

# Analysis of drownings involving children aged five years and under in NSW

NSW Water Safety Taskforce





Prepared by:

Ann Williamson, Penelope Irvine and Samantha Sadural

**NSW Injury Risk Management Research Centre**

Report for the NSW Water Safety Taskforce

OCTOBER 2002

Further information about the NSW Water Safety Taskforce is available from:

Executive Officer  
NSW Water Safety Taskforce  
Locked Bag 1422  
Concord West DC NSW 2138

Telephone: 61 2 9006 3700  
Email: [safewaters@dsr.nsw.gov.au](mailto:safewaters@dsr.nsw.gov.au)  
Website: [www.safewaters.nsw.gov.au](http://www.safewaters.nsw.gov.au)

**Acknowledgement**

We are very grateful to the NSW State Coroner and to the Clerks of Glebe and Westmead Coroner's Courts for their generous assistance in carrying out this project.

# Table of Contents



ACKNOWLEDGEMENT	1
EXECUTIVE SUMMARY	5
BACKGROUND	7
STUDY AIMS	8
METHODS	9
RESULTS	11
<b>1. Characteristics of drowning involving children 0 to five years of age</b>	11
1.1 Year of incident	11
1.2 Age and gender	11
1.3 Location of drowning	11
1.4 Property type at which drowning occurred	12
1.5 Timing	13
<b>2. Drowning in swimming pools</b>	15
2.1 Age and gender	15
2.2 Region and property type	15
2.3 Timing	15
2.4 Contributing factors	16
2.4.1 Supervision	17
2.4.2 Location of the child	17
2.4.3 Safety equipment and personal protective equipment	17
2.4.4 Other contributing factors	18
2.5 Precursor events	18
2.6 Patterns	18
<b>3. Bathtub drownings</b>	21
3.1 Age and gender	21
3.2 Region and property type	21
3.3 Timing	21
3.4 Contributing factors	21
3.4.1 Supervision and location	22
3.4.2 Other contributing factors	22
3.5 Precursor events	22
3.6 Patterns: The interaction between contributing factors and precursor events	23
<b>4. Drowning in bodies of natural water</b>	24
4.1 Age and gender	24
4.2 Region and property type	24
4.3 Timing	25
4.4 Contributing factors	26
4.4.1 Supervision	26
4.4.2 Location	26
4.4.3 Personal protective equipment and other forms of safety equipment	26
4.4.4 Other contributing factors	26
4.5 Precursor events	26
4.6 Patterns: The interaction between contributing factors and precursor events	27

# Table of Contents



DISCUSSION	29
RECOMMENDATIONS	32
REFERENCES	33

## List of Figures

Figure 1: Framework for in depth analysis of drownings	10
Figure 1.1: Number of drownings by age and gender of child	11
Figure 1.2: Proportion of drownings occurring in different locations	11
Figure 1.3: Proportion of drownings within each age group by location	12
Figure 1.4: Number of drownings by age group and property type	12
Figure 1.5: Number of drownings by age group and region	12
Figure 1.6: Proportion of drownings in metropolitan/suburban regions by location	12
Figure 1.7: Proportion of drownings in rural regions by location	13
Figure 1.8: Number of drownings by the hour closest to which they occurred	13
Figure 1.9: Number of drownings occurring in each season by the time period in which they occurred	13
Figure 1.10: Number of drownings occurring on each day of the week and average number of drownings for week days and weekend days	13
Figure 2.1: Number of children drowning in swimming pools by age in years	15
Figure 2.2: Number of children drowning in swimming pools by age group and gender	15
Figure 2.3: Proportion of swimming pool drownings occurring in each season	15
Figure 2.4: Number of swimming pool drownings by day of the week and average number of drownings per type of day	16
Figure 2.5: Number of swimming pool drownings occurring within each time period	16
Figure 2.6: Proportion of pool drownings in which pool fencing/gates contributed in various ways to the fatality	17
Figure 2.7: Typical scenario for Pattern 1 – Swimming pools	19
Figure 2.8: Typical scenario for Pattern 2 – Swimming pools	19
Figure 2.9: Typical scenario for Pattern 3 – Swimming pools	20
Figure 2.10: Typical scenario for Pattern 4 – Swimming pools	20
Figure 3.1: Age of children drowning in bathtubs	21
Figure 3.2: Proportion of bathtub drownings occurring within each season	21
Figure 3.3: Number of swimming pool drownings occurring within each time period	21
Figure 3.4: Typical scenario for Pattern 1 – Bathtubs	23
Figure 3.5: Typical scenario for Pattern 2 – Bathtubs	23
Figure 4.1: Age group and gender of children drowning in bodies of natural water	24
Figure 4.2: Number of drownings by age group and type of body of natural water	24
Figure 4.3: Number of drownings by region and type of body of natural water	24

# Table of Contents



Figure 4.4: Proportion of drownings in bodies of natural water occurring within each season	25
Figure 4.5: Number of drownings in bodies of natural water by weekday and average number by type of day	25
Figure 4.6: Number of swimming pool drownings occurring within each time period	25
Figure 4.7: Typical scenario for Pattern 1 – Natural water	27
Figure 4.8: Typical scenario for Pattern 2 – Natural water	28
Figure 4.9: Typical scenario for Pattern 3 – Natural water	28

---

## List of Tables

Table 1.1: Number and percentage of drownings per year for the period January 1995 – April 2001	11
Table 2.1: Factors contributing to drowning in swimming pools	16
Table 2.2: Number and percentage of cases involving the behaviour of the child, adults and other children in events preceding drownings in swimming pools	18
Table 3.1: Number and percentage of cases involving various contributing factors	22
Table 3.2: Number and percentage of cases involving various precursor events	23
Table 4.1: Factors contributing to drownings in natural bodies of water	26
Table 4.2: Precursor events leading up to drownings in bodies of natural water	27

# Executive Summary



A total of 82 children aged five years or under died as a result of accidental drowning based on this study of Coroners records in NSW over a six year period. Around 40% of these children drowned in pools, a further 20% in bathtubs, and around 15% each in dams and lakes/ivers. Overall, two year olds were the most vulnerable age group, accounting for approximately one third of these cases, followed by one year old toddlers. Males were more likely than females to be involved in drownings, accounting for around two thirds of all cases. Babies less than 12 months old most commonly drowned in the bath, whereas all other age groups most often drowned in swimming pools. For one year old toddlers, baths was the second most common location, whereas for those aged two years and older, bodies of natural water, such as dams, lakes and rivers were the second most common location.

Around 60% of drownings occurred within the child's own home, and over two thirds occurred in suburban or metropolitan regions. Drownings in metropolitan/suburban areas occurred most commonly in pools, then baths, whereas drownings in rural areas occurred most commonly in other bodies of natural water, in particular, in dams.

## **Characteristics of swimming pool drownings**

Swimming pool drowning was most common in the two year old age group and as age increased beyond two years, the number of children drowning in pools decreased consistently. Just over 75% of swimming pool drowning involved males and there were more males than females in all age groups. The vast majority of swimming pool drownings occurred in metropolitan/suburban areas, and over two thirds occurred within the child's own home. Whilst pool drowning was most common in summer, they occurred across all seasons. On average, they were fairly evenly spread across weekend days and week days, and occurred most commonly between 11am and 6pm, showing a peak around 5pm in the afternoon. The vast majority of drownings occurred when children accidentally fell in or deliberately went into the water.

The most common factors contributing to swimming pool drowning were a lack of adult direct supervision, combined with problems with safety equipment, such as pool fences

and gates and the behaviour of children themselves. To a lesser extent the behaviour of adults and other children also played a role. Whilst in some cases the contributing role of fencing related to the equipment itself, such as not being present or being in a state of disrepair, in other cases it was the way in which equipment was handled by adults and other children (i.e. leaving the pool gate open). Clearly the maintenance and appropriate usage of swimming pool fences and gates are problems which need addressing. Adult behaviour in the form of adequate supervision for young children also emerged as a clear contributing factor. Whilst the behaviour of children themselves definitely played a role, strategies to target the child's own behaviour are problematic due to the young age group of many of these children.

## **Characteristics of bathtub drowning**

Bathtub drowning was most common in the one year old group, followed by babies less than 12 months of age. Unlike other locations, drowning in bathtubs showed an even distribution of genders, indicating that as a group, females were proportionately more involved in drowning in bathtubs than other locations. All bathtub drowning occurred within the child's own home and all except one case occurred within metropolitan/suburban regions. Drowning in bathtubs occurred across all seasons, although were most notable in winter. They occurred mostly between 9am and 6pm and on average were fairly evenly spread across weekdays and weekend days. The majority of bathtub drownings occurred when the child was actually bathing.

The single biggest contributing factor to bathtub drowning was a lack of direct adult supervision, with children being left alone, or with another child in the bath. Sometimes this may have been for a few moments, although in some cases it appeared to be for longer periods, with children being left in the bath whilst a parent/carer attended to other household tasks. In a small number of cases children climbed or fell out of bath seats, indicating that such equipment alone cannot guarantee the safety of a small child when they are left unsupervised. Lapses by adults in failing to empty bath water after bathing also played a role

# Executive Summary



in a small number of cases in which children awoke the following day and climbed into a bathtub containing water.

## **Characteristics of drowning in bodies of natural water**

Drowning in bodies of natural water involved children aged two years, and those between three to five years of age. Males accounted for around 60% of cases. The most common locations for drowning was dams and lakes or rivers, with children falling in or deliberately entering the water. There were some differences between drowning in lakes or rivers and dams. The majority of dam drownings occurred within the child's own home and all occurred in rural regions probably due to increased exposure to dams in these areas. In contrast, more than half the cases of drowning in lakes or rivers occurred in suburban/metropolitan regions, although the vast majority did not occur in a home environment. Once again, this is likely to reflect the location of rivers or lakes in urban environments. In addition, dam drowning tended to involve younger children, whilst drowning in lakes or rivers tended to involve mostly older children.

Drowning in natural bodies of water occurred across all seasons. In contrast to pool and bathtub drowning however, on average, such drownings occurred more often on weekend days than week days. Like drowning in other locations, they occurred fairly steadily throughout the day from around 10am to 7pm, showing a peak around 6pm in the evening. Drowning in lakes or rivers was most common between 3.30–5.30pm, and drowning in dams was most common between 5.30–6.30pm.

The two most common contributing factors to drowning in natural bodies of water were a lack of direct adult supervision and the behaviour of the child themselves. In contrast to drowning in pools and bathtubs, children who drowned in natural bodies of water were more often under indirect supervision often playing whilst a carer, who was nearby was engaging in some other activity. This finding highlights the point that even indirect supervision is not sufficient when children are near water sources or outside secure environments. In the majority of all of these cases involving natural bodies of water, children wandered off in some cases breaching barriers including doors, gates and

fences to find their way to the body of water. Such breaches of safety equipment similar to those seen in swimming pool drowning, again highlights the potential inadequacies of using these barriers alone.

## **Recommendations**

By looking for common features across each of these descriptions, it was possible to make suggestions about additional strategies that could be implemented to prevent drowning in this age group. For all drowning recommendations focussed on informational and educational approaches to increase awareness of the characteristics of children and the way they change as the child develops and also to provide some guidance on the ways of focussing supervision of children to be especially watchful in specific situations and times specific situations and times. Recommendations aimed at reducing drowning in swimming pools and other bodies of natural water also included environmental modifications such as isolation fencing to reduce the child's access to these bodies of water and strategies for improving the maintenance of fencing and gates. The recommendations encouraged carers of young children to focus on the effectiveness of safety barriers particularly in the light of changes as the child develops and in situations where the barriers may be compromised by human behaviour as well as reducing compromises to safety equipment due to human behaviour.



# Background



Current data on the incidence of traumatic fatalities in children five years of age and under shows that drowning is the second leading cause of injury death in New South Wales (NSW), following motor vehicle-related fatalities (Schmertmann & Williamson, 2002). Indeed for the last decade, children under the age of five years have the highest rates of drowning-related deaths (IRMRC, 2000; Schmertmann & Williamson, 2002; Mackie, 1999) and furthermore, the rate of drowning in this age group has changed little over the last 15 years (Mackie, 1999). Clearly further work is needed to develop better interventions that will reduce this problem.

Previous work has identified some of the risk factors for drowning in young children. For example, age, gender and to some degree, location have been established as important risk factors. The peak age for drowning is two years and males generally account for between two thirds and three quarters of drownings (Thompson & Rivera, 2002; IRMRC, 2000; Schmertmann & Williamson, 2002; SWSAHS, 2000). For infants, bathtub drowning poses the greatest hazard, whereas for toddlers aged one to four years, who have attained mobility, swimming pools pose the greatest risk of immersion death and injury (Schmertmann & Williamson, 2002; Thompson & Rivara, 2002). With the exception of bathtubs where females tend to dominate drowning statistics, males account for more drownings in all locations (Schmertmann & Williamson, 2002; Mackie, 1999).

The existence of pool fencing has been identified as an important protective factor, with a recent review concluding that pool fencing significantly reduces the risk of drowning (Thompson & Rivera, 2002). In particular, isolation fencing which encloses the pool (rather than the home and pool) and thus prevents access to the pool from the home was found to be superior to perimeter fencing (Thompson & Rivera, 2002). Unfortunately, whilst many home and public pools are now fenced, reports of drowning still frequently cite some form of fault with the fencing or gates of pools where children have drowned (SWSAHS, 2000; NSW Child Death Review Team, 2001).

Adult supervision has also been highlighted as a factor in case reviews of drowning in children. For example, a report by the South Western Sydney Area Health Service (SWSAHS, 2000) has cited a lack of adult supervision as an “overwhelming feature” of drowning deaths in children 0–5 years in NSW over the period June 1997–June 1998. Similarly, reports of the Child Death Review Team frequently report a lack of adult supervision in cases of drowning (e.g. NSW Child Death Review Team, 2001).

Most of the previous research on the causes of childhood drowning has focused on the role of individual factors. There has been little analysis of the wider circumstances in which the child drowning occurs nor of the relationships between the various factors involved. If drowning fatalities are to be prevented it is essential to gain a full understanding of the wider circumstances in which they occur.

Therefore, whilst some information is available on the characteristics of drowning in children aged 0–5 years, there is insufficient information on the wider circumstances leading to drownings in all locations and on how various factors interact together to result in such tragic fatalities. Information from Coronial Inquests is one of the most comprehensive information sources available on why and how traumatic fatalities occur and potentially allows an in depth analysis of common features across cases. Given that the rate of toddler drowning in NSW remains unacceptably high (NSW Child Death Review Team, 2001, p59.), more in depth study which can inform policy and practice appears warranted.

The NSW Injury Risk Management Research Centre proposed to undertake such research and was commissioned by the NSW Water Safety Taskforce to produce this report, as part of the further development of the NSW Water Safety Framework: 2001–2003.

# Study aims

- To describe the characteristics of unintentional drowning involving children aged five years and under
- To identify factors associated with and causes of unintentional drowning in swimming pools, baths and other natural bodies of water
- To look for common factors across cases that could provide direction for action to prevent similar incidents occurring in the future.



# Methods

## Data sources:

This study used full Coroner's files through the Coroners courts in New South Wales (NSW). All cases of drowning fatalities involving children aged five years and under in NSW over the period January 1995 to April 2001 were identified through the Coroner's electronic data files. Original files were then located and cases from regional areas were sent to a city court where they were read and coded. Ninety cases were identified, of which 87 were located, read and coded. Three cases were not able to be located due to a range of administrative reasons. These were all from country areas. Of the 87 cases coded, two resulting from motor vehicle accidents and three involving intentional drowning were not included in the subsequent analysis due to their distinctive nature.

## Data coding:

A methodology was developed to code the characteristics of each case on a range of dimensions. Data relating to demographic factors was collected including; age, gender and region (i.e. rural or metropolitan). Data relating to the characteristics of the drowning was also collected including; time of day, location (i.e. pool, bath, dam, lake/river, beach, pond, and other), access to water, the use of personal protective equipment (e.g. bathseats, "floaties", lifejackets or other personal flotation devices) and involvement of other safety equipment or devices (e.g. doors/gates, pool fences or covers).

More in depth classification and coding of the circumstances leading to the fatality was undertaken for the 82 unintentional drownings. The methodology employed was based on a framework used in previous studies of workplace fatalities (Williamson & Feyer, 1990; Feyer & Williamson, 1991) and more recently in a report investigating child fatalities in driveways. This approach allows for the coding of up to three precursor events leading up to the contact between the child and the water, as well as other contributing factors.

## Precursor events are coded as:

- environmental event, defined as characteristics of the location at the time of the event (e.g. weather conditions such as choppy water, darkness, murkiness of water, temperature of the water).

- equipment event, relating to breakage or failure of equipment.
- behavioural event, relating to the behaviour of the child, as well as the behaviour of adults (e.g. supervisors) and other children. Behaviours of the child may include wandering off, letting themselves outdoors, climbing over or crawling under gates or fences, slipping and falling into the water, or going into the water. Adult behaviours include adults leaving doors or gates open or unlocked, leaving water in baths and making unsafe decisions (e.g. leaving a tap running, not attiring child with a flotation device). Behaviour of other children includes leaving doors/gates open or unlocked, opening gates for children and leaving children alone.

## Contributing factors are other pre-existing factors which contributed to the fatality and are coded as relating to the:

- Safety equipment or devices, including other safety equipment and personal protective equipment as above. Such equipment may not be used where it should be (e.g. no fence around pool; failure to wear floaties whilst swimming), may be used inappropriately (e.g. pool gate open), may be in poor condition (e.g. faulty lock or missing fence palings), or may be faulty in design (equipment design, such as size of gaps in or under fences and gates). In addition, where other safety equipment (OSE) appeared to be in good condition and used appropriately, yet was still breached by the child, this was noted.
- Supervision, which was coded as i) no supervision, indicating the child was knowingly left alone by the carer for some period of time, even if temporarily; ii) indirect supervision, indicating the supervisor was in relatively close vicinity to the child but was engaged in some other activity at the time; and iii) direct supervision, indicating that the supervisor was actively and directly supervising the child at the time (e.g. standing next to the child and/or holding the

# Methods continued

child or the child's hand). Cases which occurred when children and parents/carers were initially asleep were also noted.

- Location of the child, referring to their location when last under direct adult supervision, and was coded as i) inside a secure environment and away from water, ii) outdoors in an environment where a water source was not easily and immediately accessible, iii) outdoors in an unsafe or hazardous environment whereby the child was in close proximity to a readily accessible water source, and iv) actually in the water (e.g. in the bath, in a pool).
- Medical conditions, referring to conditions of both children and supervising adults.
- Environment (e.g. weather, darkness, steep or slippery surfaces).
- Common practices, referring to behaviours known to be the norm (e.g. child often left in bath alone; child known to be prone to climbing).

Hypothetical example:

A family had gone to a crowded local swimming hole on a hot day, taking their two year old toddler. The mother had taken one of the children to the toilet, leaving the other children in the charge of the father. Unfortunately, the father thought that the mother had taken the toddler to the toilet. In the short time that she had gone, the two year old wandered into the water. Nobody noticed and the drowning occurred.

The suggested coding of this incident would look like the following:

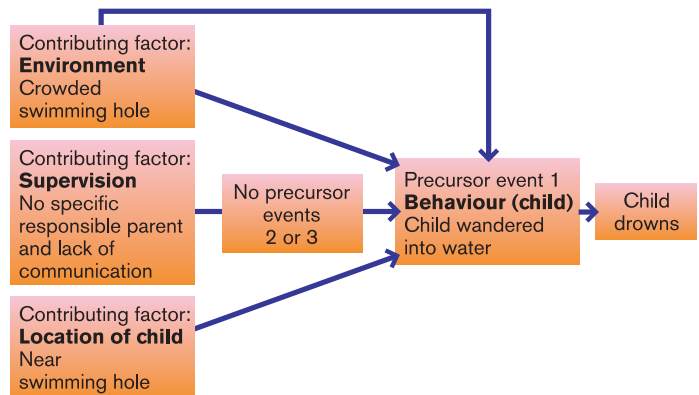


Figure 1 below sets out the framework employed in classifying and coding the circumstances surrounding these drownings.

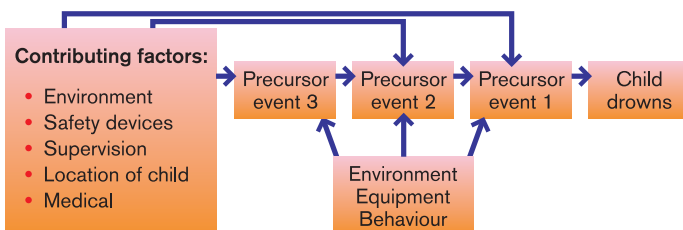


Figure 1: Framework for in depth analysis of drownings



# Results

## Characteristics of drowning involving children 0 to five years of age

The results are divided into a number of sections. The first is an overview of the entire data set of drownings involving 0 to five year olds. In the next three sections, drownings are divided into three groups based on the location in which they occurred—swimming pools, bathtubs, and other bodies of natural body—as the circumstances surrounding drowning in each type of location is likely to differ.

### 1 Characteristics of drowning involving children 0 to five years of age

#### 1.1 Year of incident

Eighty two children aged between 0 and five years of age died as a result of drowning in the period January 1995–April 2001 (see Table 1). Excluding 2001 for which not all data were available, the number of drownings was fairly evenly distributed across the years 1995 to 2000, ranging from between 13 and 16 cases. The one exception was 1996 which showed fewer cases than other years.

	Frequency	Percentage
1995	15	18.3
1996	5	6.1
1997	15	18.3
1998	16	19.5
1999	13	15.9
2000	14	17.1
2001 (January–April)	4	4.9
<b>Total</b>	<b>82</b>	<b>100.0</b>

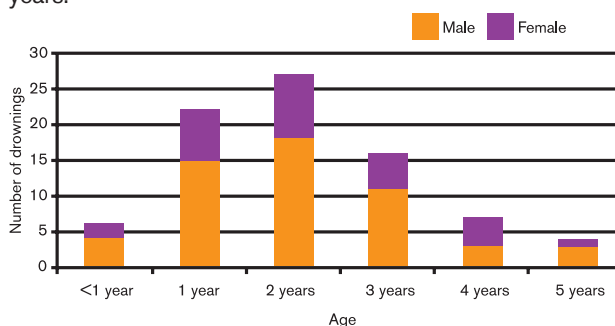
**Table 1.1:** Number and percentage of drownings per year for the period January 1995–April 2001

#### 1.2 Age and gender

Males accounted for around two thirds of all drowning (65.9%). The two year age group were involved in approximately one third (32.9%) of all drowning, with one year old children being involved in a further 26.8% of cases (Figure 1.1). As age increased beyond two years, the number of children drowning decreased steadily. There were six cases of a babies less than 12 months old drowning. Males aged one, two and three were involved in

twice as many drownings as females of the same age.

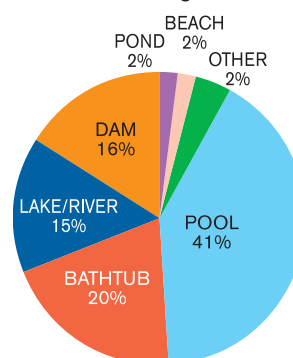
For the remainder of this analysis, children are grouped into four age brackets: those aged less than 12 months, one year olds, two year olds, and children aged three to five years.



**Figure 1.1:** Number of drownings by age and gender of child

#### 1.3 Location of drowning

The most common location for drowning was the swimming pool (41.5%, or 34 cases), followed by baths (19.5% or 16 cases), dams (15.9% or 13 cases) and lakes or rivers (14.6%, or 12 cases). An additional two drownings each occurred in lagoons at the beach and in ponds, with the remaining three cases occurring in other bodies of water found in or around homes (Figure 1.2).



**Figure 1.2:** Proportion of drownings occurring in different locations

When location was examined by age group, with the exception of one case, all babies less than 12 months drowned in the bath (5 of 6). Children in all other age

# Results

## Characteristics of drowning involving children 0 to five years of age

groups most commonly drowned in a pool (between 9 and 13 cases in each age group). Following pools, the bath was the next most common location for one year old toddlers to drown (7 of 22 cases), while dams and lakes/rivers respectively were the second most common locations for children aged two years and between three and five years to drown (6 of 27, and 8 of 27 respectively) (Figure 1.3).

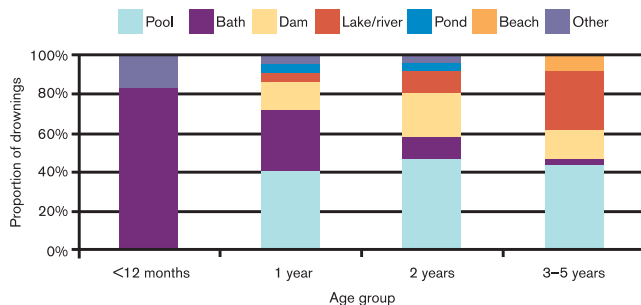


Figure 1.3: Proportion of drownings within each age group by location

### 1.4: Property type at which drowning occurred

Approximately 60% (49 cases) of drownings occurred in the child's own home, with a further five cases occurring at a neighbour's home, and four cases each occurring at another home the child was visiting or at a relative's home. Drowning in babies less than 12 months and one year olds was more likely to occur in the child's own home (100.0% and 86.4% respectively) compared to two year olds (59.3%) and three to five year olds (33.3%). Around 44% of drowning in three to five year olds, and 22% of drownings in two year old children did not occur within the environs of a home (Figure 1.4).

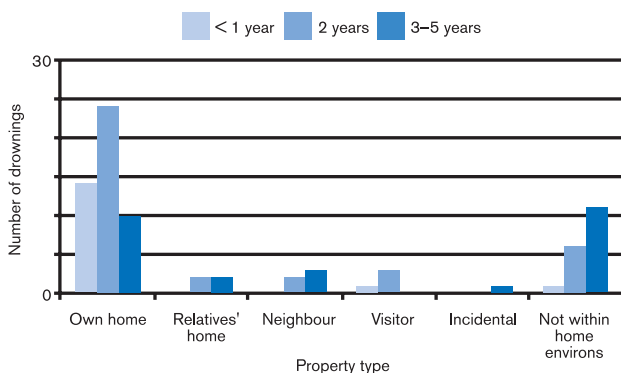


Figure 1.4: Number of drownings by age group and property type

Around 70% of drownings occurred in metropolitan or suburban regions (58 of 82) for all age groups. As age increased however, the proportion of children who drowned in rural areas increased. It should be noted that in four cases in the three to five year age group (14.8%), the type of region in which the drowning occurred was unknown (Figure 1.5).

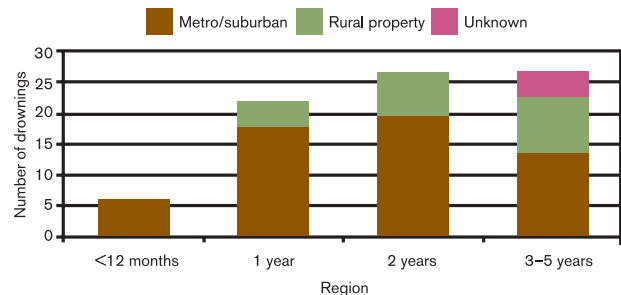


Figure 1.5: Number of drownings by age group and region

Drowning in metropolitan/suburban areas and rural areas also differed in terms of the locations in which children drowned (Figures 1.6 and 1.7). Drowning in metropolitan areas, like all drowning tended to occur most frequently in pools, followed by baths, then lakes/rivers. In contrast, drowning in rural areas tended to occur most frequently in dams, followed by lakes/rivers, then pools.

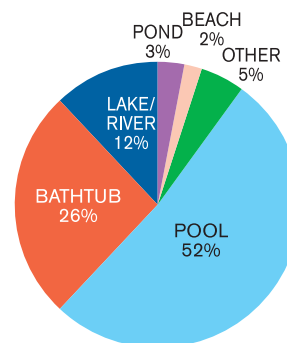
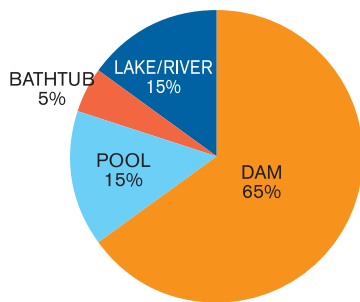


Figure 1.6: Proportion of drownings in metropolitan/suburban regions by location (58 cases in total)

# Results

## Characteristics of drowning involving children 0 to five years of age

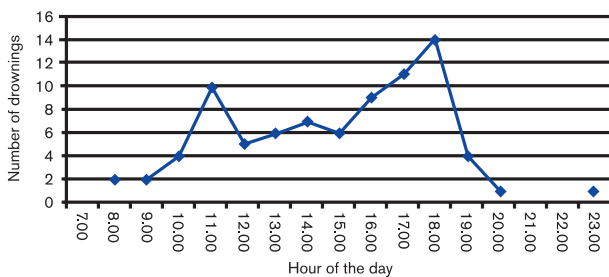


**Figure 1.7:** Proportion of drownings in rural regions by location (20 cases in total)

### 1.5 Timing

The most common times of the day for children to drown were during the day between 9am and 3pm (39.0% or 32 cases), and in the afternoon between 3pm and 6pm (37.8% or 31 cases). A further 16 drownings (19.5%) occurred in the evening between 6pm and 9pm.

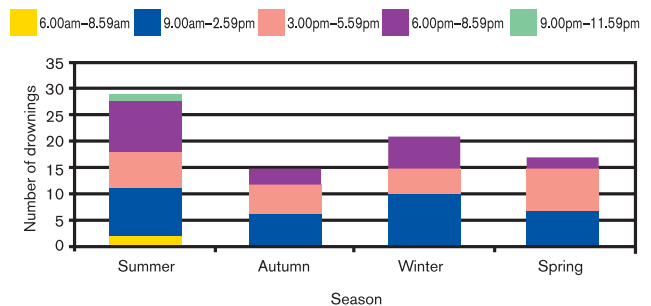
When examined by the hour of the day closest to which they occurred, the number of drownings increased in the morning from 8am through to 11am (10 cases), before decreasing by half around 12 noon. After midday, the number of drownings increased through to 6pm where they peaked with 14 cases (17.1%) occurring between 5.30pm and 6.30pm. After 6.30pm the number of drownings decreased again. As seen in Figure 1.8, around 11am, and between 3.30–6.30pm were particularly vulnerable times.



**Figure 1.8:** Number of drownings by the hour closest to which they occurred

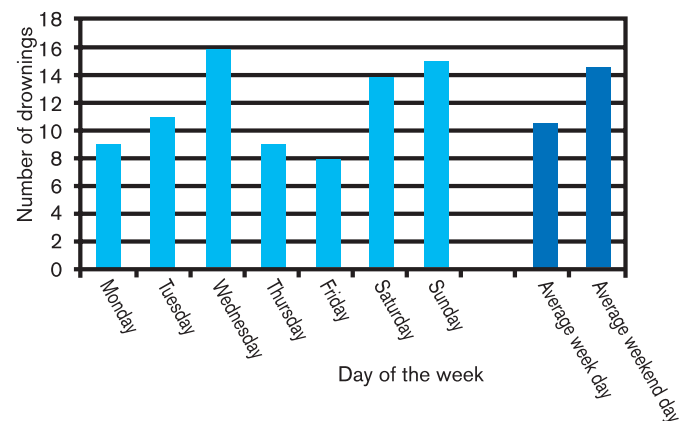
Drowning occurred across all seasons of the year (Figure 1.9). Excluding cases from 2001, one third of drownings, occurred in summer, with a further 26.9% occurring in Winter, 21.8% in Spring, and 17.9% in Autumn. When the

number of drownings in each season was examined by the time period in which they occurred, the vast majority of drownings in winter and spring occurred between 9am and 3pm. In contrast, around one in three drownings in summer and one in five drownings in autumn occurred after 6pm.



**Figure 1.9:** Number of drownings occurring in each season by the time period in which they occurred

When the day of the week on which the drowning occurred was examined, such incidents occurred across all days of the week, and were most common on Wednesdays (16 cases), Sundays (15 cases), and Saturdays (14 cases). When the average number of drownings per type of day were analysed, they were somewhat more common on weekend days (14.5 cases per weekend day on average) than on week days (10.6 cases per weekday on average) (Figure 1.10).



**Figure 1.10:** Number of drownings occurring on each day of the week and average number of drownings for week days and weekend days

# Results

## Characteristics of drowning involving children 0 to five years of age



When the type of day (i.e. week day or weekend day) was examined by the time period in which the incident occurred, a significant difference was found between the timing of incidence on the weekend and during the week. On the weekend, over half the drownings occurred between 9am and 3pm (16 of 29 cases), with a further 10 cases (34.5%) occurring between 3pm and 6pm. In contrast, during the week, whilst around 70% of drownings occurred between 9am and 6pm, at least one quarter occurred after 6pm.



# Results

## Drowning in swimming pools

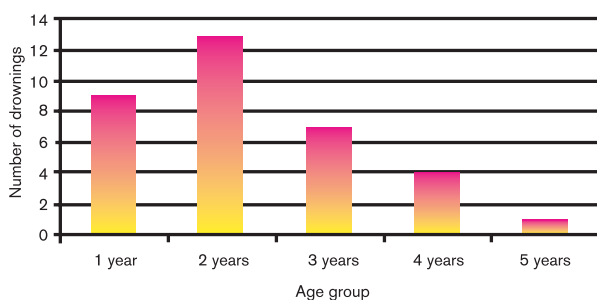
### 2 Drowning in swimming pools

There were 34 drownings in swimming pools, with all except one case occurring in home swimming pools. These cases represent 41.5% of all drownings, making swimming pools the single most common location for drowning to occur in children aged five years and under.

The vast majority of children drowning in pools either fell in or went in voluntarily (94.1% or 32 of 34 cases). In only two cases were children already in the water, either swimming or sitting in the water. Events involved in the lead up to these drownings are examined in detail later in this section.

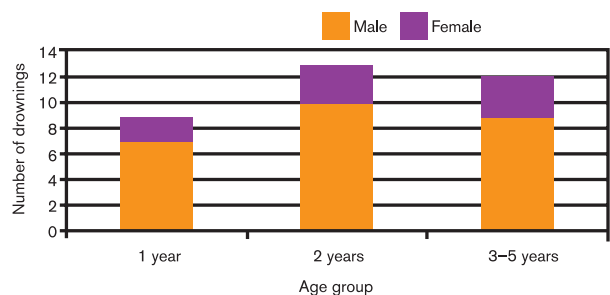
#### 2.1 Age and gender

Close to 40% of all swimming pool drowning involved children aged two years (38.2% or 13 of 34), with one year old toddlers being involved in a further 26.5% of cases (9 of 34) (Figure 2.1). As age increased beyond two years, the number of drownings in swimming pools decreased steadily.



**Figure 2.1:** Number of children drowning in swimming pools by age in years

Male children were involved in around 75% of all swimming pool drowning (26 of 34 cases) and accounted for the majority of drownings in all age groups (Figure 2.2).



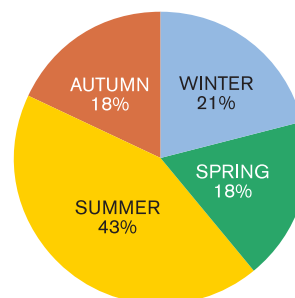
**Figure 2.2:** Number of children drowning in swimming pools by age group and gender

#### 2.2 Region and property type

Where region was known, the majority of pool drownings (88.2% or 30 of 34 cases) occurred in metropolitan or suburban areas. The child's own home swimming pool was the location for over two thirds (70.6%) of drownings, with other properties involved including that of neighbours (4 cases), relatives (3 cases) and places the child was visiting (3 cases). Only one case occurred in a public pool.

#### 2.3 Timing

Drownings in swimming pools were recorded for all years, showing a peak of nine cases in 1997, and occurred in all months with the exception of November. Excluding one case from 2001, pool drowning was most common in summer (42.4%, or 14 of 33 cases), and fairly equally spread across other seasons (Figure 2.3).

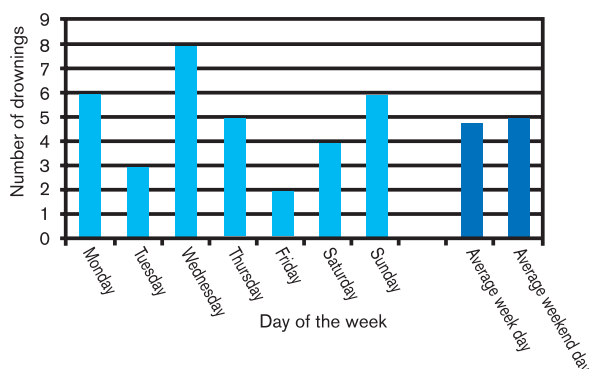


**Figure 2.3:** Proportion of swimming pool drownings occurring in each season (excluding 2001).

# Results

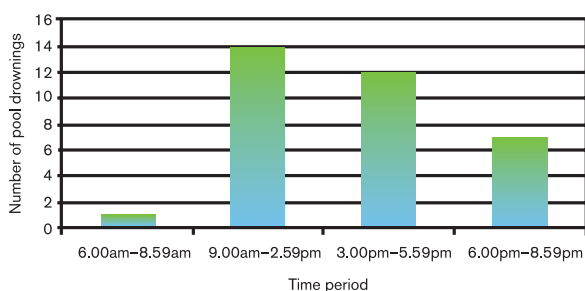
## Drowning in swimming pools

Whilst around 70% (24 of 34 cases) of pool drowning occurred on weekdays, when the average number of drownings per type of day was examined (i.e. average per weekday and average per weekend day) drownings were found to be fairly evenly spread across weekdays and weekend days (4.8 versus 5.0) (Figure 2.4).



**Figure 2.4:** Number of swimming pool drownings by day of the week and average number of drownings per type of day

Like all drownings, swimming pool drownings were most common between 9am–3pm (41.2%) and 3pm–6pm (35.3%). An additional seven cases (20.6%) occurred between 6-9pm (Figure 2.5).



**Figure 2.5:** Number of swimming pool drownings occurring within each time period

When examined by the exact time of the day at which the injury occurred, drowning occurred throughout the day from 8am–8pm. The number of drownings occurring within each hour was fairly steady from around 10.30am through to around 4.30pm, with a peak being seen between 4.30–5.30pm when seven cases occurred.

### 2.4 Contributing factors

There were a number of factors which contributed to drowning in swimming pools, with the number and percentage of cases in which various factors played a role shown in Table 2.1 below. Each factor is commented on following the table.

	Frequency	Percentage
<b>Supervision</b>		
No adult	26	76.5%
Indirect	5	14.7%
Asleep	3	8.8%
<b>Location</b>		
In water	3	8.8%
Dangerous (close proximity to water)	4	11.8%
Outdoors	11	32.3%
Indoors	16	47.1%
<b>Personal protective equipment</b>		
Not used, should have been	3	8.8%
<b>Other safety equipment: pool fencing</b>		
Not used, should have been	5	14.7%
Use inappropriate	8	23.5%
Poor condition	5	14.7%
Design fault	3	8.8%
Breached	9	26.5%
Not known	1	2.9%
Not relevant	3	8.8%
<b>Other safety equipment: other doors, gates, fences</b>		
Use inappropriate	3	8.8%
Breached	11	32.4%
Not relevant	3	8.8%
<b>Environmental factors</b>		
Environmental factors	3	8.8%
<b>Medical conditions</b>		
Medical conditions	1	2.9%
<b>Common practices</b>		
Common practices	2	5.9%

NB: *Not relevant* refers to cases in which children were already in the water

**Table 2.1:** Factors contributing to drownings in swimming pools

# Results

## Drowning in swimming pools

### 2.4.1 Supervision

Supervision played a role in all cases of drowning in swimming pools, with over 75% of cases involving a child who had been left without adult supervision. Of the 26 children who were left without adult supervision, 15 (57.7%) were known to be left with other children, while 8 (30.8%) were known to be left alone. In four of five cases in which the child was being indirectly supervised, the child was with at least one other child.

### 2.4.2 Location of the child

Seven of the children were deemed to be in dangerous (three cases) or potentially dangerous (four cases) situations, either being in the pool or within easy access to the pool (e.g. playing nearby an unfenced pool).

### 2.4.3 Safety equipment and personal protective equipment

Safety equipment in the form of barriers was mentioned in 30 of the 34 cases (88.2%). Such barriers refer to exit points from homes such as doors, pool fences and gates, as well as gates and fences bounding the property.

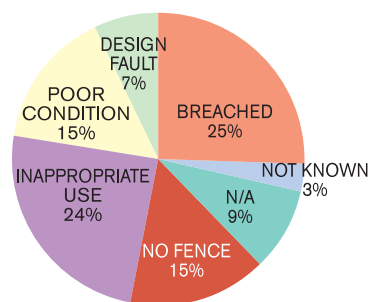
**Pool fencing:** Of all pools in which drowning occurred, some form of fencing was known to be present in the majority of cases (25 of 34, or 73.5%). There were however five pools which were not fenced (14.7%), two of which were in the process of being built. In one case it was not known whether the pool was fenced, and the one remaining case occurred in a public pool area in which the children's pool was not fenced in isolation of the larger pool.

There were three cases in which children were already in the water. Although one of these pools was not fenced, this is not viewed as a factor contributing to the fatality. For the 31 cases in which children were not already in the water, there were five cases in which a lack of fencing around the pool contributed to the fatality.

In a further sixteen cases, whilst pools were fenced, various factors, including inappropriate usage (eight cases), poor condition (five cases), or faulty design of equipment (three cases), compromised the effectiveness of pool fencing and gates and hence was seen to contribute to the fatalities. Examples of such instances included pool gates being left open, gates not locking properly, fence palings missing, or

parts of the gate being removed for repair. Design faults referred to instances in which the child was able to crawl under the fence/gate as a result of a design or installation not in line with Australian Standard 1926 requirements for pool fencing (e.g. having a six-inch gap under the fence).

In an additional nine cases, whilst there was no specific fault cited with the pool fence or gate, young children were able to breach the safety barrier. In three cases the child is thought to have climbed over the pool fence or fence to neighbouring yard and pool, whilst in a further three cases the child is thought to have gained access through the pool fence or crawled under the pool gate. In two cases another child opened the pool gate to let the child in and in another case the child is thought to have opened the gate themselves. When children opened gates or climbed fences, they were sometimes assisted by other equipment located near the pool, such as chairs, a scooter or ladder (Figure 2.6).



**Figure 2.6:** Proportion of pool drownings in which pool fencing/gates contributed in various ways to the fatality (where appropriate).

**Other safety equipment (OSE):** in the form of barriers such as doors from homes and fences or gates to other properties played some role in 31.8% of cases (14 of 34). In three cases, OSE was used inappropriately, including doors from homes being left open, or not being locked, which allowed the child to get outdoors. In a further 11 cases, whilst there was no specific reference to a lack of, misuse of or poor condition of OSE, children nonetheless breached barriers by letting themselves out of the house, and/or climbing through neighbouring fences or letting themselves through gates.

# Results

## Drowning in swimming pools

**Personal protective equipment (PPE):** played a role in three cases, all of which involved a small child not wearing floaties or other forms of floatation devices when swimming or playing around the pool.

### 2.4.4 Other contributing factors

The majority of cases (79.4% or 27 of 34) did not involve any additional contributing factors other than those already mentioned. In three cases environmental factors played a role, and these included the pool being crowded, a location being extremely dangerous, and the murkiness of the pool water increasing the time taken to find the child. In one case, a medical condition of the child further contributed to the fatality. Common practice factors, referring to instances in which the child was known to exhibit vulnerable behaviours were apparent in two cases.

### 2.5 Precursor events

With the exception of only one case, all cases involved at least one precursor event (Table 2.2).

The child's own behaviour was noted as a precursor event in all but one case and always involved the child either accidentally falling into or deliberately going into the pool. Additional behaviours engaged in by the child included letting themselves outside when indoors, wandering away from safe locations, and breaching the pool fence in some manner (e.g. climbing over, crawling under, or going through the gate). Behaviours by adults and other children that played a role in the lead up to drowning included leaving open or opening doors/gates for children and leaving the child alone. Other adult behaviours noted included failing to put appropriate flotation devices on the child and making unsafe decisions with respect to where children were left.

Precursor event	Frequency	Percentage
Child behaviour		
One	5	14.7%
Two	19	55.9%
Three	9	26.5%
Adult behaviour		
One	5	14.7%
Two	1	2.9%
Behaviour of other child		
One	6	17.6%
Combination of events		
Child only	21	61.7%
Child + adult	6	17.6%
Child + other child	6	17.6%
No precursor events	1	2.9%

**Table 2.2:** Number and percentage of cases involving the behaviour of the child, adults and other children in events preceding drownings in swimming pools.

As shown in Table 2.2, around 60% of cases involved only the behaviour of the child in events preceding the drowning, with a further 35.3% (12 cases) involving the combined effect of the behaviour of the child with either the behaviour of an adult or another child.

### 2.6 Patterns

When the interaction between contributing factors and precursor events within each case were examined across cases, a number of distinct patterns emerged. One case was not possible to classify with certainty as it was not clear how the child gained access to the pool after being left unsupervised.

#### 2.6.1 Pattern 1

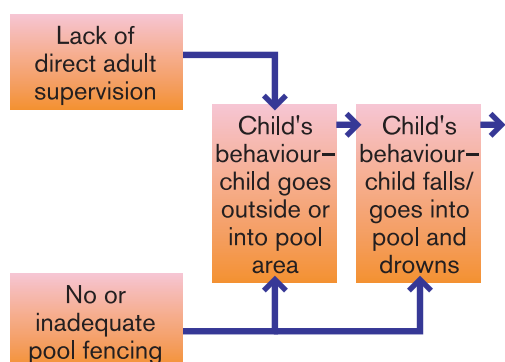
The primary pattern to emerge, seen in 13 cases (38.2%), was characterised primarily by the combination of the inadequacy of swimming pool fencing, a lack of direct adult supervision and the behaviour of children themselves (Figure 2.7). In five cases the pool was not fenced, in five cases the pool fences/gates were in a state of disrepair and in three cases there was a fault with the design of the pool

# Results

## Drowning in swimming pools

fence/gate. All cases occurred when there was no adult supervision including one case where the adult was asleep. In most cases, the child was thought to be in relatively safe locations (eight cases indoors and five cases outdoors, including two who were outdoors in hazardous locations near water), although without direct adult supervision.

All cases involved some behaviour on the part of the child. In only two cases an adult was involved by removing other barriers to the pool. Both cases, however, occurred where there was an inadequate fence and no supervision.

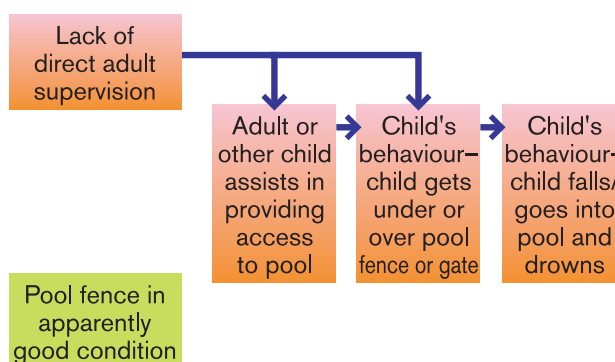


**Figure 2.7:** Typical scenario for Pattern 1–Swimming pools

This pattern of cases tended to involve more males and slightly older children. Males were involved in 10 of these 13 cases (77.0%). Nearly half were three to five year olds (six cases, 46.2%), three cases were two year olds, and four cases were one year old children.

### 2.6.2 Pattern 2

The next most common pattern accounted for nine cases (26.5%) and was characterised primarily by the existence of a pool fence in apparently good condition, but the drowning occurred due to lack of direct adult supervision in combination with access being provided to the pool by another child or an adult (Figure 2.8).



**Figure 2.8:** Typical scenario for Pattern 2–Swimming pools

In all of these cases, there was either indirect (three cases) or no supervision (six cases, including one case where the supervisor was asleep). Children were thought to be in relatively safe locations (two indoors, six outdoors and one in a hazardous location outdoors), although all were all left without direct adult supervision. All cases involved either another child providing assistance in gaining access to the pool (seven cases) or an adult leaving doors or gates open or unlocked so providing access to the pool (two cases).

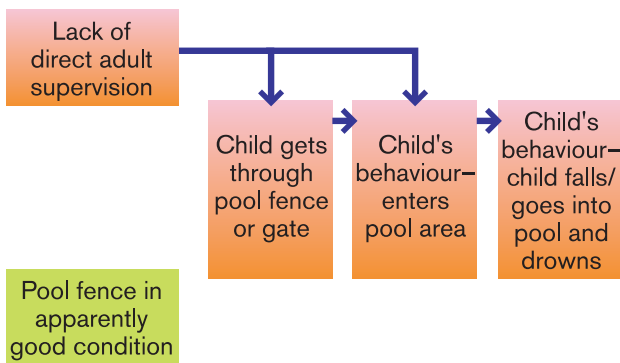
Males were involved in around half of the cases (five cases) and all were very young children of two years or less (five cases were two years and five cases were one year of age).

### 2.6.3 Pattern 3

This pattern, accounting for eight cases and again involved an apparently intact pool fence. The primary circumstances of this pattern involved an unsupervised child gaining access to the pool by breaching the pool fence either through the fence itself or through the gate (Figure 2.9). In most cases, the child was left indoors (six cases) in what was thought to be a relatively safe location, but in all cases, the child managed to get outside. All cases involve the child being able to breach the fences/gates surrounding the pool without the help of others. All of the fences were in good condition (although one was a temporary fence not to Australian Standard 1926) but in all cases children managed to climb over, crawl under the pool fence or gate, or open the pool gate themselves and in some cases used aids such as chairs, ladders or a scooter.

# Results

## Drowning in swimming pools



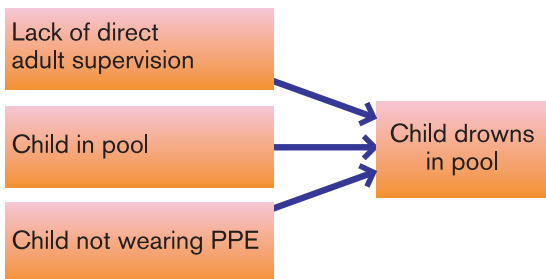
**Figure 2.9:** Typical scenario for Pattern 3–Swimming pools

Almost all of these cases were males (seven cases) and all tended to be older than seen for the previous pattern (four cases were three to five years, four cases were two years).

### 2.6.4 Pattern 4

The final pattern seen in three cases consisted of children being in the water, without direct adult supervision (Figure 2.10). In two cases children were left unsupervised, despite it being recommended to the supervisor in one of these cases to stay with the child. In the third case the child was under indirect supervision. In all three cases the child was not wearing any form of PPE.

All three cases were male and they tended to be older, as two cases were aged three to five years and one was aged two years.



**Figure 2.10:** Typical scenario for Pattern 4–Swimming pools



# Results

## Bathtub drownings

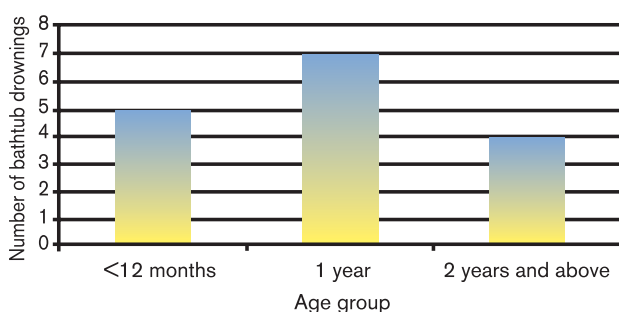
### 3 Bathtub drownings

Sixteen children drowned in bathtubs, representing 19.5% of all drownings in children aged five years and under, and making bathtubs the second most common single location for drownings in this age group.

In just over 80% (13 of 16) of cases, children were already bathing when they drowned, with the remaining three cases occurring when children climbed or fell into the bath. Events leading up to these fatalities will be examined in more detail later in this section.

#### 3.1 Age and gender

Drowning in bathtubs was most common in the one year age group (43.8%), followed by babies less than 12 months of age (31.3%) and two year olds and above (25%) (Figure 3.1).



**Figure 3.1:** Age of children drowning in bathtubs

Females accounted for 50% (8 of 16) of bathtub drownings, indicating that females, as a group, are more highly represented in bathtub drownings compared to their involvement in all drownings (32.5%).

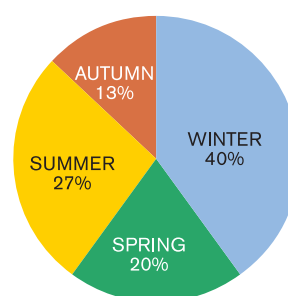
#### 3.2 Region and property type

All bathtub drownings occurred within the child's own home, and with the exception of one case, all occurred in metropolitan regions (93.8% or 15 of 16).

#### 3.3 Timing

Although small in number, there were incidences of children drowning in bathtubs in all years, and a peak was seen in 1998 when six cases were recorded. Drownings in

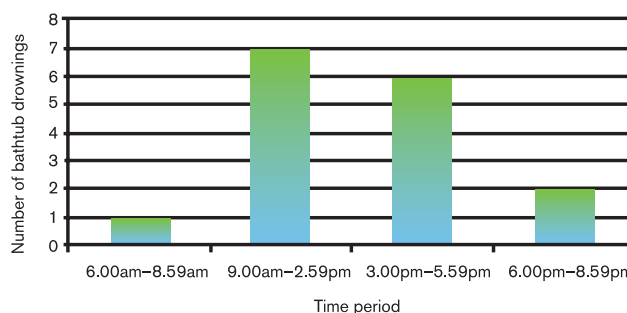
bathtubs occurred across all seasons, most notable with six occurring in Winter (Figure 3.2).



**Figure 3.2:** Proportion of bathtub drownings occurring within each season (excluding one case from 2001).

When examined by day of the week, around two thirds (68.8%) of bathtub drownings were found to occur on a weekday. However, when the average number of drownings per week day and weekend day were analysed, they were found to be approximately equal (2.2 and 2.5 respectively).

Like all drownings, the most common time of the day for bathtub drownings was during the day between 9am–3pm (seven cases) and in the afternoon between 3–6pm (6 cases) (Figure 3.3).



**Figure 3.3:** Number of swimming pool drownings occurring within each time period

#### 3.4 Contributing factors

Adult supervision and the location of children were the main factors involved in bathtub drownings, with other factors including PPE, OSE, medical conditions and common practices playing roles in a small number of cases.

# Results

## Bathtub drownings



Table 3.1 below shows the number and percentage of cases involving each factor.

	Frequency	Percentage
<b>Supervision</b>		
Indirect	1	6.3%
No adult	13	81.3%
Asleep	2	12.5%
<b>Location</b>		
In the bath	13	18.3%
<i>Left alone</i>	7	
<i>Left with another child</i>	5	
Indoors	3	18.8%
<b>Personal protective equipment</b>		
Used appropriately	2	12.5%
<b>Medical conditions</b>		
	2	12.5%
<b>Common practices</b>		
	1	6.3%

**Table 3.1:** Number and percentage of cases involving various contributing factors

### 3.4.1 Supervision and location

In around 80% of cases children were placed in the bath by their parents/carers. In the remaining three cases, children all entered the bathroom from elsewhere within the house and climbed or fell into the bath.

In all cases of bathtub drowning adult supervision played a role, with the majority of children being left without adult supervision, sometimes momentarily although in other cases for longer periods. Activities parents/carers engaged in when leaving a child unsupervised included fetching a forgotten towel or clothes, getting washing in/hanging washing out, doing the dishes, answering or making phone calls, or attending to self.

In the 13 cases in which children were left in the bath without adult supervision, seven children were left alone, five were left with other siblings, and in one case it is not known whether the child was left alone or with others.

In two cases children were sleeping with a parent/carer, with the parent/carer remaining asleep when the child woke up and got up.

### 3.4.2 Other contributing factors

Personal protective equipment, in the form of bathseats, whilst used appropriately in two cases, did not prevent children climbing or falling out of the seat and drowning in the bath. In two cases, medical conditions—in one case a condition of the supervising adult and in another case that of the child—were thought to play a role, whilst common practice factors (of leaving a child alone in the bath) was cited in one case.

### 3.5 Precursor events

Over two thirds of cases did not involve any precursor events. Where the behaviour of the child was involved, it included climbing or falling out of bathseats/frames, or going into the bathroom and climbing into the bath. When the behaviour of adults was involved (apart from supervision), it consisted of leaving water in the bath on the previous night, and making other unsafe decisions (e.g. failing to turn off the tap). The behaviour of another child, in so much as they distracted the carer, was thought to play a role in one case, whilst in two cases environmental events, such as the water temperature and blockages to water flow, played a role in leading to the fatality (Table 3.2).

# Results

## Bathtub drownings



Precursor event	Frequency	Percentage
No precursor events	11	68.8%
Child behaviour		
One	1	6.3%
Two	3	18.8%
Adult behaviour		
One	4	25.0%
Other child's behaviour		
One	1	6.3%
Environmental event		
One	2	12.5%
Combination of events		
Child + adult	3	18.8%
Child + environment	1	6.3%
Environment + adult + other child	1	6.3%

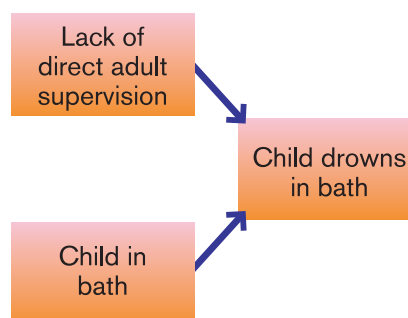
**Table 3.2:** Number and percentage of cases involving various precursor events

### 3.6 Patterns: The interaction between contributing factors and precursor events

When the interaction between contributing factors and precursor events within each case was examined across cases, two distinct patterns emerged.

#### 3.6.1: Pattern 1

The primary pattern seen in bathtub drowning, accounting for 13 of 16 cases (81.3%), was characterised by carers leaving children in the bathtub without adult supervision (Figure 3.4). In a small number of cases, other factors contributed. These included two cases in which children climbed or fell out of bathseats, and two cases in which the environment, or behaviour of others, also played a role.



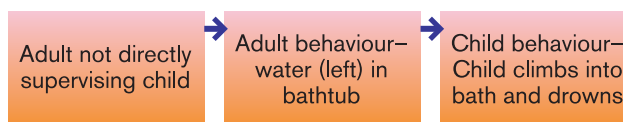
**Figure 3.4:** Typical scenario for Pattern 1–Bathtubs

Five of these children were aged one year, four were less than 12 months of age, and four were two years of age or above. Seven of the children were female.

This pattern was similar to Pattern 4 seen for drowning in swimming pools.

#### 3.6.2: Pattern 2

The remaining three cases all followed a similar pattern (Figure 3.5). Unlike Pattern 1, children in these cases were not bathing. Rather, these cases were characterised by a combination of the behaviour of the child and adults. In two cases, children were initially asleep with the carers, when they woke up and got up without waking their carer. The children proceeded to climb into the bath, and drowned in water that had been left there from the previous night. In the third case, the child was elsewhere in the house, when s/he entered the bathroom and climbed or fell into the bath where another child was bathing without adult supervision.



**Figure 3.5:** Typical scenario for Pattern 2–Bathtubs

All three children involved in cases exhibiting this pattern were males who were less than two years of age.

This pattern was most similar to Pattern 2 of drowning in swimming pools, in that the behaviour of others put the child's safety in jeopardy, and in combination with the behaviour of the child, resulted in the child's death.

# Results

## Drowning in bodies of natural water

### 4 Drowning in bodies of natural water

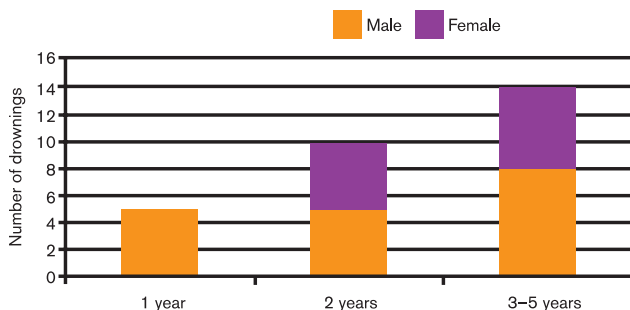
Twenty-nine children drowned in bodies of natural water, accounting for 35.4% of all drowning for this age group. Such bodies of natural water included dams (13 cases or 44.8%), lakes or rivers (12 cases or 41.4%), and beaches/lagoons and ponds (two cases each).

Most cases occurred when the child fell into, or deliberately entered, a body of water (89.7% or 26 of 29 cases), with a small number of cases occurring when the child was already in or on the water.

#### 4.1 Age and gender

Close to half of all drownings in natural bodies of water involved three to five year old children (48.3% or 14 of 29 cases) (Figure 4.1). However, it was two year old children, who were involved in 34.5% of cases of drowning in bodies of natural water, who represented the one single most vulnerable year of age for drowning in these locations. Five toddlers aged one year also drowned in bodies of natural water, although unlike the two and three to five year age groups, toddlers were significantly less likely to drown in bodies of natural water than swimming pools.

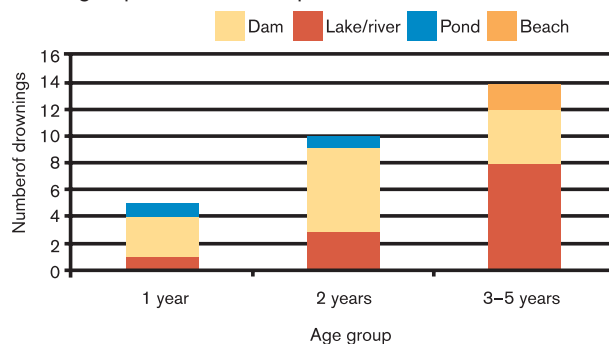
Males accounted for 62.1% of drownings in bodies of natural water (18 of 29 cases). All toddlers of aged one year who drowned in bodies of natural water were male whereas females accounted for about half the drownings for the other age groups.



**Figure 4.1:** Age group and gender of children drowning in bodies of natural water

There was some indication that drowning in different types of bodies of natural water varied with age (Figure 4.2).

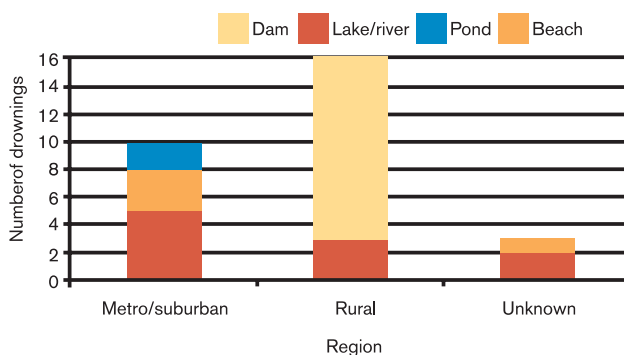
Three to five year old children most often drowned in lakes or rivers (66.7%, or 8 of 12 cases), while one and two year old children most often drowned in dams (60.0% or 3 of 5 and 6 of 10 cases, respectively). The numbers in each of these groups are however quite small.



**Figure 4.2:** Number of drownings by age group and type of body of natural water

#### 4.2 Region and property type

Where the region in which the incident occurred was known (26 cases), the majority of drownings in natural bodies of water occurred in rural areas (55.2% or 16 of 29 cases), with 34.5% (or 10 of 29) known to occur in metropolitan or suburban regions. All 13 drownings in dams were known to occur in rural regions. In contrast, more than half (7 of 12) of the drownings in lakes/rivers were known to occur in metropolitan or suburban areas (Figure 4.3).



**Figure 4.3:** Number of drownings by region and type of body of natural water

# Results

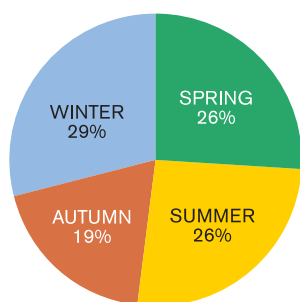
## Drowning in bodies of natural water

The majority of drownings in natural bodies of water occurred outside the environs of a home (62.1% or 18 cases). Of the 11 cases occurring within the property of a home, seven cases occurred in the child's own home environs, and four occurred at either a relatives, neighbours, or other residence the child was visiting.

### 4.3 Timing

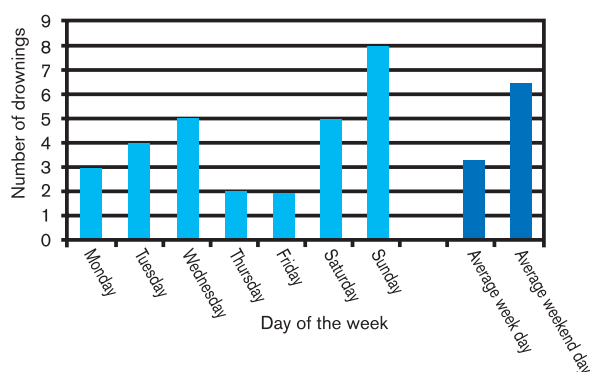
Drownings in natural bodies of water were recorded for all years, varying in number between two and seven cases each year and showing a peak in the year 2000. While the numbers for each year are small, dam drownings peaked in 1998 where they accounted for five of the six drownings occurring that year. A peak in the number of drowning in lakes and rivers was seen in 2000, accounting for 5 of 7 drownings recorded that year.

Drownings in natural bodies of water occurred in all months of the year, varying from between 1 and 4 cases per month. When examined by season, they did not show much variation with between 5 and 8 cases occurring within each season (Figure 4.4).



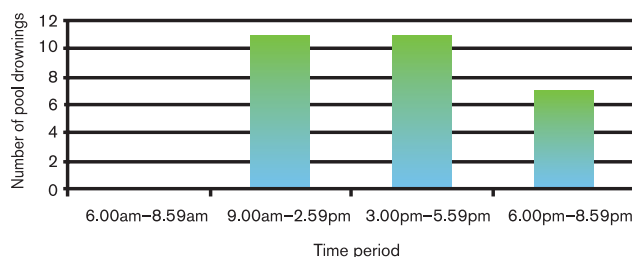
**Figure 4.4:** Proportion of drownings in bodies of natural water occurring within each season (excluding 2 cases from 2001).

Just over half (55.2%) of drownings in natural bodies of water happened during the week (Figure 4.5). When the average number occurring on weekdays and weekend days was examined however, drownings in natural bodies of water were found to occur more often on weekend days than weekdays (6.5 versus. 3.2, respectively). This was in contrast to drownings in pools and bathtubs which were, on average, fairly evenly spread across weekdays and weekend days.



**Figure 4.5:** Number of drownings in bodies of natural water by weekday and average number by type of day

Like all drownings, the majority of drownings in bodies of natural water occurred between 9am–3pm and 3pm–6pm (37.9% each or 11 of 29 cases each), with the remaining seven cases (24.1%) occurring between 6pm and 9pm (Figure 4.6).



**Figure 4.6:** Number of swimming pool drownings occurring within each time period

When examined by the hour of the day nearest to which they occurred, drownings in bodies of natural water occurred evenly across the day from 9.30am to around 7pm. A peak of six cases was seen around 6pm the evening. When types of bodies of natural water were examined separately, half of all drownings in lakes and rivers (six cases) occurred between 3.30pm–5.30pm, while close to half of all drownings in dams (six cases) occurred slightly later, between 5.30pm–6.30pm.

# Results

## Drowning in bodies of natural water

### 4.4 Contributing factors

Table 4.1 below lists the number and percentage of cases in which various factors contributed to the drowning.

	Frequency	Percentage
Supervision	15	51.7%
No adult	12	41.4%
Direct adult supervision	2	6.9%
Location		
In water	1	3.4%
Dangerous	10	34.5%
Outdoors	13	44.8%
Indoors	5	17.2%
Personal protective equipment		
Not used, should have been	3	10.3%
Other safety equipment: locks, doors, gates, fences		
Not used	2	6.9%
Breached	3	10.3%
No barrier to water source	7	24.1%
Environmental factors	3	10.3%

**Table 4.1:** Factors contributing to drownings in natural bodies of water

#### 4.4.1 Supervision

With the exception of two cases, supervision was a factor in all cases of drowning in bodies of natural water, with around half of all children being without any adult supervision, and the remainder being indirectly supervised by an adult. When left unsupervised, the child was known to be left with another child/children in eight cases, and alone in seven cases. When under indirect supervision, another child/children were present in five cases, while in seven cases the child was by themselves.

#### 4.4.2 Location

In ten cases (31.1%), children were in a dangerous location, being either on the water or near a body of water (e.g. playing on the riverbank or near a dam). There was only one case in which the child was actually in the water.

#### 4.4.3 Personal protective equipment and other forms of safety equipment

The failure to use PPE and OSE was a factor in a small number of cases, and included not wearing floaties or lifejackets when on, in, or very near to the water, and a failure to install locks on doors. Additional cases in which OSE was cited included cases in which children were able to breach barriers (e.g. by opening doors/gates or climbing through fences). In a further 24.1% of cases it was noted that there was no barrier separating the child from a source of water once outdoors (e.g. no fenced safe play area preventing access to a dam).

#### 4.4.4 Other contributing factors

Whilst the majority of cases (89.3%) did not involve any other contributing factors, the environment did play a role in three cases. Aspects of the environment seen to contribute to drownings included steep, slippery embankments on which children slipped, and factors such as weed in water or murkiness which potentially increased the time taken to locate the child.

#### 4.5 Precursor events

In all except one case, there was at least one precursor event. The majority of cases involved at least one behaviour on the child's behalf, typically slipping and falling in or deliberately going into the water. Where additional behaviours were engaged in by the child, they included actions such as letting themselves outdoors, climbing over/through or crawling under fences or gates, as well as wandering off. The three instances of adult behaviour (apart from supervision) involved unsafe decision-making in failing to attire children with PPE. Environmental events playing a role included rapid changes in weather and the behaviour of animals.

# Results

## Drowning in bodies of natural water



Precursor event	Frequency	Percentage
No precursor events	1	3.4%
Child behaviour		
One	8	27.6%
Two	13	44.8%
Three	5	17.2%
Adult behaviour		
One	3	10.3%
Environmental event		
Two	1	3.4%
Three	1	3.4%
Combination of events		
Child only	24	82.8%
Child + adult	2	6.9%
Adult + environment	1	3.4%
Environment only	1	3.4%

**Table 4.2:** Precursor events leading up to drownings in bodies of natural water.

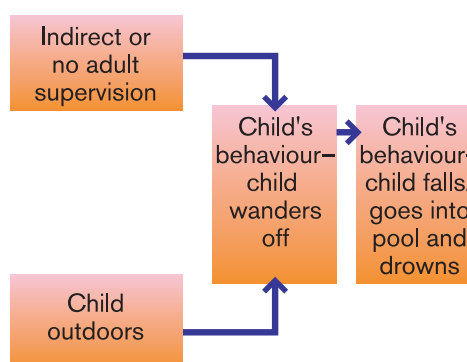
### 4.6 Patterns: The interaction between contributing factors and precursor events

When the interaction between contributing factors and precursor events within each case was examined across cases, three distinct patterns emerged.

#### Pattern 1:

This pattern accounted for 11 cases (37.9%), which were characterised by children wandering off and going/falling into the water, when they were left outdoors without direct adult supervision (Figure 4.7).

All children were outside prior to the incident, although not in immediately hazardous environments. A lack of direct adult supervision was a factor in all cases, with seven children being indirectly supervised and the remaining four being left without adult supervision. The only precursor events in all cases involved the behaviour of the child, and typically included wandering off and entering the water - either deliberately going in or accidentally falling in.



**Figure 4.7:** Typical scenario for Pattern 1: Natural water

Five of these drownings occurred in lakes/ rivers, five in dams, and one case occurred in a pond. From the coroners reports there was no evidence that the child had breached any barriers around the water source and in fact, in six of these 11 cases it was noted that there was no barrier separating the body of water from the child's location.

The children involved in this pattern tended to be slightly older as five cases each involved two year old children and three to five year old children. There were roughly equal numbers of male and female children involved with six males and five females.

This pattern appears to be different from those patterns seen within pool drownings by the ease with which children were able to access natural bodies of water, and lack of involvement of OSE, in particular, fences and gates.

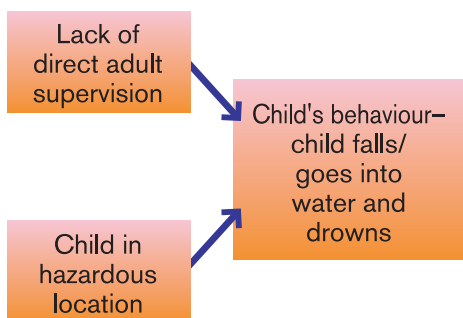
#### Pattern 2:

The second most common pattern accounted for 8 cases (27.6%), and was characterised primarily by children all being in hazardous locations very near to the water, without direct adult supervision (four cases indirect supervision, four cases left without direct adult supervision) (Figure 4.8).

The behaviour of children played a relatively small role in these cases, apart from either going into or falling into the water.

# Results

## Drowning in bodies of natural water



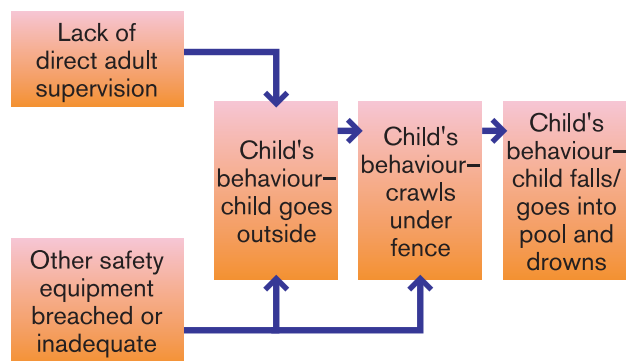
**Figure 4.8:** Typical scenario for Pattern 2: Natural water

Four cases occurred in dams, three cases occurred in lakes/ rivers, and one case occurred at the beach. Four cases involved three to five year old children, and three involved two year old children. Females were involved in five of the eight cases.

This pattern of events was the same as that seen in Pattern 4 within the patterns for swimming pool drowning.

### Pattern 3:

This pattern of drownings in natural bodies of water accounted for seven cases (24.1%). Whilst children were not located in an immediately hazardous environment (four indoors, three outdoors), they were however without direct adult supervision (four no adult supervision, three indirect supervision) (Figure 4.9). Unlike the first two Patterns described above, this pattern involved factors relating to safety equipment. Children who were indoors were able to get outdoors in four cases – in two cases there were no locks on the door, in one case the door was left unlocked by an adult, and in one case it is not clear how the child got outside. In a further three cases, whilst some form of safety equipment, such as gates and fences, was in place, children were able to climb through or crawl under them.



**Figure 4.9:** Typical scenario for Pattern 3: Natural water

Four of these cases occurred in dams, two in lakes/ rivers, and one in a pond. All cases involved male children. Three cases involved one year old toddlers, and two cases each involved two year old and three to five year old children.

This pattern most closely resembled Patterns 1 and 2 seen in swimming pool drownings.

### Other cases:

There were three cases of drowning in natural waters in which the pattern of events did not neatly fit the patterns outlined already. Two of these cases were quite similar, and different from all other cases, in that whilst children were on the water in potentially hazardous location, they were under the direct supervision of adults at the time. Environmental events played a primary role in both these cases, rather than the behaviour of the children. In one of these cases, the failure to attire the child with appropriate PPE is thought to have further contributed to the fatality.

The final case involved a child who was in the water, without personal protective equipment, under indirect adult supervision. No precursor events were noted in this case, which is most similar to swimming pool drownings showing Pattern 4.

# Discussion

This study looked at the circumstances of all drownings involving children aged 0 to five years reported to the NSW Coroner over the period January 1995 to April 2001. It therefore provides a useful series of cases for describing the wider circumstances in which these tragic accidents occur. The main purpose of such an analysis is to attempt to more fully understand the causes of these drownings and to develop better approaches to preventing them.

The characteristics of drowning identified in this case series are similar to those found in previous studies. For example, males were involved in around two thirds of all drownings, and two year old children were most highly represented. Swimming pools were the location for the majority of drownings in children aged one year and above, whilst the majority of babies less than 12 months of age drowned in bathtubs. Other bodies of natural water such as lakes/streams and dams also accounted for significant proportions of drownings in children two years and above. Consistent with previous findings on exposure, children in metropolitan and suburban areas tended to drown most often in pools followed by bathtubs, whereas in rural areas, children tended to drown most commonly in dams, followed by lakes and rivers. The majority of children also drowned as a result of falling into, or intentionally entering, a body of water.

This analysis highlighted the vulnerability of two groups in particular: one to two year old children and boys. These groups present important targets for reducing drownings in 0 to five year olds. Around half the children aged one to two years drowned in swimming pools, with around another 30% drowning in bodies of natural water. Fifty per cent of males also drowned in pools, and around one third in bodies of natural water.

These results lead inevitably to the question of why one to two year old children are so vulnerable? The most likely answer lies in the developmental stage of children in this age group. The transition from babyhood to fully functioning child is overall a gradual one in which the child's physical and mental processes develop but may progress in fits and starts. In the period between around one and a half to around two years of age corresponds to considerable developmental change

(e.g. Piaget & Inhelder, 1973). The child is becoming increasingly more mobile and curious with an emerging independence, but is still not capable of understanding the concepts of rules and risks in their behaviour.

At the age of one to two years, young children are, however, discovering new behaviours which could include how to open a door or gate, and refining their ability to imitate the behaviour of others which could include following older children into unsafe locations and jumping into the pool. As highlighted by Pearn (2002), toddlers do not perceive water as a threat, and bodies of water such as the in-ground home swimming pool are actually seen as an attractant for toddlers (ibid pg2). Aquatic programs used with toddlers cannot however ensure that young children will understand water hazards or employ safety skills when near pools (American Academy of Pediatrics, 2000). Currently, there is no strong evidence to support that teaching children of this age to swim would be a successful strategy, as it is generally not until children reach four to five years of age that development of their motor skills allows them to acquire appropriate swimming skills. As a consequence, strategies to reduce the toddler's vulnerability that focus on the child him/herself, for example, setting a rule for a two year old or telling them to stay in a secure place, are unlikely to be successful.

The second vulnerable group, boys, are also more highly represented in drownings in both swimming pools and bodies of natural water, although not bathtubs. One of the common findings in the research on injury is that males have higher risk of injury than females, although not for all types of injury (Schmertmann & Williamson, 2002). The greater involvement of males in injury is often attributed to their supposed higher propensity for risk taking compared to females (Vavrick, 1997). Whilst the behaviour of both male and female children contributed to drownings, three-quarters of cases in which males drowned involved the child engaging in two or three behaviours, compared to only about 40% of female cases. Acts such as taking oneself outside, wandering away, and crawling under or climbing over fences, reflect risky, adventurous or inquisitive behaviour, which result in the child coming into contact with water sources. The finding of this study also suggests that gender differences in such

# Discussion continued

behaviours are exhibited very early. For this vulnerable group, as for one to two year old children, the most effective prevention strategies are likely to focus on the circumstances in which the child becomes vulnerable, rather than on modifying the child's behaviour.

There were a number of factors other than the child's own behaviour that emerged from this analysis and which could be targeted more effectively when campaigning to reduce drownings in this age group. This study is one of the first of its kind to systematically assess the role that adult supervision, and the behaviour of adults and other children, in the range of factors and circumstances contributing to child drownings. The lack of direct, active adult supervision was a factor in the vast majority of cases, with around 70% of children being left without adult supervision, even if left only temporarily, and 20% being indirectly supervised. Indeed in around 16% of drownings the only factors involved were the child's location and a lack of direct supervision and in particular this pattern was seen in around two thirds of drownings in bathtubs.

According to Pearn (2002), the majority of drownings in bathtubs in infants and toddlers occur during specific "vulnerable" periods in which family routine is suddenly broken such as when someone in the family is acutely sick or marital relationships are strained. In such cases, a mother, who is already under pressure, may be attempting to bath several young children, when someone knocks at the door and she leaves an infant with one or two slightly older children who climb out of the bath and leave the infant to drown (Pearn, 2002). Whilst this study did not directly assess such vulnerability, the activities engaged in by parents when leaving children in the bath, suggest such incidences occur when a number of household chores need attending to, such as washing dishes or getting the clothes washing, or when the telephone rings. Communicating with parents the risk associated with such vulnerable and busy times and ensuring they have the support needed to cope in times of difficulty may help. Encouraging parents never to leave a child in the bath without adult supervision and not to leave infants and toddlers in the care of slightly older siblings who are not likely to understand the danger of the situation and their actions is also likely to help reduce these fatal drownings. Further,

parents and carers should be reminded that all it takes is a couple of minutes i.e. the time taken to fetch a towel or clothing and only a few centimetres of water for their child to drown.

A lack of direct adult supervision was also a factor in the vast majority of drownings in swimming pools and bodies of natural water. Whilst the majority of children were left without adult supervision, sometimes only for a brief time. A further one in five who drowned were under indirect adult supervision, showing that even this is not sufficient to prevent drowning in this age group. When a parent/carer is focused on another activity, be it talking with others, or performing work in or around the house, young children can easily wander away unnoticed. Further, when a child is in a hazardous location near a body of water, parents/carers are not likely to notice the instant when a child falls into the water and be able to react quickly enough to save them.

Unfortunately, strategies for overcoming lapses in supervision are difficult. Clearly, simply telling supervisors to be more careful and active in their supervision is not the answer and may be an unreasonable expectation of carers/parents who cannot be with the child for every minute of the day. Rather, this study has suggested some specific characteristics of drowning in young children which point to the most vulnerable ages and stages of childhood and the circumstances and periods to which carers could be especially alert to water hazards. For example, male children between one and two years of age were shown to be most vulnerable and whilst drowning occurred throughout the day, peaks were observed in the afternoon between around 3.30 and 6.30pm.

Apart from supervision, the behaviour of adults and other children played a role in one third of swimming pool drownings, one quarter of bathtub drownings and around 10% of drownings in bodies of natural water. Such behaviours included leaving doors and gates open or unlocked, and leaving water in the bath. These errors may be due to underestimating the risk involved, lapses in memory or temporarily not paying attention to such aspects of the child's safety. It is clear that absent-minded and lapse types of errors are very common in everyday life (Reason, 1990) and they also appear as a factor in these drowning cases.

# Discussion continued

Unfortunately, these types of errors are difficult to overcome. On the other hand, behaviour due to poor judgment or hazard awareness on the part of the adult about the riskiness of leaving a child in a potentially vulnerable place in the vicinity of water hazards may be moderated by programmes that provide better education and awareness on childhood drowning risks.

Another factor emerging from this analysis, in line with previous research, related to barriers designed to ensure the safety of children. Such barriers most notable included pool gates and fences, as well as doors from the home and other fences and gates within or surrounding the home or property. For drowning in swimming pools, factors relating to fencing and gates, including an absence of fencing, inappropriate usage of gates, a general state of disrepair, or faulty design, played a role in around half the cases. As highlighted by Pitt and Cass (2001), compliance with gate closure is a major limiting factor in the effectiveness of gates to prevent drownings, a finding replicated in this study. As in previous research focusing on pool fences and gates, the use of self-closing and self-latching gates and pool alarms are advocated (NSW Child Death Review Team, 2001; Pearn, 2002). The legislation of isolation fencing together with regular inspections has proved effective in one study in reducing the fatality rate of home pool drownings (Pearn, 2002) and is also advocated. In addition, educating adults about how actions such as leaving a gate open and not taking swift action when faults are noticed can compromise the safety of young children, is also recommended.

This study also found that a number of pool fences thought to be in good condition were able to be breached by children, who either crawled under or climbed over pool fences, in some case using aids such as chairs. Whilst previous commentary in this area has not focused on children's ability to climb over pool gates and fences, as "few children climb a pool fence and drown" (Pitt & Cass, 2001), the present findings show that this does occur. Previous research examining the climbing ability of young children has shown that children are able to climb fences quite rapidly, with their success varying according to the type of fence, (Rabinovich, Lerner & Heuy, 1994). Analysis of such cases in future would benefit from more comprehensive data collection regarding

the features of fencing and compliance of fences/gates with Australian Standards 1926. There was insufficient data on the extent of compliance with Australian Standard 1926 of fences in the Coroner's data available for this study. More stringent data collection regarding features of fences and gates has been adopted in Queensland and is currently being employed in a study of near drowning at the Children's Hospital at Westmead (Pitt & Cass, 2001). In addition, the Monash University National Centre for Coronial Information (MUNCCI) is currently trialling a new police notification form of death which includes specific information relevant to drowning deaths, such as features of swimming pool fencing.

Other forms of safety equipment, such as doors from homes, locks on doors, and gates or fences to neighbouring properties or bushland, were breached in a number of cases of drownings in pools and bodies of natural water found near the home. Ensuring such equipment is in place, functional and used appropriately is also necessary to ensure the safety of young children. Whilst currently not legislated for, barriers preventing children from accessing dams and other bodies of natural water, particularly in rural areas, either in the form of fencing around homes or fences separating children's play areas from sources of water, also need to be addressed.

Overall this study showed that all of the causal patterns leading to drowning in 0 to five year olds involved little or no adult supervision as one of the primary causal factors. Other factors also played a role, but involved considerably fewer cases and depended on the type of water hazard. For swimming pools and to a lesser extent for natural water sources, the role of barriers between the child and the water were important. Many drownings occurred in situations where there was no safety barrier between the child and the water hazard. It should be noted, however, that a significant proportion of pool drownings occurred however when the child breached the barrier. The patterns of bathtub drowning were different from those occurring in pools or natural water. Like drowning in all other situations they always involved lack of adult supervision, but they typically involved no barriers and a young child who was already in the water or who had ready access to water.

# Recommendations




The results of this case investigation of the causal factors of drowning in 0 to five year olds suggest a number of recommendations for strategies to reduce the numbers of under 0 to five year old children drowning. The most likely to produce the greatest impacts include:

- 1** Providing information and guidance to adult supervisors and carers of small children on the potential risks involved in the different types of water sources. Information should be provided on the risks of leaving young children unattended while they are exposed to sources of water, especially baths.
- 2** In particular adult carers should be alerted to the differences in vulnerability at the developmental stages of the child, between the ages of one and two years and the higher risk of drowning for male children. Information should also be provided on the higher vulnerability at different times of the day, such as the late afternoon and during times when adult carers are busy.
- 3** Efforts should be made to reduce access to bodies of water and to ensure that the barriers are adequate for the age and stage of the child. It is also essential that efforts are directed towards ensuring that the barriers installed to reduce access to water hazards are maintained so that they continue to function adequately. In particular, greater effort need to be directed towards encouraging isolation fencing for private swimming pools and their ongoing and regular inspection and maintenance.
- 4** Attention should be directed to developing methods for alerting parents if the child comes into close or direct contact with water hazards especially in pools and natural bodies of water.



# References

- 
- American Academy of Pediatrics (2000).** *Swimming programs for infants and toddlers. Pediatrics*, 105 (4), 868–870.
- Feyer, A-M., & Williamson, A.M. (1991).** *A classification system of the causes of occupational accidents for use in preventive strategies. Scandinavian Journal of Work Environment and Health*, 17, 302–311.
- IRMRC (2000).** *Analysis of drowning in Australia and pilot analysis of near-drowning in New South Wales. NSW Injury Risk Management Research Centre, for the Australian Water Safety Council.*
- Mackie, I.J. (1999).** *Patterns of drowning in Australia, 1992–1997 Medical Journal of Australia(MJA)*, 171, 587–590.
- Pearn, J. (2002).** "Prevention of drowning in the home, garden and environment" From [www.drowning.nl](http://www.drowning.nl) World Congress on Drowning, downloaded March 2002.
- Piaget, J. & Inhelder, B. (1973).** *The psychology of the child. London, Routledge & Kegan Paul*, 1–173.
- Pitt, W.R., & Cass, D.T. (2001).** *Preventing children drowning in Australia. Medical Journal of Australia*, 175, 603–604.
- Rabinovich, B.A., Lerner, N.D., & Huey, R.W. (1994).** *Young children's ability to climb fences. Human Factors*, 1994, 36 (4), 733–744.
- Reason, J. (1990).** *Human error. London: Cambridge University Press.*
- Schmertmann, M., & Williamson, A.M. (2002).** *NSW Injury Profile: A review of injury data from 1995–1999. NSW Injury Risk Management Research Centre, UNSW, Sydney.*
- Svanstrom, L.** *Evidence-based Injury prevention and Safety Promotion. State-of-the-art. In Injury prevention and Control. Eds D. Moham, G. Tiwari, London, Taylor & Francis, 2000. Chap 14: 181–198.*
- SWSAHS (2000).** *Drowning: Toddler drowning in backyard swimming pools. www.swsahs.nsw.gov.au/livtrauma/public/injprevent/drowning.asp. Downloaded 12 February 2002.*
- Vavrick, J. (1997).** *Personality and risk-taking: A brief report on adolescent male drivers. Journal of Adolescence*, 20, 461–465.
- Williamson, A.M., & Feyer, A-M. (1990).** *Behavioural epidemiology as a tool for accident research. Journal of Occupational Accidents*, 12, 207–222.
- World Congress on Drowning (2002).** [www.drowning.nl](http://www.drowning.nl) – Task Force Prevention (outline)

**Prepared by**  
**NSW Water Safety Taskforce 2002**



**Members of the NSW Water Safety Taskforce**

Australian Professional Ocean Lifeguard Association

Austswim NSW

Community Relations Commission

Farmsafe NSW

Kellogg Australia

Municipal Employees Union

NSW Department of Education and Training

NSW Department of Health

NSW Department of Local Government

NSW Department of Sport and Recreation

NSW Fisheries

NSW Local Government and Shires Association

Premier's Department

Surf Life Saving NSW

The Royal Life Saving Society Australia (NSW Branch)

Waterways Authority