exposure (i.e., before entering the water). The major risk factors here comprise that which a person *brings* to the activity plus the enduring physical hazards inherent to the setting. These factors include; an individual's motivation to swim, expectations about swimming conditions, willingness to take risks (influenced, for example, through psychological characteristics of personality, mood, and self-efficacy), control and recognition of hazards (presumed to be related to surf and swimming experience), and the general level of fitness. Enduring characteristics of the setting identified before the event include physical features such as submerged rock shelves, water temperature, and general currents (Short, 1993).

The overrepresentation of young males identifies this grouping as a key target for injury countermeasures associated with factors contributing to *pre-event* risk factors. Interestingly, this pattern is repeated in other injury problems including road transport (Hewitt, et al., 1995), and overall drowning patterns (Bordeaux & Harrison, 1998). Further testing and development of theories explaining risk taking propensity, misperception of hazards (e.g., those associated with shallow diving), and the role of alcohol and other drugs is required to design and assess injury prevention strategies (e.g., Hewitt et al., 1995; NHMRC, 1996; Nixon et al., 1995).

International tourists comprise a second group for targeted prevention. In Mackie's study (1999), of the 162 beach drownings, 54 (33%) were international tourists. Presumably, a lack of swimming and surf experience is a key explanation for this finding. Given the projected growth rates in Australia's inbound tourism markets (Industry, Science and Resources, 2000) and the common depiction in tourism promotional

materials of Australian beach scenes, the number of drowning fatalities among international tourists can be expected to rise without effective countermeasures (other factors remaining equal).

During the *event*, or the time-period where the person has chosen to swim or surf in the beach zone, a range of dynamic risk is brought into play. The overriding factor relevant to swimmers or surfers is their capability *meet the challenge* presented by the conditions. This capability will be influenced through those factors brought to the event (discussed above) and also include *event-specific* factors that effect performance (e.g., alcohol or other drugs and energy levels). The nature and location of the activity also bears upon the inherent risk of the event. For example, an individual in difficulty will have a better chance of rescue where other participants or surf beach patrols are proximate. Specific sea and weather conditions will be a major determinant of the environmental hazards. For example, the combination of plunging waves and low tide can heavily 'dump' swimmers onto sandbanks causing spinal injury and subsequent drowning (Short, 1993).

Post event refers to the time following a drowning (or near-drowning). The elapsed time before help reaches the victim (and, if required, before resuscitation is commenced) is a crucial factor for life preservation. Therefore, ease of access to the victim, the first aid training of helpers, and the time period before access to full medical care will influence the recovery of the victim. Historically, considerably fewer drowning deaths having occurred inside flagged areas (on patrolled beaches) and the success of expired air and cardiopulmonary techniques used by surf lifesavers has been highlighted in the medical literature (Manolios & Mackie, 1988).

PROPOSED STRATEGIES TO REDUCE THE INJURY PROBLEM

Over the last decade, numerous reports and studies demonstrate a considerable amount of thought and expertise directed towards prevention of both beach drowning and drowning in the wider context. A brief overview of these works is presented in Table 2. This table presents a range of directions to be followed through research, advocacy and awareness, education and communication, legislation and regulation, equipment and environmental design, and community based strategies.

These strategies may prove to be effective countermeasures for surf beach drowning. Moreover, an integrated strategy that reinforces safety messages and behaviours throughout the chronological sequence surrounding a drowning event (pre event, event, and post event) will most likely offer maximum benefit in reducing this injury problem. Of course, these countermeasures should, where possible, be evaluated through rigorous research methods to provide evidence which demonstrate the measure's effectiveness and utility.

In conclusion, the majority of coastal drowning is preventable. The social and economic costs that these incidents have on the community demands that potential evidenced-based strategies and countermeasures aimed at reducing the problem should be investigated. The first step towards the goal of zero beach drowning requires research and dedicated funding. Nevertheless, the allocation of resources for targeting this injury problem must be considered within the context of other health priority areas for injury reduction.

Table 2: Evidenced Based and Proposed Strategies to Reduce Surf Beach Drowning

Countermeasure category	Surf beach targeted	Drowning targeted (applicable to surf beach)
Research		Comprehensive epidemiological studies (Health and Aged Care, 1999a; NHMRC, 1999; Nixon et al. 1995)
Awareness/ advocacy	Television advertising about dangers (Vicswim, 1998) Surf safe videos for inbound tourists (Vicswim, 1998) Kellogg's Surf safe summer campaign (SLSA, 1999)	TV personalities to promote water safety (Vicswim, 1998) Water safety information published in many languages (Health and Aged Care, 1999b)
Education/ Communication	Simulated risk training (Vicswim, 1998) Wider bronze medallion training (Vicswim, 1998) Surf education curriculum at Schools including resuscitation skills (SLSA, 2000; Vicswim, 1998) Mobile learning centres (SLSA, 2000) Improve SLSA volunteer skills (Erby, undated; NHMRC, 1999; SLSA, 1999)	Alcohol education (Health and Aged Care, 1999b; Health and Aged Care, 1999c; NHMRC, 1996; NHMRC, 1999; Nixon et al. 1995; Vicswim, 1998) Swimming training (NHMRC, 1999) Resuscitation training (Australian Water Safety Council, 1998; Health and Aged Care, 1999b; NHMRC, 1996) Target 'black spots' (Health and Aged Care, 1999b; NHMRC, 1996)
Legislation/ Regulation	SLSA official recognition as an emergency body (SLSA, 2000) Standardised warning and hazard signage (Statewide, 1998; Vicswim, 1998)	Flotation devices (NHMRC, 1996)
Equipment/ environmental design	Emergency telephones on beaches (Vicswim, 1998) Beach safety audits (Short, 1993; SLSA, 2000) SLSA input to coastal development (SLSA, 2000) Use of jet skis (SLSA, 2000)	Lifeguards at public places (NHMRC, 1996)
Community-based	Enhance Rescue patrols (NHMRC, 1999) Coordinate bodies in rescue (SLSA, 1999)	

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