Swimming pool immersion accidents: an analysis from the Brisbane Drowning Study

John H Pearn, James Nixon

Abstract
An analysis of a consecutive series of 66 swimming pool immersion accidents is presented; 74% of these occurred in inground swimming pools. The estimated accident rate per pool is five times greater for in-ground pools compared with above-ground pools, where pools are inadequately fenced. Backyard swimming pools account for 74% of pool accidents. Motel and caravan park pools account for 9% of childhood immersion accidents, but the survival rate (17%) is very low. Fifty per cent of pool accidents occur in the family's own backyard pool, and 13.6% in a neighbour's pool; in the latter the survival rate is low at only 33%. In only one of the 66 cases was there an adequate safety fence; in 76% of cases there was no fence or barrier whatsoever. Tables of swimming pool accidents by age, season, site, and outcome are presented.

Child drowning in swimming pools are common. Immersion accidents involving children are increasing worryingly in some centres. This increase has been coincident in time with a dramatic increase in the installation rate of home swimming pools. Drowning accidents involving children under the age of 6 years exceed deaths due to motor vehicle accidents in all Australian states. Because of the serious epidemiological position that drownings and near-drownings now occupy, we have felt that a specific analysis of swimming pool incidents is urgently required. This paper reports the findings from a series of 66 consecutive pool drowning and near-drownings over the five year period 1971 to 1975 inclusive. This report furnishes further data from the Brisbane Drowning Study.

Methods
Details of case-finding, parental interviews, approaches to family doctors, use of coroner's reports and hospital records have been described previously. All cases of swimming pool immersion incidents in which consciousness was lost in the water, without selection, have been included.

SWIMMING POOLS
A swimming pool has been defined as a receptacle containing water, specifically constructed for swimming or water recreation.
rescue and resuscitation efforts in school pools and public swimming baths; in the latter the survival rate is 82% even after consciousness is lost in the water. By sharp contrast, although motel and caravan park pools account for only 9% of all childhood immersion accidents, they are particularly tragic, as only 17% of victims survive in such surroundings once consciousness is lost.

Table 3 shows the geographical location of the 65 pools involved. It can be seen that immersion accidents most commonly occur (50%) in the child’s own backyard pool and 13.6% occur in a neighbour’s backyard pool. The latter statistic is of particular significance, as the survival rate in such situations is only 33%. This high mortality is partly due to the fact that it takes longer to find a missing toddler who has wandered from home and who is drowning in a neighbour’s pool.

Figure 1 shows the age distribution of all swimming pool immersion victims in the study. The skewed distribution is compatible with the interpretation that there are two overlapping subpopulations, probably differing in aetiological factors. This impression is supported by anecdotal data from the parents of older children, who note that the drowning scenario sometimes is of a child who is in unrecognized difficulties in a crowd of swimmers. This impression—that childhood pool accidents fall into at least two separate categories—is given support by figure 2, which shows the age distribution of children who died.

Table 4 shows data obtained from a study of safety barriers used to protect the pools in which an immersion accident occurred. It can be seen that in 76% of cases there were no safety fences or barriers whatsoever. In one case only could there be said to have been an adequate fence and gate (in this instance drowning was due to the misuse of a retractable ladder leading into the enclosed pool area). In 22% of immersion accidents some attempt had been made to erect a fence before the accident; in these cases either the fence or the gate, or both, was technically inadequate as a practical safety barrier.

The data in table 4 also indicate that an adequate fence (as opposed to no fence) may have inherent dangers of its own; such may pull the pool owner into a false sense of security. It can be seen that the survival rate for unfenced pools is 65.8% compared with a rate of 36% for those pools with a fence, but a technically inadequate one (0.05 > p > 0.01). As the principal factor determining the survival rate is the immersion period before extraction from the water, this suggests that children who fall into an inadequately fenced pool are at particular risk once they enter the water. Parents tend to
Swimming pool accidents

![Swimming pool accidents](image)

**Figure 3** Frequency distribution histogram for the month of occurrence of 66 consecutive swimming pool immersion accidents (Brisbane Drowning Study).

<table>
<thead>
<tr>
<th>Season</th>
<th>No of accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer (Dec to Feb)</td>
<td>29 (43.9%)</td>
</tr>
<tr>
<td>Autumn (Mar to May)</td>
<td>8 (12.1%)</td>
</tr>
<tr>
<td>Winter (Jun to Aug)</td>
<td>5 (7.6%)</td>
</tr>
<tr>
<td>Spring (Sep to Nov)</td>
<td>24 (36.4%)</td>
</tr>
<tr>
<td>Total</td>
<td>66 (100.0%)</td>
</tr>
</tbody>
</table>

Table 5 Swimming pool immersion accidents by season of occurrence

relax vigilance of a young child if they imagine (wrongly) that a water hazard is adequately fenced.

Figure 3 shows the swimming pool accident rate by month of occurrence. The immersion accident rate is very high in spring and summer, but the autumn and winter months nevertheless still account for some 20% of accidents (table 5). These figures reinforce the fact that, on a wintry day, however uninviting a cold pool may look in adult eyes, to a toddler an exposed water hazard may be fatally seductive. Although January and February are Brisbane's two hottest months, the immersion accident rate is less than half (41.4%) that observed in November and December. We believe that this may indicate that the publicity regarding drowning accidents (which always starts to increase in spring and early summer) may make parents more aware of the threat as the 'pool season' wears on.

**Discussion**

It is known that the drowning and near-drowning rate is running parallel with the rate of pool installation, and that pools are not becoming intrinsically more dangerous.\(^5\) Whilst this is in some respects heartening, it means that, unless protective measures are adopted, the drowning rate will continue to climb as pools become even more popular. Studies from other centres\(^10\) suggest that adequate safety legislation may prevent an increase in pool deaths, even in spite of a rapid increase in backyard pool installation.

It is commonly said, with some vehemence, that children will still drown even although adequate fences are built. We can find no supporting evidence whatsoever for this view. We have yet to encounter a fatal childhood swimming pool accident in which an effective fence (with a self closing self locking gate) has been present. Victorian data\(^11\) have shown that, in a minimum of 70% of swimming pool drownings of children under 10 years of age, there was no fence or safety barrier whatsoever. A large Swedish study of drowning records\(^12\) has also shown that, in over 300 fatal childhood water accidents, an adequate safety barrier was not present in any instance. The evidence is so strong that we believe it is indefensible for fencing legislation not to be introduced.

The fact that 50% of those children who drown, or nearly drown, do so in pools not in their own backyard is further evidence for the need for safety legislation. The 13% of young children who drown in a neighbour's pool compares consistently with the Victorian proportion of 15%\(^11\) who drowned under similar circumstances.

We further advocate that home swimming pools should be registrable only if the resident owner has a current first aid certificate, since there is good evidence from the Brisbane Drowning Study that this will lift the survival rate in the 'potentially fatal' group.

Serious immersion accidents in public swimming baths form a surprisingly high component (13.6%). Similar high figures are known from the United Kingdom.\(^3\) In the United States\(^4\) swimming pool drownings far outnumber other causes of drowning in the home (bathtubs, wells, cisterns, and so on).

Swimming pools, and the ability to buy them, are becoming more widespread. It will be an epidemiological tragedy of major proportions if this cumulating threat is not recognized, and if this rise in our standard of living continues to be needlessly purchased in children's lives.

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9. Australian Bureau of Statistics (Northern Territory). *Cause of death, Tabulation for Northern Territory, 1973 year. Table ACDDA.


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