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REVIEW ARTICLE

Infant and toddler drowning in Australia: Patterns, risk factors and prevention recommendations

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Abstract: Drowning is a leading cause of death among infants and toddlers. Unique physiological and behavioural factors contribute to high mortality rates. Drowning incidents predominantly occur during warmer months and holidays. Recent studies link high socio-economic status and drowning, in contrast to earlier studies. Cardiac arrhythmias, epilepsy and autism are strong risk factors for drowning incidents. Prevention strategies have substantially lowered drowning rates. While legislation-compliant pool fencing substantially reduces drowning risk, compliance levels are low, and penalties are minor. Active supervision education for parents and carers is an effective drowning prevention strategy. Bystanders provide basic life support in only 30% of cases; strategies to increase training uptake are needed. Fencing costs should be a mandatory inclusion for pool installations, with high penalties for non-compliance. Basic life support training should be compulsory for pool owners, and tax incentives should be used as a lever to increase training uptake.

Key words: community; education.

Drowning is defined as submersion or immersion in liquid that results in respiratory failure.¹ This includes both fatal and non-fatal outcomes. Previously, the term *drowning* was used to describe a fatal outcome, whereas *near drowning* was used to describe a non-fatal outcome. Drowning is a leading cause of death among infants and toddlers aged 0–4 years in Australia.^{2–5} Although prevention efforts have contributed to a significant reduction in drowning deaths over the past decade,^{6,7} mortality rates in the 0–4 age group remain high.^{5,8} In this paper, we will focus on drowning incidents in infants and toddlers 0–4 years of age in Australia and review drowning death patterns and risk

factors. Successful prevention strategies will be reviewed, and we will provide suggestions for future prevention efforts.

Where possible, data specific to the 0–4 age group will be used and will be described with the terms infants and toddlers. The term child will be used when an age range has not been clearly stated.

Patterns of Drowning

Patterns of drowning vary according to age, gender, cultural background and geographic location.¹ Infants are most likely to drown in bathtubs, yet toddlers are most likely to over-balance and fall into buckets of water or other bodies of water around the home.^{9,10} In Australia, non-Indigenous children are most likely to drown in domestic swimming pools, whereas Indigenous children are most likely to drown in open waterways.¹¹ Private swimming pools are the site of most drowning fatalities, at more than 4.5 times the rate of other locations.¹² Public pools and natural fresh water sites, including rivers, lakes and floodwaters, are other common locations for child drowning.⁹

Outcomes of Child Drowning

The Royal Life Saving National Drowning Report (2014) identified 20 infants and toddlers aged 0–4 years who drowned between July 2013 and June 2014.¹² Nationally, the drowning mortality rate for infants and toddlers 0–4 years is 50% higher than for the 5–9 age group and 130% higher than for young people aged 10–14 years.¹³ Although it is difficult to accurately estimate the rate of drowning morbidity in Australia,¹⁴ it has been reported that for each drowning death four children are hospitalised,¹⁵ and 5–10% of all drowning episodes will result in

Key Points

- 1 Drowning is a leading cause of death among infants and toddlers.
- 2 Basic life support training among pool owners and parents needs to increase as only 30% of childhood drowning victims are provided basic life support (i.e. cardiopulmonary resuscitation) by bystanders.
- 3 Although pool fencing is one of the most effective prevention strategies, penalties for non-compliance are minimal; mandatory inclusion of fencing costs for all pool installations is recommended.

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some degree of neurological impairment.^{1,14,16} Drowning outcomes are generally better in icy water due to the protective effect of rapid hypothermia on brain function.¹⁶ Poorer outcomes are observed in open water settings compared with backyard locations, possibly due to the increased complexity of retrieval in open water settings.^{1,17}

Risk Factors

Age and gender have been extensively examined in relation to child drowning risk. Infants and toddlers aged 0–4 years are the most vulnerable group, particularly in the first and second years of life.^{3,6} At this age, they become more mobile and are inherently curious.¹⁴ They also demonstrate limited insight into potential dangers and have little or no capacity to care for themselves.^{3,13} Physiological characteristics that increase their risk include a higher centre of gravity, weak musculature and underdeveloped balance and co-ordination systems.¹⁰ The drowning mortality rate of males 0–4 years is 70% higher than that of females,¹⁸ which has been attributed to the exploratory characteristics of the male gender.³ The only exception to this is for bathtub drowning, where the rates are higher for females,¹⁹ yet no explanation for this has been investigated in the literature.¹⁹

Whether socio-economic status is a risk factor for drowning in children remains contentious.²⁰ Anecdotal evidence suggests that children from affluent families and those living in cities with high swimming pool to population ratios are at particular risk.^{20,21} Conversely, earlier studies report that children from low-income families are 4.1 times more likely to die from a drowning incident.²² Low paternal income and low maternal education attainment is correlated with decreased awareness of water safety issues and higher rates of child drowning.²³ Several reports also suggest that children of younger mothers (under 25) are less likely to drown than children of mothers over the age of 30.^{20,24} Older mothers are more likely to have several children and competing demands, which may compromise their ability to actively supervise.^{20,24}

Cultural background has been investigated as a risk factor for child drowning.^{19,20} Although some reports document higher rates of drowning mortality in Indigenous children,²⁵ others contradict this, citing more child deaths in the non-Indigenous population.^{4,11} A higher rate of domestic pool ownership by non-Indigenous families has been identified as a contributing factor.¹¹ Children born to migrant families and those holidaying from overseas are also overrepresented in the drowning data, with one-fourth of child drowning events occurring in families with parents not born in Australia.²⁰ Some suggest this is due to a lack of knowledge regarding environmental hazards and larger-than-average family sizes common in some cultures, which may result in inadequate supervision of children near water.²⁰

Temporal and geographic factors are also associated with drowning.¹ The risk of drowning is higher in hot climate regions, including the Northern Territory and Queensland, where drowning death rates per 100 000 population are the highest in Australia.^{4,11} Almost two-thirds of drowning incidents occur in the warmer months (November to March) and are more common on weekends and during holiday periods when there is higher involvement in aquatic activities.¹⁶ Risk is also increased between the hours of 4–6 pm when pool access is heightened

and when parental supervision may be comprised during meal preparation.⁵

Certain health conditions are strongly linked with drowning risk.^{10,16,21} Increased exertion during water activity can cause arrhythmias and a loss of consciousness in children with cardiac disorders.^{1,26} Reports also suggest that drowning is the most common cause of injury-related mortality in people with epilepsy.²⁷ Seizures often involve a loss of consciousness and muscle control, and children can disappear underwater quickly and silently during the tonic phase of a seizure.²⁸ An examination of drowning fatalities in the Brisbane Drowning Survey found that 5.4% of child drowning cases occurred as the result of seizure activity,²⁹ whilst another retrospective study reported that children with epilepsy are 7.5 times more likely to suffer a drowning incident.²⁸ Developmental disorders have also been associated with drowning in children.³⁰ Although there has been little research into this association, several studies identify drowning as a leading cause of death in toddlers aged 2–5 years who have autism³¹; this is likely a result of cognitive and communication deficits and increased seizure activity in this population.³¹

Overview of Prevention Measures

Current research focuses on four prevention measures to address drowning incidents in infants and toddlers aged 0–4 years. These are (i) fencing domestic pools in accordance with guidelines and legislation; (ii) active 'adult supervision'; (iii) swimming and water safety education and (iv) the immediate delivery of basic life support from bystanders.^{32,33} The success of drowning prevention efforts requires a multifaceted approach and can be discussed in relation to three Es of injury prevention: engineering, enforcement and education.⁹ Engineering addresses physical environmental factors; enforcement involves policies, legislation and penalties to prevent injury; and education includes increasing knowledge and awareness to achieve behaviour change.³⁴

Fencing of domestic pools

Pool fencing is a universally recommended drowning prevention measure with the intent of physically restricting access to water.³⁴ Australian Standard (AS 1926.1) requires pool fences to be a minimum height of 1.2 m with, a maximum of 10-cm gaps between vertical elements and minimum of 90-cm gaps between horizontal elements, with a self-closing and self-latching gate.^{3,5,13,34} Although it is well known that pool fencing can prevent approximately three-fourth of all child-related pool drownings,¹⁵ a Queensland report indicated that 87% of pools where children drowned did not comply with fencing legislation.¹⁵ Analysis of drowning incidents reveals that no child drowning deaths occurred where compliant four-sided pool fencing was present.^{2,29}

Guidelines for pool fencing differ from state to state, particularly with regard to three- versus four-sided pool fencing.^{2,13,19} Three-sided fencing enables access to the pool from the residence, whilst four-sided fencing isolates the pool from existing structures on the property.⁵ A 2010 systematic review of pool fencing research concluded that four-sided isolation pool fencing is

superior to three-sided perimeter fencing¹⁵; however, to date, four-sided fencing has only been enforced in three of the seven Australian states and territories (Queensland, Western Australia and the Northern Territory).²

Enforcement of pool fencing legislation is estimated to have reduced child drowning deaths by 30%.³⁵ Although all Australian states now enforce pool fencing regulations, compliance with the legislation continues to be a challenge.³⁶ Requirements and provisions in the legislation differ according to location,¹³ which results in difficulty interpreting and enforcing the legislation.¹ Currently, a breach of the legislation attracts a maximum penalty of \$500; however, inadequate rates of domestic pool inspections by local councils, coupled with inconsistent enforcement of the legislation, have resulted in poor overall compliance.^{3,36}

Education can be used to increase adherence with pool fencing legislation and should occur in parallel with increased efforts in legislation enforcement.³³ Local councils and pool fencing installation companies provide brochures and verbal education regarding pool fencing to consumers,³⁷ but more needs to be done at a population level, specifically related to public media campaigns to reinforce the pool fencing message.³⁷ These campaigns should clearly articulate the responsibility borne by pool owners, the potential consequences of non-compliant fencing and the alarming fact that the majority of child drowning occur in pools with non-compliant fencing.

Active adult supervision

Active adult supervision requires attention, proximity and continuity.³⁸ Inadequate supervision can result from momentary lapses in supervision when reading, eating and talking on the phone.¹ The use of alcohol or drugs by an adult also affects supervision, causing impaired judgment and delayed reaction times.^{26,39} Absent or inadequate adult supervision is the most common factor in infant and toddler drowning.¹⁶ This includes situations where children have gained access to a pool (either with or without compliant fencing) without the knowledge of a care giver. Analysis of unintentional child drowning deaths between 2002 and 2009 indicate that inadequate supervision was a significant contributing factor in 71.7% of deaths and a suspected contributing factor in an additional 17.1% of cases.¹⁴ The literature often refers to supervision in terms of 'adult supervision', and several studies note the presence of an older sibling in cases of drowning.¹⁴ The consensus among drowning experts is that the presence of an older sibling is inadequate as their ability to supervise a child is open to interpretation.²⁰

Educating adults involved in the care of children about supervision is a necessary step in drowning prevention.³³ Although there is a lack of statistical evidence evaluating the effectiveness of supervision education,⁴⁰ one study evaluated a parent education programme addressing toddler safety issues. This study showed that parent education programmes run concurrently with swimming and water safety lessons improved parental awareness of adult supervision as a critical component of toddler drowning prevention.⁴¹ There is also support in the literature for key health professionals to discuss the risks of child drowning as part of routine child safety education.⁴²

Swimming and water safety education

Swimming and water safety education initiatives are associated with an overall lower risk of drowning and improved drowning outcomes in toddlers aged 2–4 years.³⁴ Several Australian population-based initiatives address child safety around water. These include Laurie Lawrence's 'Kids Alive do the Five' programme; the Royal Life Saving Society Australia (RLSSA) 'Keep Watch' and 'Swim and Survive' programmes; Surf Life Saving Australia's 'Beach to Bush' programme, targeting rural residents with beach access; and Farm Safe Australia's 'Safe Play Areas' initiative, addressing child drowning in dams.⁴³ Whilst these programmes have received widespread support and media coverage, the impact on child drowning death figures thus far has been limited.⁴⁴ Community-based programmes that cover water awareness education, swimming techniques, water and deck behaviour, rescue and resuscitation have been associated with significant reductions in drowning risk for children.^{32,45} However, others have argued that swimming programmes for infants and toddlers 0–2 years are unlikely to be protective as children of this age do not have the necessary cognitive or motor skills required for water survival.³⁴

The RLSSA has developed the Guidelines for Safe Pool Operation (GSPO).^{46,47} Whilst the guidelines are not enforced, they do provide managers with a set of standards for the best practice operation of public pools and aquatic facilities.³² Elements outlined in the guidelines include general operations, technical operations, first aid requirements, facility design, supervision requirements, information regarding low patronage pools and aquatic programmes offered.^{46,47} To monitor and increase compliance with the GSPO and other legislative requirements, the RLSSA can provide independent Aquatic Facility Safety Assessments (AFSAs). Between 2010 and 2011, 186 AFSAs were conducted nationally. Although good compliance was noted overall, 16% of facilities did not meet supervision requirements.³²

Basic life support from bystanders

Immediate basic life support (BLS) from bystanders is associated with significantly better outcomes and improved prognosis following a drowning incident.^{9,16} To maximise BLS effectiveness, adequate ventilation and chest compressions should be administered within 4–5 min of breathing interruption (obviously immediately whenever possible).^{7,33} An Australian study conducted in 2008 identified that of eight children involved in a drowning incident, the four children who received BLS within 5 min of immersion survived with no neurological deficits. In the remaining four cases, where the child was unaccounted for greater than 5 min, BLS was attempted in only one case, and all four children subsequently died.⁷ While the poor outcomes in the latter group could be attributed to either lack of BLS or long immersion time, there is no doubt that early BLS contributes to positive outcomes. Child survival rates increase by 30% if they are attended to immediately by a bystander trained in resuscitation.⁴⁸ Given this evidence, it is alarming that only 30% of child drowning victims receive BLS following a drowning incident.⁴⁹ Although there have been calls for all pool owners to be trained in BLS, this has yet to be enforced.^{14,33} Whilst individuals generally have a positive attitude towards learning BLS, they often feel hesitant and ill-equipped to perform resuscitation even after receiving education.⁵⁰

Recommendations for Future Action

Reducing drowning deaths in infants and toddlers aged 0–4 is a key priority of the Australian Water Safety Strategy.³² Whilst there is ample evidence to support the efficacy of the aforementioned interventions in the prevention of drowning, several recommendations for future action have been highlighted in the literature. It is recommended that government financial assistance schemes be provided and pool fencing costs be included in the total cost of pool installation to address compliance issues.⁵¹ More public awareness campaigns that specifically address pool fence legislation, coupled with higher penalties, are required to change behaviours.⁸ Compulsory BLS competency is recommended for all domestic pool owners and for parents of infants and toddlers 0–4.^{3,32,48} Government funding for BLS education programmes or tax benefits for parents and carers who participate are also recommended to overcome barriers to participation.⁷ Finally, parent education addressing the importance of supervision in drowning prevention must be provided to parents of all children by health-care providers at regular points of care.⁴²

Multiple Choice Questions

- 1 Child survival rates after a drowning incident increase by 30% if a bystander trained in resuscitation attends to them immediately. In what percentage of cases is basic life support provided?
- 15%
 - 30%
 - 60%
 - 85%
 - 95%

Answer: b

Unfortunately, only 30% of childhood drowning victims receive basic life support from a bystander.

- 2 Four-sided pool fencing that isolates the pool from existing structures on the property is superior to three-sided fencing where the pool is accessible from the residence. Which Australian states require four-sided fencing?
- Victoria and New South Wales
 - Western Australia and South Australia
 - Northern Territory only
 - Queensland, Western Australia and the Northern Territory
 - All Australian states

Answer: d

Only Queensland, Western Australia and the Northern Territory require four-sided fencing.

- 3 The drowning mortality rate of males 0–4 years is 70% higher than that of females. In which setting is this gender bias reversed?
- Farm settings
 - Open water environments
 - Bathtub
 - Swimming pool
 - Around the home

Answer: c

More females than males in the 0–4 age bracket drown in the bathtub. It is unknown why this is the case.

References

- Weiss J. Technical report – prevention of drowning. *Pediatrics* 2010; **126**: 253–62.
- Barker R, Spinks D, Hockey R, Pitt R. *Pool Fencing Legislation in Australia in 2003: The Way Forward*. Brisbane: Queensland Injury Surveillance Unit, 2003.
- Blum C, Shield J. Toddler drowning in domestic swimming pools. *Inj. Prev.* 2000; **6**: 288–90.
- Edmond KM, Attia JR, Deste CA, Condon JT. Drowning and near-drowning in Northern Territory children. *Med. J. Aust.* 2001; **175**: 605–8.
- Stevenson MR, Rimajova M, Edgecombe D, Vickery K. Childhood drowning: Barriers surrounding private swimming pools. *Pediatrics* 2003; **111**: e115–9.
- Franklin RC, Scarr JP, Pearn JH. Reducing drowning deaths: The continued challenge of immersion fatalities in Australia. *Med. J. Aust.* 2010; **192**: 123–6.
- Marchant J, Cheng NG, Lam LT *et al.* Bystander basic life support: An important link in the chain of survival for children suffering a drowning or near-drowning episode. *Med. J. Aust.* 2008; **188**: 484–5.
- Bugeja L, Franklin R. Drowning deaths of zero- to five-year-old children in Victorian dams, 1989–2001. *Aust. J. Rural Health* 2005; **13**: 300–8.
- Brenner RA. Childhood drowning is a global concern. *BMJ* 2002; **324**: 1049–50.
- Byard RW, Lipsett J. Drowning deaths in toddlers and preambulatory children in South Australia. *Am. J. Forensic Med. Pathol.* 1999; **20**: 328–32.
- Silva DT, Ruben AR, Wronski I, Stronach P, Woods M. Excessive rates of childhood mortality in the Northern Territory, 1985–94. *J. Paediatr. Child Health* 1998; **34**: 63–8.
- Royal Life Saving Society of Australia. *Royal Life Saving National Drowning Report*. Sydney: The Society, 2014.
- Scott I. Prevention of drowning in home pools – lessons from Australia. *Inj. Control Saf. Promot.* 2003; **10**: 227–36.
- Ross FI, Elliott EJ, Lam LT, Cass DT. Children under 5 years presenting to paediatricians with near-drowning. *J. Paediatr. Child Health* 2003; **39**: 446–50.
- Thompson DC, Rivara F. Pool fencing for preventing drowning of children. *Cochrane Database Syst. Rev.* 1998; **1**: CD001047.
- Salomez F, Vincent JL. Drowning: A review of epidemiology, pathophysiology, treatment and prevention. *Resuscitation* 2004; **63**: 261–8.
- Nixon J, Pearn J, Wilkey I, Corcoran A. Fifteen years of child drowning – a 1967–1981 analysis of all fatal cases from The Brisbane Drowning Study and an 11 year study of consecutive near-drowning cases. *Accid. Anal. Prev.* 1986; **18**: 199–203.
- Australian Bureau of Statistics. *Mortality and Morbidity: Accidental Drowning*. Canberra: Australian Bureau of Statistics, 2000.
- Mackie IJ. Patterns of drowning in Australia, 1992–1997. *Med. J. Aust.* 1999; **171**: 587–90.
- Pearn J. Why children drown. *Aust. Paediatr. J.* 1986; **22**: 161–4.
- Grenfell R. Drowning management and prevention. *Aust. Fam. Physician* 2003; **32**: 990–3.
- Nersesian WS, Petit MR, Shaper R, Lemieux D, Naor E. Childhood death and poverty: A study of all childhood deaths in Maine, 1976 to 1980. *Pediatrics* 1985; **75**: 41–50.
- Kim MH, Subramanian SV, Kawachi I, LKim CY. Association between childhood fatal injuries and socioeconomic position at individual and

- area levels: A multilevel study. *J. Epidemiol. Community Health* 2007; **61**: 135–40.
- 24 Davoudi-Kiakalayeh A, Mohammadi R, Yousefzade-Chabok S. Maternal beliefs and socioeconomic correlated factors on child mortality from drowning in Caspian Sea coastline. *Bull. Emerg. Trauma* 2014; **2**: 86–91.
 - 25 Möller H, Falster K, Ivers R, Jorm L. Inequalities in unintentional injuries between indigenous and non-indigenous children: A systematic review. *Inj. Prev.* 2015; **21**: e144–52.
 - 26 Quan L, Pilkey D, Gomez A, Bennett E. Analysis of paediatric drowning deaths in Washington State using the child death review (CDR) for surveillance: What CDR does and does not tell us about lethal drowning injury. *Inj. Prev.* 2011; **17** (Suppl. 1): i28–33.
 - 27 Spitz MC. Injuries and death as a consequence of seizures in people with epilepsy. *Epilepsia* 1998; **39**: 904–7.
 - 28 Kemp AM, Sibert JR. Epilepsy in children and the risk of drowning. *Arch. Dis. Child.* 1993; **68**: 684–5.
 - 29 Pearn JM. Epilepsy and drowning in childhood. *Br. Med. J.* 1977; **1**: 1510–1.
 - 30 Brenner RA. Prevention of drowning in infants, children, and adolescents. *Pediatrics* 2003; **112**: 440–5.
 - 31 Somers GR, Chiasson DA, Smith CR. Pediatric drowning: A 20-year review of autopsied cases: II. Pathologic features. *Am. J. Forensic Med. Pathol.* 2006; **27**: 20–4.
 - 32 Australian Water Safety Council. *Australian Water Safety Strategy 2012–15*. Sydney: Australian Water Safety Council, 2012.
 - 33 Bugeja L, Franklin RC. An analysis of stratagems to reduce drowning deaths of young children in private swimming pools and spas in Victoria, Australia. *Int. J. Inj. Contr. Saf. Promot.* 2013; **20**: 282–94.
 - 34 Wallis BA, Watt K, Franklin RC, Taylor M, Nixon JW, Kimble RM. Interventions associated with drowning prevention in children and adolescents: Systematic literature review. *Inj. Prev.* 2015; **21**: 195–204.
 - 35 Pearn JH, Nixon JW, Franklin RC, Wallis B. Safety legislation, public health policy and drowning prevention. *Int. J. Inj. Contr. Saf. Promot.* 2008; **15**: 122–3.
 - 36 van Weerdenburg K, Mitchell R, Wallner F. Backyard swimming pool safety inspections: A comparison of management approaches and compliance levels in three local government areas in NSW. *Health Promot. J. Austr.* 2006; **17**: 37–42.
 - 37 Mitchell R, Haddrill K. Swimming pool fencing in New South Wales: Who is checking compliance? *Health Promot. J. Austr.* 2004; **15**: 68–72.
 - 38 Saluja G, Brenner R, Morrongiello BA, Haynie D, Rivera M, Cheng TL. The role of supervision in child injury risk: Definition, conceptual and measurement issues. *Inj. Control Saf. Promot.* 2004; **11**: 17–22.
 - 39 Feldman KW, Monastersky C, Feldman GK. When is childhood drowning neglect? *Child Abuse Negl.* 1993; **17**: 329–36.
 - 40 Morrongiello BA, House K. Measuring parent attributes and supervision behaviors relevant to child injury risk: Examining the usefulness of questionnaire measures. *Inj. Prev.* 2004; **10**: 114–8.
 - 41 Moran K, Stanley T. Toddler drowning prevention: Teaching parents about water safety in conjunction with their child's in-water lessons. *Int. J. Inj. Contr. Saf. Promot.* 2006; **13**: 254–6.
 - 42 Simon HK, Tamura T, Colton K. Reported level of supervision of young children while in the bathtub. *Ambul. Pediatr.* 2003; **3**: 106–8.
 - 43 Australian Government Department of Health. *Water and Snow Safety. Funding, Programs and Support*. Canberra: The Department, 2013.
 - 44 Lynch TJ. Swimming and water safety: Reaching all children in Australian primary schools. *Int. J. Aquat. Res. Educ.* 2012; **6**: 267–78.
 - 45 Brenner RA, Taneja GS, Haynie DL *et al.* Association between swimming lessons and drowning in childhood: A case-control study. *Arch. Pediatr. Adolesc. Med.* 2009; **163**: 203–10.
 - 46 Royal Life Saving Society of Australia. *Guidelines for Safe Pool Operation*. Sydney: The Society, 2007.
 - 47 Royal Life Saving Society of Australia. *Guidelines for Safe Aquatic Venues*. Sydney: The Society, 2007.
 - 48 Girasek DC. Evaluation of a brief intervention designed to increase CPR training among pregnant pool owners. *Health Educ. Res.* 2011; **26**: 689–97.
 - 49 Meyer RJ, Theodorou AA, Berg RA. Childhood drowning. *Pediatr. Rev.* 2006; **27**: 163–8.
 - 50 Larsen P, Pearson J, Galletly D. Knowledge and attitudes towards cardiopulmonary resuscitation in the community. *N. Z. Med. J.* 2004; **117**: U870.
 - 51 Fisher KJ, Balanda KP. Caregiver factors and pool fencing: An exploratory analysis. *Inj. Prev.* 1997; **3**: 257–61.