

ANALYSIS OF DROWNING IN AUSTRALIA AND PILOT ANALYSIS OF NEAR-DROWNING IN NEW SOUTH WALES

Presented to the Australian Water Safety Council



NSW Injury Risk Management Research Centre University of New South Wales October 27, 2000





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ACRONYMS

ABS	Australian Bureau of Statistics
ACT	Australian Capital Territory
ARIA	Accessibility/Remoteness Index of Australia
AUS	Australia
AWSC	Australian Water Safety Council
AWSC Steering Committee	Australian Water Safety Council Research Steering Committee
E code	External Cause of Injury Code
HSRG	University of Newcastle Health Services Research Group
ICD-9	International Classification of Disease, 9th Revision
ICD-9-CM	International Classification of Disease, 9th Revision with Clinical Modification
IRMRC	NSW Injury Risk Management Research Centre
ISC	Inpatient Statistics Collection
NSW	New South Wales
NT	Northern Territory
QLD	Queensland
RLSSA	Royal Life Saving Society Australia
SA	South Australia
SLA	Statistical Local Area
TAS	Tasmania
VIC	Victoria
WA	Western Australia
Ncode	Nature of medical condition

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EXECUTIVE SUMMARY

This study was commissioned by the Royal Life Saving Society Australia on behalf of the Australian Water Safety Council to undertake an analysis of the patterns of occurrence of drowning in Australia and near-drowning in NSW over the period 1992 to 1998 using existing data sources. The drowning analysis used data from the Australian Bureau of Statistics national death record collection and for near-drowning NSW hospital in-patient record data. In both analyses, E-coded cases for codes E830 (.0 to .9), E832 (.0 to .9) and E910 (.0 to .9) were the basis of the analysis. The analysis looked primarily at the frequency of the event, age and gender - specific rates and age-adjusted death and hospitalisation rates. The analysis focussed on changes over the period of study, age and gender related outcomes, the influence of the activity at the time, the location of the event, the time of day and year, the involvement of drugs and alcohol and occupation.

The results showed that drowning is most common in NSW, Victoria and Queensland, although the highest rates occurred in the Northern Territory overall and for the Northern Territory and Tasmania for males in particular. Drowning rates have decreased slightly for overall and for most states over the study period, but there has not been much change over the last few years. The results indicate that drowning risk is clearly associated with exposure to water-related hazards. Young children and babies under the age of five years are most at risk, showing around three times the rates of other age groups. Apart from this group, males of all other ages were three times as likely to drown as females. Young males in the 15 to 34 age group showed higher risk than other age groups. Males and females in the 70 to 74 year age group were also at higher risk, but again, the risk for males was much higher than for females.

Drowning and near-drowning rates depended on the activity being undertaken at the time. The under fives were more likely to drown due to falls into the water, as were the over 65 years group. Young children under five and older women were also most likely to drown in bathtubs and swimming pools. The 15 to 34 years group was likely to be engaged in swimming or wading or boating or had fallen into the water at the time of the accident or incident. Watercraft activities and skin diving were factors for all age groups over the age of 15 years. Males over 15 years of age were also more likely to drown in tidal water and to a lesser extent at surf beaches.

Overall these results indicate that high drowning risk is associated with more frequent exposure to water-related hazards. The patterns for activities and location of drowning and near-drowning confirm this as does the distribution of drowning and near-drowning by season, by time of day and by type of day. Drowning and near-drowning was overall more likely in summer, during the day and on public holidays, although there were some differences between gender and some age groups. In addition, analysis of the patterns of drowning and near-drowning by the location of residence for each case revealed that people from remote regions were at higher risk of drowning and near-drowning. The pattern of drowning involving tourists also showed that they drowned in the states in which they were more likely to be exposed to water activities, NSW and Queensland. Without information on the location of the drowning episode it is not possible to determine whether this finding reflects increased risk of exposure to water-related hazards when they occur in remote areas or a lack of experience in dealing with water-related hazards by people from remote regions. Further analysis is needed to clarify this issue and a number of others raised by this research.

KEY POINTS

- Overall, the results of this study indicate that increased drowning risk is associated with factors that increase exposure to water-related hazards.
- Australia's drowning rate has been declining slowly since 1992. All states and territories show an overall decline between 1992 and 1998; however, all states and territories experienced at least one peak in the seven-year period. Tasmania was the only state showing signs of an increasing drowning rate from 1997 to 1998.
- Just over 300 people drowned each year on average in Australia across the years 1992 to 1998.
- Nearly three-quarters of drownings occurred in NSW, Victoria and Queensland. The highest rates occurred for the Northern Territory although it accounted for only three percent of drownings.
- Australians under age five and 70-74 years of age are at greatest risk for drowning and males are at greater risk than females in all age groups.
- Most drownings involving Australian males under age five and over age 65 occurred as a result
 of falling into a body of water. Males between the ages of 15 and 54 drowned most often
 while swimming or wading. For males 15 years and older, drowning was often associated with
 activity involving watercraft.
- The majority of Australian males who drowned between 1992 and 1998 lived in highly accessible areas but drowning risk was higher for remote and highly remote regions
- Most Australian males drowned in the summer, with the number of drownings the highest in the 15-24 age group. Australian females under the age of 55 also drowned more often in the summer. Females aged 55-64 drowned more often in autumn and females 65 years and older drowned in equal numbers almost all year around.
- While summer time was the highest risk time for drowning and near-drowning for virtually all ages and for both males and females, some states differed. Drowning in the NT occurred year-round and in Queensland, over 45 year olds drowned more often in autumn and winter.
- The majority of Australian males and females who drowned between 1992 and 1998 were not under the influence of drugs or alcohol at the time of their death. For around 20 percent of 25 to 34 year olds there was evidence of alcohol involvement at the time of the drowning.
- The majority of Australian males who drowned between 1992 and 1998 died on a public holiday. The majority of Australian females who drowned died on a school holiday.
- The majority of Australian males who drowned between 1992 and 1998 were working as skilled labourers. The majority of Australian females who drowned between 1992 and 1998 were also working as skilled labourers (i.e., home duties).

- The near-drowning rate has increased overall since 1992, to its 1998 near-drowning hospitalisation rate of 4.1/100.000 population
- Near drowning was approximately twice as common as drowning in NSW, but showed a similar pattern of occurrence. An average of approximately 235 hospitalisations per year occurred in NSW between 1992 and 1998 due to near-drowning incidents.
- The same gender and age differences were seen for near-drowning as for drowning.
- Rates for near-drowning in young children under five years of age were approximately three times higher than those for drowning but the rates for near-drowning and drowning were about the same for all other age groups.
- Near-drownings occurred most often during the daytime (when the time of admit was known) for all age groups and for both males and females.
- Near-drownings showed similar patterns of occurrence (e.g., location, season, type of day, ARIA category) to drownings in NSW.
- Drowning involving tourists occurred mostly in Queensland, followed by NSW, and mostly in open water.

1.0 INTRODUCTION

1.1 Purpose

The purpose of this report is to present current statistics on drownings and near-drownings. These statistics will be used to (i) update the baseline data for drowning and near-drowning injuries; (ii) explore common beliefs about the populations at risk of drowning and neardrowning; and (iii) assess the role of contributing factors (e.g., activity at time of drowning, location of drowning).

The information in this report will be used to enhance and, in some cases, revise current drowning prevention strategies. It will also increase awareness of high-risk groups and activities among water safety personnel and other aquatic related organizations.

This report will address one of the key objectives of the National Water Safety Plan developed by the Australian Water Safety Council (AWSC). The information in this report will be used to prioritize areas of water safety requiring further research. It will also allow AWSC to facilitate opportunities for collaboration and research between aquatic-related organizations.

1.2 Scope

This report presents the demographic and environmental analysis of drownings and neardrownings occurring in Australia and New South Wales, respectively, between 1992 and 1998. It includes background information on the nature of the problem, as well as recommendations for improved data collection and analysis and directions for future research.

1.3 Terms of Reference

This drowning and near-drowning data analysis project was undertaken as part of an agreement between AWSC and the NSW Injury Risk Management Research Centre (IRMRC). The organization and content of this report was guided by the members of the Australian Water Safety Council Research Steering Committee (AWSC Steering Committee).

1.4 Structure of Report

The following describes the structure of this report:

 Section 1- introductory information on the purpose, scope, terms of reference and structure of the report;

- Section 2- background information on the nature of the drowning problem, drowning and near-drowning data collection and previous reports on drowning in Australia;
- Section 3- method information about the definitions and data sources used, as well as the specific analyses done;
- Section 4- results of the analyses;
- Section 5- discussion of the results;
- Section 6- contains conclusions drawn from the results;
- Section 7- recommendations to improve drowning and near-drowning analysis;
- Section 8- bibliography of sources
- Appendix 1- Maps resulting from the analysis;

2.0 BACKGROUND

2.1 Nature of Drowning Problem

Australia is an island with a very long coastline and the majority of Australia's residents live in coastal areas. Many Australians have access to water-related activities and the warm climate available in most parts encourages many people to use their access to water. While access to water and water-related activities is seen by many as a positive attribute of living in Australia, it has negative consequences in the form of the potential for drowning or near-drowning.

2.2 Drowning and Near-Drowning Data Collection

The drowning and near-drowning data used in this report are based on information obtained from national death record data and NSW in-patient (hospitalisation) record data. The national death record data come from the cause(s) of death information written on a death certificate by a coroner and the hospitalisation record data (usually) come from notes written in a patient's medical chart.

If a person died or was hospitalised, as a result of a medical condition or injury (e.g., cancer or skull fracture), a code called the 'nature of disease code' (Ncode) is assigned using the cause(s) of death and/or notes in the patient's record. There is a specific Ncode for each type of medical condition (i.e., 001-799) or injury (i.e., 800 -999) and rules governing the assignment of Ncodes can be found in the International Classification of Disease (ICD) coding manual corresponding to the year of death or hospitalisation. Ncodes are developed and revised approximately every ten years by the World Health Organisation and are usually assigned by trained medical record coders. Once the Ncode is assigned, the record is entered into the corresponding death or hospitalisation data set.

If the person died or was hospitalised as the result of an injury, a special code called an 'external cause of injury code' (Ecode) is also assigned, using the cause(s) of death and/or notes in the patient's record to identify the cause or mechanism of the injury (e.g., drowning, fall, burn). As with the Ncodes, there is a specific Ecode for each type of injury (i.e., E800 -E999) and rules governing the assignment of Ecodes can be found in the International Classification of Disease (ICD) coding manual corresponding to the year of death or hospitalisation. Each Ecode identifies not only the cause, but the intent of the injury as well (i.e., accidental, self-inflicted (suicide), inflicted by another (assault) and undetermined). Ecodes are also developed and revised along with Ncodes by the World Health Organisation and are also usually assigned by trained medical record coders. Once an Ecode is assigned, the record is entered into the corresponding death or hospitalisation data set.

If a drowning was the primary cause of death, a drowning flag is also added to the death record. This flag provides more detailed information about the location of the drowning (e.g., swimming pool, ocean) and activity the person was participating in (e.g., wading, boating), at the time of the drowning. There is no corresponding 'near-drowning' flag in the hospitalisation data. In some cases, the drowning or near-drowning may be a secondary cause of death or injury. For

instance, the drowning or near-drowning occurred as the result of a medical problem (e.g., epilepsy, heart attack) or another cause of injury (e.g., a motor vehicle goes over an embankment, landing in very deep water). A drowning flag is still assigned in these cases, but the corresponding flag serves only to identify these cases as drowning-related.

2.3 Previous reports on the causes of drowning and near drowning in Australia

In the last decade, there have been two major reviews of the patterns and causes of drowning in Australia. The first, Giles (1995), was a qualitative review of accidental drowning and submersion deaths in Australia, focussing on the high risk groups. This review covered the years 1968 to 1993. The second review (Mackie, 1999) used more recent data (1992 to 1997) to take an overview of the patterns of victims, circumstances and locations of drownings. In addition, the Royal Life Saving Society Australia produced a brief report on drowning for 1999. The major findings of these reports are described in the following sections.

Even though drowning rates are considerably lower than the rates for some other types of injury, such as falls and suicide, drowning is still a cause for concern. The reviews of previous research on drowning in Australia reveal that drowning rates have decreased considerably since the early 1970's (Giles, 1995), but most of this drop occurred in the mid-to-late 1970's and early 1980's. Since then, drowning rates have not changed much. In light of this lack of improvement in drowning rates and because it is believed that many drownings are preventable (Giles, 1995), drowning is seen to be a major safety concern for the Australian community.

Previous research on the nature of drowning deaths reveals that males are consistently the most at-risk group. A review of drownings over the period 1992 to 1998 showed that males accounted for more than three-quarters of all drowning victims (Mackie, 1999). Very young children have also been identified as a major group at-risk for drowning. Mackie (1999) calculated the overall risk for the 0 to 4 year age group as around two times that for the population in general (4.6 per 100,000 for 0 to 4 year olds per year compared to 1.44 per 100,000 population per year).

Previous analysis also indicates that the causes of drownings are very different for each of these at risk groups. Drownings involving adult males occurred mainly in the ocean or estuary areas, although they were also strongly represented in drowning accidents involving inland waters, and while engaged in activities like boating, fishing and scuba diving. In contrast, children under five years of age drowned mainly in swimming pools (Giles, 1995; Mackie, 1999). There was also a relatively strong finding from the most recent study (Mackie, 1999) that overseas tourists were highly represented in ocean-related drowning and drowning while diving. Most females who drowned were under five years or over sixty-five. Females were most likely to drown in private swimming pools and bathtubs and were far less likely to drown in the ocean.

The findings from these previous analyses are important because they point out areas where it might be most useful to concentrate efforts to prevent drownings. Unfortunately, the previous analyses do not provide much depth for the interpretation of the circumstances surrounding the drowning. This lack of depth is one of the major roadblocks to developing targeted drowning prevention measures. This report attempts to expand the analysis of the circumstances in which drowning occurs in Australia and to use NSW hospitalisation data to look at how and why near-drowning occurs. Through this analysis, it is hoped to develop a better understanding of the intervention approaches most likely to be effective in preventing drowning in Australia.

3.0 METHODS

3.1 Definitions

The following two sections present the definitions of accidental drowning and neardrowning used for the purposes of this report. The ICD-9 and ICD-9-CM drowning and near-drowning Ecodes used in the analysis are also included.

3.1.1 Drowning

A drowning is a submersion or immersion episode resulting in the death of the individual (Shepherd and Martin, 2000). The corresponding ICD-9 Ecodes are E830 (.0-.9), E832 (.0-.9) and E910 (.0-.9).

3.1.2 Near-Drowning

A near-drowning is a submersion or immersion episode of sufficient severity to warrant medical attention, possibly resulting in admission to a hospital, and survival of the individual (Ellis and Trent, 1995). The corresponding ICD-9-CM Ecodes are E830 (.0-.9), E832 (.0-.9) and E910 (.0-.9).

Australia added three new Ecodes to the ICD-9-CM, to provide specific Ecodes for neardrowning occurring (i) in swimming pools while swimming; (ii) after a fall into a swimming pool; and (iii) after a fall into natural water, respectively. These codes were in use from July 1, 1996 to June 30, 1998. The next revision of the ICD codes was released in July 1998 and has been used since its inception.

3.2 Data Sources

The following two sections present the sources of the data used in this report on drowning and near-drowning.

3.2.1 Drowning Data

Data was obtained for all states and territories for 1992-1998 from the Australian Bureau of Statistics (ABS) for all Ecoded death records. Only death records containing one of the Ecodes listed in Section 3.1.1 were used in the analysis.

3.2.2 Near-Drowning Data

Data from the NSW Health Inpatient Statistics Collection (ISC) was obtained from the University of Newcastle, Health Services Research Group (HSRG) for all hospitalisations. Only hospitalisation records containing one of the Ecodes listed in Section 3.1.2 were used in the analysis.

3.3 Analysis

Each of the following sections briefly describes the types of analysis done using the drowning and near-drowning data. Three types of epidemiological analyses were done:

- Frequency of event;
- Age-specific rate; and
- Age adjusted death and hospitalization rates (proxies for drowning rate and near-drowning rate).

The frequency of an event is calculated by counting the number of times the event occurs in a given time period (e.g., number of drownings in 1992). Frequencies are often subdivided into categories (e.g., age and gender groups) so that comparisons between the different categories are possible.

An age-specific rate is calculated by dividing the frequency of event for a particular age group (e.g., under five) by the total population in that age group that could have experienced the event in that same time frame. Once this is done, multiply the resulting value by 100,000 so that the number of deaths in that age group is given per 100,000 population. For example, one (1) three year old drowned in Place X in 1992. The total population of under five year old children in Place X in 1992 was 4000. The resulting age-specific rate for under five year old children in Place X in 1992 is 25/100,000 population.

Age adjusted rates are standardized age-specific rates. Each age-specific rate is multiplied by a standard population weight for that age group. The standard population weight is calculated by dividing the frequency in an age group by the total population for the year chosen to represent the standard year. The standard population currently being used is the 1991 Australia population census.

Once all of the age groups have been weighted, the new age-specific values are added together to produce one age-adjusted rate. This method of age-adjustment is called direct standardization. Standardization allows for the comparison between different states and territories when the same age-specific population weights are used.

The time period measured can be any length of time. In some cases, it is beneficial to group at least five years of data together. This is done for two reasons: (i) so enough events can be measured; and (ii) 'typical' data is captured, minimising the influence of fluctuations from year to year. For the purposes of this report, age-adjusted rates were calculated both annually and for the block of years from 1992 to 1998. Age-specific rates and frequencies were calculated using data for the block of years from 1992 to 1998.

All of the following analyses were done for each state and territory and Australia. Unless, otherwise specified, each analysis was done on both the drowning data and the NSW near-drowning data.

3.3.1 Time Trend

Time trends look at the change in a given value over a period of time. For the purposes of this report, it was most useful to calculate age-adjusted death rates for drowning for each year from 1992 to 1998. In the pilot analysis of NSW Health data, the age-adjusted hospitalization rate was calculated for each year from 1992 and 1998.

3.3.2 Age- and Gender-specific Frequencies and Rates

Age- and gender-specific frequencies and rates look at the role age and gender play in an event in order to determine whether certain age/gender groups are at greater risk of drowning/near-drowning than other age/gender groups.

The following age/gender groups were used to present frequencies for most of the analyses presented in the following sections. Although age groups are usually grouped in 5 or 10 year increments, a 0-1 age group was analysed separately from the rest of the under five age group. This was done because children under two are likely to exhibit different patterns in drowning and near-drowning as compared to the rest of the under five age group.:

- Males 0-1, 2-4, 5-14, 15-24, 25-34, 35-44, 45-54, 65+; and
- Females- 0-1, 2-4, 5-14, 15-24, 25-34, 35-44, 45-54, 65+.

For the purposes of this analysis, the age- and gender-specific rates were based on five year age groups to allow ages of similar ability to be grouped together. Age- and gender-specific rates will identify the age/gender groups at greater risk because of a higher frequency of drownings or near-drownings per age/gender group population in relation to other age/gender groups. Age-specific rates and gender-specific rates were calculated and presented as trends by age group.

3.3.3 Activity

Drownings and near-drownings may be more likely to occur while engaging in certain activities. The frequency of each activity type was analyzed in the drowning data, using the drowning flags.

The following activity groups were used:

- Swimming, wading;
- Fell into;
- Watercraft;
- Swept off rock;
- Attempting rescue;
- Skin-diving;
- Environmental factor (e.g., flood); and
- Other unspecified activity.

No corresponding measure of activity type exists in the near-drowning data.

3.3.4 Location

Drownings and near-drownings may be more likely to occur in certain locations. The frequency of each location type (e.g., swimming pool, surf), was analyzed in the drowning data, using the drowning flags (See Appendix 4).

The following location types were used:

- Swimming pool;
- Surf Beach;
- Tidal water (i.e., ocean, river, estuary, harbour, bay);
- Non-tidal water (i.e., lake, lagoon, dam, water hole, creek);
- Bathtub; and
- Other and unspecified place.

The general location type of the drowning was known from the drowning flag and was combined with the place of usual residence to produce national maps by location. Each map showed the frequency of each drowning location by place of usual residence. No corresponding measure of location exists in the near-drowning data; however, generic locations (e.g., bathtub, open water, swimming pool) were derived using ICD-9-CM Ecodes.

Drownings and near-drownings may also be more likely to occur in certain locations because of their inherent accessibility or remoteness. An accessibility and remoteness indicator has been developed for each statistical local area (SLA) existing in Australia in 1996 by the University of South Australia (Department of Health and Aged Care, 1999). The rate of the indicator, known as the Accessibility and Remoteness Index of Australia (ARIA), was analyzed in the drowning data.

The following ARIA categories were used to describe SLAs:

- Highly Accessible;
- Accessible;
- Moderately Accessible;
- Remote;
- Very Remote; and
- Unknown (e.g., SLA didn't exist in 1996).

3.3.5 Time of Year

Drownings and near-drownings are more likely to occur at certain times of year. The frequency of each season was analyzed. The following time of year groups were used:

- Summer December 1- February 29;
- Autumn March 1- May 31;
- Winter June 1 August 31; and
- Spring September 1 November 30.

3.3.6 Drug/Alcohol Involvement

Drownings and near-drownings may be more likely to occur to persons under the influence of alcohol and/or drugs. The frequency of drug and alcohol involvement was analyzed in the drowning data, using the following drug/alcohol involvement categories:

- No smoking, alcohol or other drug involvement;
- Smoking-involvement;
- Alcohol involvement;
- Other drug involvement;
- Smoking and alcohol involvement;
- Smoking and other drug-involvement;

- Alcohol and other drug involvement; and
- Smoking, alcohol and other drug involvement.

No corresponding measure of drug/alcohol involvement exists in the near-drowning data.

3.3.7 Type of Day

Drownings and near-drownings may be more likely to occur on certain types of days when people are likely to have time for recreation (e.g., public and school holidays). The frequency of different day types was analyzed in the drowning and near-drowning data, using the following types of days:

- Public holidays;
- School holidays;
- Other weekends; and
- Other weekdays.

The public and school holidays for 1992 to 1998 were used. Other dates were assigned to either the other weekday's or other weekend's group, based on the day of the week. Each group was mutually exclusive.

Since some day types (e.g., public and school holidays) occurred less often in a year, thus decreasing the exposure time for drownings and near-drownings, each frequency was weighted to allow for an exposure-corrected comparison between day types. This was done by dividing the frequencies of the deaths by day type by the number of days of that type in one year. The values used were 11, 82, 80 and 192 for public holidays, school holidays, other weekend days and other weekdays, respectively. These numbers were based on the public and school holidays in 1995.

3.3.8 Time of incident

Drownings and near-drownings may be more likely to occur at certain times of the day (e.g., after 3 PM). The frequency of the different times of day was only analyzed in the near-drowning data. The 'time of admit' date field in the ISC data was used as a proxy for time of incident by subtracting one hour from the time of admit. No time of incident analysis was possible with the drowning data.

The time of incident was grouped into the following blocks of time:

- 12:00 am 5:59 am;
- 6:00 am 8:59 am;
- 9:00 am 2:59pm;
- 3:00 am -5:59 pm;
- 6:00 pm 8:59pm; and
- 9:00 pm 11:59 pm.

3.3.9 Occupation Group

Drownings and near-drownings may be more likely to occur in persons with certain occupations. The frequency of occupation type was analyzed in the drowning data, using available occupation codes. The occupations were grouped into the following categories:

- Professionals (i.e., professionals, para-professionals, managers and consultants);
- Skilled Labourers (i.e., tradespersons, machine operators, labourers and home duties);
- Clerks and Salespersons; and
- Retired.

Students, children under 15 and the unemployed were not included in this analysis.

No corresponding measure of occupation type existed in the near-drowning data.

3.4 Tourists

Drownings and near-drownings may be more likely to occur in persons who are participating in water-related activities in unfamiliar areas (i.e., tourists). The frequency of drowning by age groups, gender and location of event was analysed.

Corresponding hospitalisation data for near-drowning in tourists was not verifiable and was not analyzed.

4.0 **RESULTS**

The following sections present the results of the data analysis of drowning in Australian residents and near-drowning in NSW residents. The results for drowning analysis for tourists are described in Section 4.3. Figures of special significance are highlighted in the text below. All figures and tables are presented in Appendices 1 and 2, respectively.

4.1 Drowning

4.1.1 Trends in Drowning

Accidental drownings claimed the lives of more than 2,000 Australians between 1992 and 1998. Since 1992, the national drowning rate has been slowly declining, to its 1998 accidental drowning death rate of 1.2/100.000 population (see Figure 1).



Table 1 shows the number of drownings and drowning rates for all states and territories between 1992 and 1998. As the table shows, one-third of all drownings occurred in New South Wales. Northern Territory had the highest drowning rate, even though it accounted for only three percent of all drownings in Australia.

Drowning rates for males exceeded the corresponding rates for females in all states and territories. The greatest disparity between the genders occurred in SA and TAS, with the male drowning rates six and seven times greater than the corresponding female rates, respectively.

State	All N (%)	AII AADR*	Male N (%)	Male AADR	Female N (%)	Female AADR
New South Wales	674 (33)	1.6	531 (33)	2.5	143 (35)	0.6
Victoria	427 (21)	1.4	348 (21)	2.2	79 (19)	0.5
Queensland	348 (17)	1.5	269 (16)	2.4	79 (19)	0.7
South Australia	144 (7)	1.4	126 (7)	2.5	18 (4)	0.3
Western Australia	236 (11)	2.0	182 (11)	3.0	54 (13)	0.9
Tasmania	80 (4)	2.5	70 (4)	4.4	10 (2)	0.6
Northern Territory	67 (3)	4.5	51 (3)	6.6	16 (3)	2.2
Australian Capital Territory	23 (1)	1.1	17 (1)	1.7	6 (1)	0.6
Australia	1999 (100)	1.6	1594 (100)	2.5	405 (100)	0.6

Table 1. Number of Drowning Deaths and Death Rates by Gender: All States and
Australia, 1992-1998

*Age-adjusted death rate

Figure 2 shows the yearly trend in drowning rates for New South Wales (NSW). Since 1992, the NSW drowning rate has been fluctuating, reaching its lowest point in 1996 with an accidental drowning death rate of 1.3/100.000 population (see Figure 2). Peaks in the trend can be seen in 1994 and 1997, when 111 and 102 NSW residents died from accidental drownings, respectively.



In Figure 7 (shown below), the accidental drowning rate for Tasmania (TAS) decreased overall between 1992 and 1996. Since 1996, the TAS drowning rate has increased to 2.5/100,000 population. The peak in 1995 represents a drowning rate of 2.6/100,000.



As shown below in Figure 8 the accidental drowning rate for Northern Territory (NT) fluctuated between 1992 and 1998, although the overall trend is downward. The drowning rate reached its highest point in 1993 (i.e., 9.7 drownings/100,000 population) and its lowest point in 1996 (i.e., 2.2 drownings/100.000 population. Since 1996, the NT drowning rate has increased overall to 3.6/100,000 population.



Trends in drowning rates for all of the other states and territories showed similar overall patterns and are in Appendix 1 (Figures 3-6, 9). Trends in these other states and territories decreased overall between 1992 and 1998. Victoria (VIC) and South Australia (SA) both experienced a high peak in 1993. Queensland (QLD) esperienced an increase in 1995. Western Australia (WA) and Australian Capital Territory (ACT) both experienced a peak in drowning rates in 1996.

4.1.2 Age and Gender Specific Frequencies and Rates in Drowning

As shown in Figure 10, the number of deaths due to drowning varied markedly across age groups, particularly for males. Many more males in the 15 to 54 age group drowned than any other age group, except males over 65 years. These age groups also showed the biggest differences between males and females. For children under the age of 15, fewer drowning deaths were recorded. It is noteworthy, however, that the proportion of females who drowned was considerably higher in the under 5 age group and in the over 65 years age groups than for the older age groups. The most striking involvement of females can be seen in the youngest group (0-1) where almost half of the drowning deaths involved females.



The same pattern across age and gender groups was exhibited for each state. The only notable exception was for the Northern Territory (see figure 17) where a smaller proportion of drownings occurred for girls less than two years old. In addition, there were very few drownings of people of either gender over the age of 55 years.



When the age and gender specific rates of drowning were calculated a different picture emerged. Even though the greatest number of drownings occurred in 15 to 55 year olds, the age and gender-specific rates show that Australians under age five and 70-74 years of age are at greatest risk for drowning (see Figure 19). Drowning rates for age groups 15-19 to 65-70 indicate that the risk of drowning remain fairly static for Australians between 15 and 70 years of age.



Figure 19 also shows that males are at greater risk than females in all age groups, even though males and females show similar patterns across all age groups. The same pattern between males and females was seen in the frequency of drowning figure (Figure 10).

The following three figures (Figures 25-27) show age- and gender-specific rates for TAS, NT and ACT. All three figures have trends dissimilar to the age- and gender-specific rates for Australia.

The figure for TAS shows a lower peak in females under five age group in relation to the pattern for the Australia figure (See Figure 25). Also, the 25-29 age group has a higher peak than the 70-74 age group, the reverse of which is true in the corresponding Australia figure.

The age-specific rates for NT show the same high drowning rate for children under five as shown for Australia overall, but the under five drowning rate for both sexes is 3.6 times greater than the corresponding rate for Australia. For NT, (Figure 26) there were no drownings in the 65 years and older age groups. In addition, female drowning rates exceeded male drowning rates in the 60-64 age group and in the 5-9 age group, but to a lesser extent.

For the ACT, the same high drowning rate for children under 5 and for 70-74 year olds was shown, but the results did not indicate a continuing problem among the age groups 15-19 to 65-70. In addition, the female drowning rate exceeded the male drowning rate in the 40-44 age group. These results should be interpreted, however, in the context that the number of drownings in ACT only accounted for one percent of all drownings in Australia between 1992 and 1998.







The other age- and gender-specific charts for the remaining states can be downloaded from the web at www.rlssa.org.au/drowning

The figure for NSW (Figure 20) shows a drowning pattern in age and gender similar to that of Australia, but the rates for males and females are much less similar. Figures 21 and 22 (VIC and QLD) show a slight increase in the drowning rate in the 85+ age group. Male Australians in SA age 75-79 had a higher death rate between 1992 and 1998 than any other age group (Figure 23). Also, the SA drowning rates in males show an upward trend with increased age. The age-specific drowning rates for WA children under five (see Figure 24) are slightly higher than the corresponding rates for Australia. The rest of the age-specific trend for WA is similar to that for Australia, with the exception of the bimodal peak around the over 65 age group which differs from the age-specific pattern in Australia.
4.1.3 Frequency of Drowning by Activity at Time of Drowning

The following figure shows frequencies by activity at the time the drowning occurred and by age groups for males. Most Australian males under age five and over age 65 drowned as the result of falling into a body of water. Males between the ages of 15 and 54 drowned most often while swimming or wading. For males 15 years and older, drowning was also often associated with activity involving watercraft.



Figure 37 shows the same chart for Australian females. The pattern in drowning activity in females under age five and over age 65 is similar to that of males, but the numbers are smaller. Also, females between the age of 5 and 64 drowned in almost equal numbers while swimming or after falling into water.

The following figures show frequencies by activity at time of drowning and age groups for males for states and territories that differed from national patterns. The first figure (Figure 33) shows that falls into water resulted in more drownings in middle-aged male WA residents, when compared to other activities in the same age group. Skin-diving also resulted in a larger proportion of drownings in WA males age 15 and older than in the national data.



Figure 34 (shown below) shows that watercraft-related activities resulted in more drownings in male TAS residents age 25-34 than other activities. Overall, watercraft-related activities in TAS resulted in a substantial proportion of drownings in males compared to the same figure for Australia. The figure also shows that a larger proportion of males over 25 years of age drowned while skin-diving than was shown in the national figures.



The following figure for NT (Figure 35) shows that a larger proportion of males age two to four drowned while swimming or wading than in the national data. A larger proportion of males from the NT in the 25 to 43 age group drowned after falling into water than was shown in the national data, but a smaller proportion drowned due to water craft, with the exception of the 45 to 54 year olds.



The figures for males in the other states and territories can be downloaded from the web at www.rlssa.org.au/drowning (Figures 29-32, and 36). The figures for NSW, VIC, QLD and SA all have age-specific drowning activity patterns similar to Australia.

Figures 37 to 45 show the activity-specific data for females by state and territory. The pattern in drowning activity in females is similar to the patterns in males for each state and territory.

4.1.4 Frequency of Drowning by Location and Rates by ARIA Category

The following figure shows frequencies by location at the time the drowning occurred and by age groups for males. As shown in Figure 46, most drownings involving males under the age of two years occurred in bathtubs and swimming pools and young children in the two to four age group mostly drowned in swimming pools. No other age groups showed this pattern for males. For older males over the age of 15, drowning occurred mainly in tidal water and to a lesser extent, in the surf and nontidal water. For a significant number of cases in this age group, no information was available on the location of the drowning.



Figure 47 shows the location of drowning for females. Similar to the pattern for males, bathtub drownings occurred most often in the youngest female age group (0-1), and swimming pools were also a major location for drowning involving females under the age of five years. Unlike the figure for males, Figure 47 shows that a large number of bathtub and swimming pool drownings occurred for females in the over 65 age group. These two age groups (under five and 65+) also showed the highest number of drownings for females. Again, unlike males, drowning on surf beaches and tidal pools were relatively uncommon for females over 15 years of age.



Each type of location was also mapped against the Statistical Local Area of Residence (SLA) of the person who drowned. The results are shown in Maps 1 to 6 (see Appendix 1). The maps show different patterns of distribution for different types of drownings. For example for bathtub drownings (see Map 1), most of the drownings occurred in major cities, including Sydney, Canberra, Melbourne, Perth and Brisbane, and relatively few occurred to people living outside those areas. For swimming pool drownings (see Map 2), the areas of residence were slightly more distributed but still clustered to a large extent around the capital cities. Surf-related drownings (see Map 3) occurred mainly to people residing on the coast, again clustering mainly around the main cities, with very few surf drownings occurring outside those areas. In contrast, Australians who drowned in nontidal water (see Map 4) came from a very widely distributed range of SLAs and as might be expected, were not distributed mainly around the coastal areas. On the other hand, people who drowned in tidal waters also tended to be from both coastal and inland residential SLAs (see Map 5).

The pattern of drowning was examined for each state in terms of the level of accessibility of the area of residence of the person who drowned. As shown in Figure 48, drowning was most common in the highly accessible areas of all states except the Northern Territory and Tasmania. As might be expected, drownings in remote regions occurred mainly in Western Australia, but only in very low numbers.



Comparison of the rates of drowning for each ARIA category (Figure 49) reveals different picture to that shown by the frequency of drownings. The figure shows that people living in remote areas are at considerably higher risk of drowning in NSW, NT, QLD and WA.



The following figure (Figure 50) shows drowning rates by ARIA category for the SLA of residence for each age group. The highest rates in most age groups were for Australians who lived in remote or very rural areas. Australians under age five drowned more often than the other age groups for all areas except remote regions. In these areas, people age 70-75 had the highest drowning rate.



Examination of the influence of remoteness in each of the states showed different findings depending on the state (see Figures 51 to 58. These can be downloaded from the web at www.rlssa.org.au/drowning). Figure 51 shows the age-specific drowning rates for NSW by ARIA category. There were markedly higher rates for five to nine year olds and 15 to 19 year olds in very remote regions. For under fives, 45 to 49 year olds and 60 to 64 year olds, drowning rates were also higher for remote regions. Rates for highly accessible and accessible regions were much lower overall for most age groups than for the remote regions.



In VIC, where there are no remote or very remote regions, age-specific rates showed that the drowning risk was higher for moderately accessible regions for some groups, in particular, five to nine year olds, 55 to 59 year olds and 70 to 75 year olds. Interestingly, the rates for children under five were highest for highly accessible and accessible areas.



Queensland also showed a slightly different picture as shown in Figure 53. Very remote regions showed the highest drowning rates for most age groups, especially the under fives and 25 to 49 age group. Rates for all regions were higher for under fives, whereas the five to nine and 10 to 14 age groups showed the lowest rates for all regions.



4.1.5 Frequency of Drowning by Time of Year

The following two figures (Figures 59 and 68) show frequencies by season at time of drowning and age groups for both males and females. Most Australian males drowned in the summer, with the number of drownings the highest in the 15-24 age group.



Figure 68 shows Australian females under the age of 55 also drowned more often in the summer. Females age 55-64 drowned more often in autumn and females 65 years and older drowned in equal numbers almost all year around.



The following figure (Figure 62) shows frequencies by season at time of drowning and age groups for males for states and territories that differed from national patterns. The figure below shows the drownings for males in QLD. The data mimics the AUS data until age group 45-64 is reached, when other seasons show greater numbers of drownings.



The figure below shows the drownings for females in WA (Figure 73). Female WA residents age 15-44 died most often in the summer as compared to the higher frequencies for summer in the females under age five in Australia.



The figures for males in the other states and territories can be downloaded from the web at www.rlssa.org.au/drowning (Figures 60, 61, and 63-67). The figures for NSW and VIC both have age-specific seasonal drowning patterns similar to Australia. The figures for SA and WA also show patterns similar to AUS, but males age 35-44 died more often in the summer than other age groups. Figures for TAS and NT males are also similar, but NT males age 25-34 drowned almost equally in summer, autumn and winter.

Figures 69 to 76 show the season-specific data for females by state and territory. Figure 69 (NSW) shows a seasonal pattern similar to AUS, except that women over 65 drowned more often in autumn. The figures for NSW, VIC, and SA all show that children under age two drowned most often during the summer months (see Figure 69 below for example) whereas QLD females under age two drowned most often in the winter (see Figure 71 below).





4.1.6 Frequency of Drowning by Drug/Alcohol Involvement

The following figure (Figure 77) shows frequencies by influence of alcohol and /or drugs at time of drowning and age groups for Australian males. A small proportion of Australian males age 15 and older who drowned between 1992 and 1998 were under the influence of drugs or alcohol at the time of their death.



Figure 86 (see Appendix 1) shows the same chart for females. An even smaller proportion of Australian females who drowned was also under the influence of drugs or alcohol at the time of their death.



All of the other figures for the other states and territories are similar to the overall figures for Australian males and females can be downloaded from the web at www.rlssa.org.au/drowning (see Figures 78 - 85 and 87 - 94).

4.1.7 Frequency of Drowning by Type of Day

Figure 95 shows weighted drowning deaths in males by the type of day the drowning occurred. The majority of Australian males who drowned between 1992 and 1998 died on a public holiday. For males age 25-34, drownings occurred as often on other weekends as public holidays. For males age 65+, drownings were almost equally distributed by type of day.



Figure 104 (below) shows the same chart for females. The majority of Australian females who drowned between 1992 and 1998 died on either a school holiday or a public holiday.



Analysis of patterns of drowning for males by type of day for each state are shown in Appendix 1 (Figures 96 to 102). The figures for NSW, VIC, QLD, SA WA, TAS and NT all have age-specific drowning day type patterns similar to Australia (i.e., majority of drownings across age groups occurring on a public holiday). In VIC, SA and TAS, males age 15-24 drowned more often on public holidays than any other age group. In QLD and WA, males in age groups 45-54 and 65+, respectively, drowned more often on public holidays than any other on public holidays than any other often on public holidays than any other age group.

Figures 105 to 112 (see Appendix 1) show the day type-specific data for females by state and territory. Figures 103, 105 and 107 (NSW, QLD and WA) show a day type pattern similar to AUS for age, except that NSW women drowned more often on public holidays and QLD women drowned almost equally among day types in most age groups. Figure 108 (SA) shows the same high frequencies for the under two year olds, but most of the female drownings occurred in either school holidays or other weekends.



For VIC and NT, the patterns for the type of day that the drowning occurred showed differences compared to national patterns. The following figure for VIC females shows a pattern by age group similar to the corresponding chart for AUS. The majority of drownings occurred, however, on public holidays as opposed to school holidays, especially for 15 to 24 year olds.



The following figure for NT shows that females aged 5-14 drowned most often in non-holiday weekends. This pattern is dissimilar to the corresponding chart for AUS.



4.1.8 Frequency of Drowning by Occupation Group

The following figure shows frequencies by occupation group at time of drowning and age groups for males. The majority of Australian males who drowned between 1992 and 1998 were working as skilled labourers.



Figure 122 shows the same chart for females. The majority of Australian females who drowned between 1992 and 1998 were also working as skilled labourers (i.e., mostly home duties).



The following figure for WA males shows that the majority of drownings occurred in skilled labourers under 55, with the highest frequencies in the 15-24 and 35-44 age groups.



The following figure for TAS males shows that the majority of drownings occurred in skilled labourers under 45, with the highest frequencies in the 15-24 and 25-34 age groups. Males over the age of 44 who drowned were often retirees.



The following figure for QLD females shows that females under age 25 and older than 64 who drowned were usually clerks and retirees, respectively.



The figures for males in the other states and territories can be found in Appendix 1 (Figures 114 to 117 and 120 to 121). The figures for NSW, VIC, QLD, SA and NT all have age-specific drowning occupational patterns similar to Australia. In QLD and SA, male retirees age 65 and older drowned more often than other occupation groups.

Figures 123 to 130 can be downloaded from the web at www.rlssa.org.au/drowning show the occupation-specific data for females by state and territory. All figures show an occupational pattern similar to AUS, except that most women who drowned in TAS were over 65 and were retired.

4.2 Near-Drowning

4.2.1 Trend in Near-Drowning

Near-drownings resulted in the hospitalisation of more than 1,637 NSW residents between 1992 and 1998. Since 1992, the NSW near-drowning rate has increased overall, to its 1998 near-drowning hospitalisation rate of 4.1/100.000 population (see Figure 131).



4.2.2 Age-Gender-Specific Hospitalisation Rates

NSW residents under the age of five years were most likely to be hospitalised due to neardrowning as their rates were more than three times the rate for any other age group (See Figure 132). The rates for males show that they are more likely to be hospitalised for near-drowning than females at every age group, but especially in the 15 to 30 years age group. Apart from the under fives, females had very low rates of hospitalisations.



4.2.3 Frequency of Near-Drowning by Location

Figures 133 and 134 show the number of near-drownings reported in the hospitalisation data for different locations for males and females of different age groups. Fairly similar patterns can be seen for both genders. Swimming pool and bathtub near-drownings occurred mainly in the under five year old group for both genders. Near-drownings occurred in open water for males predominantly in the 15 to 24 year age group, whereas for females open water drownings occurred mainly in the 5 to 14 year age group. Interestingly, more females under two years of age had a near-drowning episode involving the bathtub than males. This was the only location where the number of female near-drowning outnumbered males. For both genders, boat-related near-drownings occurred in the young to middle-aged adult groups.





4.2.4 Frequency of Near-Drowning by Time of Day.

Figures 133 and 134 show the number of near-drownings for males and females of each age group. As can be seen, for each age group the time of the incident was not known for around two-thirds of cases. Where that information was available, near-drowning incidents mostly occurred during the daytime for all age groups and for both males and females. Most near-drowning incidents occurring at night involved young males in the 15 to 24 year age group and females under age two.





4.2.5 Frequency of Near-Drowning by Time of Year

The following charts show the frequencies of near-drowning by the season of the year. Figure 137 shows that near-drownings in males occurred most often during the summer months. In each age group, more drownings occurred in summer than at any other time. In contrast, near-drowning incidents were least common in the winter time overall and especially for the five to 24 year group. Near-drowning was also fairly likely to occur at other times of the year for males under age two and over 55 years of age.



The patterns of near-drowning incidents in females were quite similar to those for males (See Figure 138). For females, however, the higher frequency of near-drowning in summer was only more likely in some age groups. As for males, near-drowning in females under age two was also likely to occur at any time during the year. For females in the 15 to 34 and 45+ age groups, near-drowning incidents were also more evenly spread across the seasons.



4.2.6 Frequency of Near-Drowning by Type of Day

Figures 139 and 140 show the number of near-drowning incidents for males and females of each age group that occurred on holidays and other days. For males under 25, most near-drowning incidents occurred on non-holiday weekends. Not surprisingly, males age five to 14 were most likely to have a near-drowning incident during school holidays, whereas in the working age groups near-drownings were more likely on public holidays. Interestingly, males under the age of two years were considerably less likely to have a near-drowning episode on public holidays, as were the over 65 age group.



In contrast, females under five years of age were more likely to experience a near-drowning incident on a public holiday. Females age five to 14, like males of the same age group, were more likely to have a near-drowning incident on school holidays. In addition, females under age two were more likely to have a near-drowning on a week day than any other group.



4.2.7 Age-Specific Near-Drowning Rates by ARIA Category

The figure below (Figure 141) shows the hospitalisation rates of near-drowning incidents by the ARIA category of residence for each age group. The highest near-drowning rates occurred in remote areas for the over 85 years age group, followed by the very remote regions for the 50 to 54 age group and the remote region for the under five year age group. Apart from the under fives, accessible and highly accessible regions had relatively low near-drowning rates.



4.3 Drowning Injury in Tourists

Between 1992 and 1998, there were 119 tourists deaths due to drowning in Australia, an average of 17 per year. Table 20 shows the breakdown of tourist drownings by state.

State	Number of Deaths	%
NSW	30	25.2
VIC	7	5.9
QLD	60	50.4
SA	3	2.5
WA	9	7.6
TAS	1	0.8
NT	9	7.6
AUST	119	

 Table 20.
 Number of Drownings in Tourists: All States and Australia, 1992-1998

More than half of the drownings in tourists occurred in QLD, with the second highest frequency of tourist drownings occurring in NSW.

The following table and chart show the number of tourist drownings by age group and state.

Table 21.	Number	of Drownings in	Tourists by	Age Group:	All States	and Australia,
1992-1998	8					

	Age Group														
State	Under	5-9	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	65-	70-	75-
	5		19	24	29	34	39	44	49	54	59	64	69	75	79
NSW			3	4	6	5	1	1	2	3	2		2	1	
VIC	1		1		1	1			1						
QLD	1	1	2	8	5	3	1	8	8	6	5	2	5	3	2
SA					2	1									
WA				1	3	3					1			1	
TAS					1										
NT			1		3		2	1		1		1			
AUST	2	1	7	13	21	13	4	10	11	10	8	3	7	5	2

Figure 142 shows that tourists age 25-29 died more often than tourists of other ages as a result of drowning. As the table also shows, QLD had a tourist death in every age group, with the largest numbers in the 20-24 and the 40-49 age groups.



The following table shows the number of tourist drownings by gender and state.

Table 22. Number of Drownings in Tourists by Gender: All States and Australia,1992-1998

State	Males (N)	Males %	Females (N)	Females %
NSW	24	24.7	6	27.3
VIC	7	7.2	0	0
QLD	47	48.5	13	59
SA	2	2.1	1	4.5
WA	8	8.2	1	4.5
TAS	1	1	0	0
NT	8	8.2	1	4.5
AUST	97		22	

Male tourists drowning numbers were higher than corresponding female numbers in all states. Males drowned seven times more than females in WA and NT.

The following table and figure show the number of tourist drownings by location of drowning and state.

	Location of Drowning								
State	Bathtub	Boat-	Open	Swimming					
		related	water	Unspecified	pool				
NSW		1	24	3	2				
VIC		2			5				
QLD		2	38	9	11				
SA	1		1	1					
WA		2	1	1	5				
TAS				1					
NT		3	3		3				
AUST	1	10	67	15	26				

Table 23.	Number	of Drownings in	Tourists	by Location:	All States a	nd Australia,
1992-1998	8	-		-		

The table shows that more than 50 percent of all tourists who drowned were participating in an open water activity. Of all tourist drownings, more than 20 percent occurred in a swimming pool and tourist in QLD drowned most often in a pool.



5.0 **DISCUSSION**

This analysis has confirmed previous findings (e.g., Mackie, 1999), that around 300 Australians drown each year. It has also demonstrated that the number of drownings has remained at much the same level over the last seven years. This suggests that recent attempts to reduce drowning have only had a limited effect. Furthermore, based on NSW figures, this analysis has suggested that near drownings, severe enough to require hospitalisation, occur around twice as often as drownings.

Compared to other types of injury, the rates for drowning are low at 1.3 per 100,000 for Australia overall. This puts drowning as one of the injuries with lower risk compared to the other major causes of injury (e.g., suicide, road, poisoning, falls). It should be recognised however that the rates for drowning almost certainly underestimate the true risk of drowning as they do not take into account the fact that not all members of the population will be exposed to the hazard of water. While most people are exposed to the hazards of the road environment in some capacity, often many times each day, exposure to water is far less frequent for the majority of people. For example, for many people, visits to the beach or other open water, are a rare event and swimming pools and dams are also used relatively infrequently. Even bathtubs are only used by a proportion of the population, typically the very young and the elderly. This means that in order to establish the true risk of drowning or near-drowning it would be necessary to estimate the number of people who are really likely to be exposed to a drowning risk and to estimate the frequency with which they are exposed.

The problem of exposure to the water-related risk is highlighted by the patterns of drowning and near-drowning that emerged from this study. The major groups that were shown to be at most risk of drowning and near-drowning were very young children, males in general and young males in particular and to a lesser extent elderly people. This pattern confirms previous findings on drowning, especially for young children and young males (Wintemute, Kraus, Teret and Wriht, 1987; NISU, 1995; Giles, 1995; Mackie, 1999), although there is less support for the higher risk for older people (Mackie, 1999). The results of this study show that the drowning risk for each of these groups is related predominantly to their exposure to water. For example, the results showed that for young children and babies, drowning occurred almost exclusively due to falling into water and from the near-drowning data that swimming pools and bathtubs were the major locations in which the near-drowning occurred. In contrast, young males drowned more often whilst swimming or boating. Similarly, near-drownings involving young males occurred more often in open water. Older males were more likely to drown or have a near-drowning episode during activities involving watercraft or that resulted in them falling into water. These results reinforce the conclusion that drowning and near-drowning occurs primarily where the exposure to water occurs.

The question that then arises is why are these groups at most risk? This analysis can only shed some light on this question as it was limited by a lack of depth of the data available on drowning and near-drowning. Most of the results from information available for this study simply reflected the characteristics of the exposure to water for each of these at-risk groups. For example, for all ages and both genders, most drownings and near-drownings occurred in summer, although this was mainly so for males in the 15 to 34 age group which is consistent with the greater number of drownings in this group while swimming, boating or near-drownings in open water. There was least difference between the seasons for the youngest (<5 years) and oldest (> 65) age groups

where a larger proportion of drownings occurred in winter. This is, again, consistent with the higher proportion of bathtub and swimming pool drownings found for both under fives and over 65 year olds. Similarly, drowning was more likely to occur on public holidays for males of all ages except the over 65 age group where drowning was equally likely across holidays and non-holidays. Again, this is most likely to be reflecting the exposure to the water-hazard as most people have best access to water activities on non-working days, unless they are no longer working such as for retired people over the age of 65 years.

Interestingly, drowning and near-drowning were more likely to occur for females on school holidays for under 15 year olds and 25 to 44 year olds. It is likely that this reflects the greater access to school holidays of children and mothers, although drowning was not more likely on school holidays for school age boys. This highlights the differences between the patterns of drowning for males and females. Over the age of 14 years, females showed very low rates of drowning, but this is likely to be due to a much lower exposure to water-related hazards for adult females.

There is evidence from this study, however, that the risk of drowning may be moderated despite exposure to water-related hazards. The results demonstrated that 5 to 14 year olds showed very low risk of drowning and near-drowning, yet it could be assumed that this age group is highly exposed to water, especially the beach and swimming pools. Certainly, where drownings and near drownings occurred in this group, they were associated with activities involving falling into water, swimming and in the location of open water, but there was a considerably lower rate of drowning. This study did not allow further analysis of the reasons for such a low risk of drowning and near-drowning in this group. Further research is needed to determine why children of this age group seem to be better protected from drowning compared to other age groups.

The study also revealed new information about the role of accessibility of the location of the drowning or near-drowning. Analysis by ARIA category showed that the rates of drowning and near-drowning are higher for remote and very remote regions of NSW, Western Australia and Queensland, and Victoria showed higher rates for its most inaccessible regions. From these findings it seems that accessibility is associated with drowning rates in a range of age groups and with near-drowning mainly in the youngest and oldest age groups which may be the most vulnerable. It is likely that in less accessible areas, there are also likely to be less patrolling and guarding of water-hazards and lower availability of rescue and medical support which may serve to make the increase the risk associated with exposure to water-related hazards.

This study found evidence that alcohol and drugs played a role in increasing drowning risk, but for a small percentage of cases. For most drowning cases for each age group there was no evidence of the involvement of alcohol or other drugs. Where it did occur, it involved males over 15 years of age, with a peak in the 25 to 34 years age group where just under one in five cases (19%) involved some evidence of alcohol involvement. This is lower than suggested by Howland and Hingson (1988) in a review of the epidemiological evidence on alcohol and drownings.

Tourists added a further five percent of drowning cases each year on average. The pattern of drowning for tourists also reflects the opportunities for access to water-based risk. Mostly tourists drowned in NSW and Queensland which is not surprising as this almost certainly reflects the patterns of maximum tourist activities in Australia. Most drowning involving tourists occurred in

open water. This result supports the findings of an earlier study of drowning in the surf (Leahy, Harrison and Fenner, 1999) who found that 19.5% of surf drownings involved international tourists. A further cluster of tourists drowned in swimming pools, mainly in Queensland and Western Australia.

The patterns of drowning varied between states. Although NSW, Victoria and Queensland together accounted for nearly three-quarters of all drownings, these states did not have the highest rates. The Northern Territory showed the highest drowning rates, being more than twice the rates of any of the other states. The rates for males showed a similar pattern, although the rates for males in Tasmania were considerably higher than for males in any other state, followed by Western Australia. The rates for females were very low and similar across all states except the Northern Territory, where, again, rates for females were around three times that of the other states. It seems that although the Northern Territory only accounts for a very small percentage of the drownings, (3%), drowning risk is markedly higher than any other state.

The study revealed some possible reasons for these differences between the states. For the Northern Territory the under five year old group was at significantly higher risk than the already high risk for this age group in other states. Also, a larger proportion of drownings in the Northern Territory involving 25 to 44 year olds occurred by falling into water, a smaller proportion involved water-craft and a larger proportion in 2 to 4 year olds involved swimming and wading. For Tasmania, in contrast, the risk of drowning for under five year olds was lower than overall figures for Australia, which is consistent with other findings (Riley, Lawson and Langford, 1996), but 25 to 29 year old and 70 to 74 year old males showed much higher risk than any other state for these age groups. In addition, drowning in adult males in Tasmania was more likely to occur during activities involving watercraft and skin diving than compared to the national figures.

This study was able to compare drowning and near-drowning for NSW. The ratio of neardrowning incidents severe enough to require hospitalisation and drowning was around two to one. This ratio seems quite low as it would be expected that there would be more incidents based on other types of injury. This result may be an artifact of only having hospitalisation data available for estimating the number of near-drowning incidents so that only the more severe survivable cases are included as near-drowning episodes. Further research is needed to answer this question.

In any case, the near-drowning results show a very similar pattern to the drowning analysis. The pattern for near-drowning shows the same steady rate since 1992, the same gender differences and the same age differences as for drowning. On the other hand, the rate for hospitalisation for under five year olds was around three to four times that of drowning, whereas for the other age groups, near-drowning rates were quite similar to those for drowning. This finding is probably due to a tendency for young children and babies to be hospitalised for less severe outcomes from a near-drowning compared to older people. These findings highlight the utility of near-drowning data as an alternative source of information about the causes of drowning.

6.0 CONCLUSIONS

Water is an inherently hazardous environment for humans in which there is always a degree of risk of drowning. Given this, it is surprising that there are not more drownings and near-drownings. Drownings and near-drownings gained national focus in 1997 with an unexpected increase in the number of beach drownings. While a large number of drownings do occur in the surf, the majority of drownings also occur in swimming pools, dams, rivers, lakes and bathtubs. The results of this study show that overall, Australia's drowning rate has decreased since 1992, although it has remained steady since 1996. While the overall rates of drowning are low compared to other injuries, the drowning and near-drowning rates are clearly an underestimate of the risk involved in exposure to water-related hazards.

The findings of this study reinforce this conclusion. Almost all of the results show a link between the opportunities for exposure to water and higher risk. The results reiterate the finding from previous work that babies and small children under five years of age are at significantly higher risk of drowning and near-drowning. The results show, however, that the risk arises from the types of exposure that babies and small children are most likely to encounter. Children in this age group are most likely to be exposed to swimming pools and bathtubs, where they drown most frequently after falling into the water. Drownings in this group can occur during most seasons and mainly during the daytime. Males, especially young males are most likely to drown in open water, while boating or swimming, mainly during the summer and on public holidays when they have the most chance to have access to water activities. Tourists also show higher risk of drowning related to their exposure to water, since drownings involving tourists occurred mainly in the most popular states for tourism (NSW and Queensland) and in open water situations, such as the beach.

The results suggest that drowning is an unforgiving type of injury, which may be difficult to survive. Comparison of the drowning and near-drowning rates suggests that near-drownings are relatively uncommon compared to drownings especially for adults since they occur at about the same rates. This finding needs to be explored further as one of the approaches to reducing the number of drownings may be to focus on rescuing near-drowning victims. A study by Manolios and Mackie (1988) reinforces the importance of early intervention following submersion on surf beaches. Possible support also comes from the finding of higher risk rates for drowning for people residing in more remote regions which may reflect problems due to poor access for rescue in cases where the drowning occurred close to the person's residence. Unfortunately, it is not possible to determine accessibility of drowning location from the available data. Further work is needed to clarify this possibility.

This study has suggested other avenues for intervention to reduce drowning. Along with a number of other studies, it has clearly demonstrated that action is needed most in reducing the drowning risk for babies and small children. It has also shown, however, that young males and older people are at higher risk, and that intervention activities that focus on boating and swimming are the most likely intervention targets. Different interventions are needed for different states. For example, the results show that boating activities are a major area to target to reduce drowning in Tasmania and that interventions in NSW and Queensland need to focus on remote and very remote zones.

Overall this study has provided a basis for further action and research on the causes and most appropriate avenues for reducing the risk of drowning in Australia.

7.0 RECOMMENDATIONS

7.1 National

The following recommendations are applicable nationally.

- Doctors need to be educated about the important data items needed for proper surveillance
 of drowning and near-drownings. Often, this information is not available when the medical
 record or death certificate reaches the coder. This results in the drowning or near-drowning
 being classified very generically, which inhibits prevention strategies, because certain types of
 drowning may be missed in this way.
- Due to the volume of rescues each year, data collection by lifeguards from local councils and Surf Life Saving volunteers needs to be improved, so that populations at risk of a drowning or near-drowning may be more closely monitored. This may be possible if some sort of 'data logger' were available for them to keep track of each rescue more easily.
- If people, age 65 years and older, are drowning in bathtubs, as the result of a fall, then the AWSC should work with state and local groups (e.g., NSW Falls Prevention Network) to promote fall prevention programs. Alternately, AWSC could work to improve medical record documentation, so that falls in the bathtub would be recorded as a drowning secondary to a fall.
- Further research is needed into the most effective approaches to reducing the very high risk of drowning for children under five years of age. This should include study of the barriers to implementing solutions such as swimming pool fences and the best approaches for increasing parental awareness of the drowning risk for this group.
- Further research and analysis is also needed on why the drowning risk for 5 to 14 year olds is so much lower than at any other ages. Through this it should be possible determine whether there are interventions that could be applied successfully for other age groups.
- Further work is also needed to understand the findings of higher drowning and near-drowning risk for people who come from areas classified as remote or very remote. It is possible that these people are at greater risk because they are less used to coping with water-related hazards, or it may be that if drownings occur near the person's home in remote regions, there is far less likelihood that a rescue would be successful.
- Further research and analysis is also needed to estimate the number of people who are really likely to be exposed to a drowning risk and to estimate the frequency with which they are exposed.

7.2 State and Territories

The following recommendations are state and territory specific.

7.2.1 New South Wales

- Work with Child Fatality Review teams to establish list of drowning data collection and reporting items
- Establish a type of activity measure, similar to drowning flags for near-drowning data sets.
- Develop a data resource with more in-depth information about the circumstances of drowning and near-drownings and the characteristics of the individual involved.
- Examine further the circumstances that lead to increased drowning risk for males from remote and very remote regions.

7.2.2 Northern Territory

• Investigate further the circumstances for higher risk of drowning for all groups and particularly for the group of under five year olds.

7.2.3 Tasmania

• Investigate further the most appropriate interventions for watercraft-related drownings, especially for the 25 to 29 and 70 to 74 year age groups.

7.2.4 Queensland

• Examine further the circumstances that lead to increased risk for males from remote and very remote regions.

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APPENDIX 1

MAPS




















Nontidal Drownings 1 - 3 4 - 6 7 - 8 No deaths







Map 6. Number of Other and Unspecified Locations of Drowning by SLA of Residence



NOTES