Caregiver factors and pool fencing: an exploratory analysis

K John Fisher, Kevin P Balanda

Abstract

***Objectives*—To explore the relationship between caregiver characteristics and the adequacy of domestic swimming pool fencing.**

***Setting*—A typical metropolitan area of a large Australian capital city, Brisbane.**

***Methods*—From a reanalysis of the dataset of the 1989 Brisbane Home Safety Survey of 1050 householders, associations between 10 caregiver factors, pool ownership, and quality of pool fencing, were analysed. Household characteristics relating to toddlers (children ⩽4 years), and socioeconomic measures were also included in the analyses. Pool fencing quality was measured on an ordinal scale derived from Australian Standards Association guidelines, confirmed through home visits by trained inspectors.**

***Results*—Caregiver factors did not distinguish households with a swimming pool from those without, nor were they associated with adequacy of pool fencing among pool owners. Pool owners, with or without children, were less likely to perceive having a childproof fence as being important. Strongest correlates of adequacy of pool fencing were socioeconomic indicators of surrounding districts.**

***Conclusions*—These results do not support the arguments of opponents of compulsory pool fencing that caregiver factors are adequate to prevent toddler drownings and obviate the need for a pool fence. Pool owners do not appear to perceive their pool as a hazard for young children, and complacency about the adequacy of pool fencing needs to be replaced by increased caregiver health beliefs, skills, and perceptions.**

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Drowning is the most common cause of accidental death of children in Australia of whom 70% are aged between 1 and 3 years.[1] The drowning rate in Queensland is the highest in Australia and over 90% of all child domestic pool drownings involve toddlers.[2] In Brisbane Statistical Division, 77% of all childhood drownings occur in domestic swimming pools.[1 2] Modern resuscitation techniques prevent some drownings, but 5–10% of survivors suffer permanent, severe brain damage.[3 4] Domestic pool drownings account for 61% of all childhood drownings in urban areas and 21% in rural areas.

Many studies have suggested that adequate pool fencing can reduce childhood drownings, with several studies advocating compulsory pool fencing legislation.[5–9] Almost all toddler drownings in fenced pools occur because the fence is in disrepair or the gate is not functioning.[3 6 7] It is clear that adequate pool fencing and pool safety are essential components of an effective drowning prevention program.[3 7 8–12]

The characteristics of the members of the households, their individual and collective knowledge, attitudes and behaviours with respect to pool safety and injury prevention, are often overlooked in physical and environmental audits and safety checklists (J Elkington *et al*, 1991 unpublished).[13] Factors that could play a significant part in frequency of child injuries include parents' attentiveness or vigilance, type and consistency of disciplinary actions or instructional behaviours,[14] as well as parents' beliefs and values.[15] Several studies have shown levels of supervision to be highly related to the number of hazards in the home[16] and to childhood injuries.[17] Caregiver surveillance, attentiveness, and water safety skills take on greater importance in or around water. Taken together, these studies suggest that caregiver characteristics may be strong moderators of the effects of environmental hazards to toddlers such as swimming pools. In fact, opponents of compulsory pool fencing argue that such caregiver factors are adequate to prevent toddler drownings and obviate the need for a pool fence.

The Brisbane Home Safety Survey was conducted, as part of the National Better Health Program, in June 1989.[18] It was the first in Australia to comprise both a personal interview and a visual assessment of the respondent's household. Households with domestic swimming pools were deliberately oversampled in order to gather detailed information to contribute to an ongoing pool safety campaign. Following the campaign in 1990, legislation covering pool fencing was introduced in 1991 and was fully implemented in April 1992. The toddler drowning rate fell dramatically from 15 in 1990 to one in 1993, but has now risen to almost prelegislation levels.[2]

In this paper, we undertake a secondary analysis of the 1989 Brisbane Home Safety Survey to explore the potential role of caregiver factors such as: pool safety knowledge, attitudes and beliefs, perceived importance of pool fencing, parent/caregiver surveillance and attentiveness, perceptions of toddler's abilities, and caregiver resuscitation skills, in the prevention of toddler pool drownings.

In particular, we focus on differences between pool owners and non-pool owners, and on the relationship between caregiver factors and the quality of the pool fence among pool owners. In this way we hope to shed light on whether or not these caregiver factors explain some of the variation in adequacy of domestic pool fencing in the households in the Brisbane Statistical Division.

Methods

BRISBANE HOME SAFETY SURVEY

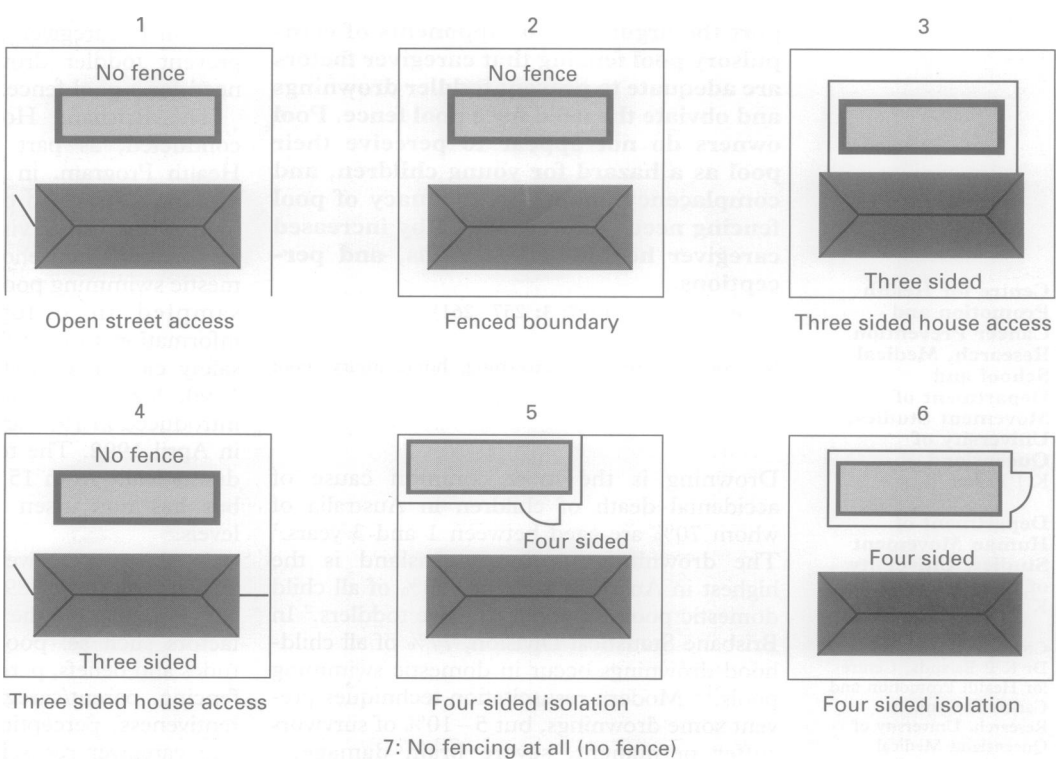
The Brisbane Home Safety Survey was conducted in June 1989. Details of survey methodology are given elsewhere.[6 18 19] Personal interviews of residents in randomly selected Brisbane households were conducted by trained female interviewers. After each interview the interior and exterior of the respondent's household was assessed and the results recorded on a 'household checklist'. An independent market research company undertook the fieldwork following the delivery of an explanatory leaflet to households and promotion of a telephone 'hot line' at Queensland Health, the State Health Department. Six households were chosen from each of 165 randomly selected Australian Bureau of Statistics collectors districts (street blocks) in the Brisbane Statistical Division. Interviewers returned to a household twice, before moving to the next available address in a collectors district. Quotas of at least 200 households with swimming pools and 200 households with an occupant aged 65 years or over were imposed. The quota on households with older residents was filled without oversampling. However, to fill the swimming pool quota an additional 47 households with swimming pools were sought after interviews in households with older residents ceased. Weighting used to adjust for this oversampling was based on the pool prevalence observed before the oversampling began.

During the initial fieldwork, 1399 persons were eligible for interview. Of these, 18.9% refused to be interviewed, and a further 9.4%, who agreed to be interviewed at a later time were replaced (as outlined above) before this could be done. This resulted in 1003 interviews with an overall participation rate of 71.7%. Fieldwork then continued until a further 47 households with swimming pools were included, resulting in a total of 1050 interviews.

The personal interview covered a range of pool safety issues, including support for compulsory fencing of all domestic swimming pools, methods used to prevent drownings, and perceptions about the swimming skills of children. In addition, general demographic and household information was collected. The household checklist recorded the type of swimming pool, the configuration of any pool fence, and pool fence characteristics, such as height, distance between horizontal and vertical elements, and the presence of a self closing gate and a child resistant lock. Further details of the items relating to pool safety are given elsewhere.[19]

CAREGIVER FACTORS

The term *young child* or *toddler*, refers to a child aged 4 years and younger. As well as demographic details, the questionnaire assessed 10 caregiver factors grouped into beliefs, behaviours, and skills. Definitions are given in the Appendix.



Australian Standards Association guidelines for pool fencing.

HOUSEHOLD CHARACTERISTICS

In addition, two further household characteristics were recorded: the number of children aged 4 years or under, and (in households without children) whether or not they had been visited by a child aged 6 years or under in the last six months.

SOCIOECONOMIC INDICATORS

Finally, two area based socioeconomic indicators were obtained from the Australian Bureau of Statistics. These were based on census data for the street blocks surrounding each household and reflect the level of economic resources of the district and the education/occupation profile of its residents.

POOL FENCE CHARACTERISTICS

As well as pool ownership (ascertained by visual inspection of the garden), the adequacy of pool fencing was measured on a three point ordinal scale describing the configuration of the fence (see figure). Trained female interviewers visually assessed the pool fence and recorded its configuration in relation to the eight diagrams derived from Australian Standards Association guidelines in operation at the time.[11] These were collapsed to form an ordinal scale with three levels: unfenced (diagrams 7, 1, and 2), three sided (diagrams 3 and 4), and four sided (diagrams 5 and 6). In a case-referent study conducted in 1991, Pitt and Balanda found this description of pool fencing to be associated with the risk of immersion involving unintended access.[6] The characteristics of the pool fences in the sample are described elsewhere.[19]

STATISTICAL METHODS

To facilitate analyses, demographic characteristics and caregiver factors were dichotomised. Standard bivariate statistical procedures were then used to assess differences between the demographic characteristics of pool owners and non-pool owners. The χ^2 test was then used to assess crude differences in the caregiver factors of pool owners and non-pool owners.

Logistic regression was then used to adjust p values for demographic differences between pool owners and non-pool owners (see table 2).

Ordinal regresssion was used to calculate both crude and adjusted p values measuring the strength of the relationship, among pool owners, between the caregiver factors and the quality of the pool fence. Covariates included in the adjustment were the same as those above.

Results

Crude comparisons of characteristics of household respondents show that respondents with pools were more likely to be males, to be younger, and to have some postsecondary education. Moreover, they had significantly higher incomes and lived in areas that had higher mean education and occupation scores, and higher economic resources scores (see table 1). It was noted that more non-pool owners either owned their own house or were in the process of buying one. Over one quarter of pool owners in our sample were not owner/buyers of their homes.

Table 2 shows the differences in the caregiver factors of respondents with pools and those without pools. Crude p values are adjusted for demographic differences identified in table 1. Perceived importance of having a childproof fence was the only caregiver factor that distinguished pool owners and non-pool owners in this sample, ($p<0.001$; adjusted $p=0.006$), with non-pool owners considering

Table 1 Demographic characteristics of householders by pool ownership (n=1050); values are per cent unless otherwise indicated

Demographic characteristics	*Total*	*Pool owner*	*Non-pool owner*	*p Value*
Sex: male	23.7	25.2	17.7	0.022
Age (years)				
≤34	29.3	27.5	29.8	<0.001
35-54	39.2	65.1	33.9	
55+	31.5	7.4	36.3	
Owns house/buying	77.7	74.0	92.6	<0.001
Education				
Presecondary	17.5	9.8	19.6	0.002
Some secondary	53.2	50.5	53.9	
Some postsecondary	29.3	39.7	26.5	
Income of >$30 000 per annum	46.7	71.1	40.5	<0.001
Education and occupation*‡	1008.17	1030.44	1002.46	0.0001
Economic resources†‡	1030.71	1076.93	1019.36	0.0001

* Socioeconomic indicator for area score representing education and occupation profile of the district.
† Socioeconomic indicator for area score representing economic resources of the district.
‡ Mean scores reported and compared.

Table 2 Caregiver factors of household respondents, by pool ownership (n=1050); values are per cent unless otherwise indicated

Caregiver factors	*Total*	*Pool owner*	*Non-pool owner*	*Crude p value*	*Adjusted p value*
All householders	*n=1050*	*n=207*	*n=843*		
High perceived importance	91.6	78.3	94.9	<0.001	0.006
High perceived behavioural control*	3.66	3.64	3.66	0.732	0.689
High perceived susceptibility	13.4	11.6	13.9	0.388	0.675
CPR training	16.0	19.8	15.1	0.095	0.255
Young children	21.0	21.3	20.9	0.905	0.997
Householders with young children	*n=220*	*n=44*	*n=176*		
Perceived bath skills*	11.10	12.16	10.83	0.541	0.440
Perceived general skills*	13.36	15.22	12.89	0.108	0.067
Households without young children	n=*880*	*n=90*	*n=790*		
Recent visit by small children	56.5	62.2	55.6	0.238	0.8635

* Mean scores reported and compared (see table 1).
CPR=cardiopulmonary resuscitation.

Table 3 Adequacy of pool fencing by caregiver factors among households with swimming pools (n=207); values are per cent unless otherwise indicated

Caregiver factors	*No fence*	*Three sided fence*	*Four sided fence*	*p Value*	*Adjusted p value*
All pool owners (n=207)					
Perceived importance					
Low (n=45)	60.0	37.8	2.2	**<0.001**	**<0.001**
High (n=162)	23.5	48.2	28.4		
Perceived behavioural control*	3.69	3.63	3.62	0.700	0.597
Perceived susceptibility					
No (n=183)	32.2	45.4	22.4	0.772	0.555
Yes (n=24)	25.0	50.0	25.0		
CPR training					
No (n=166)	29.5	45.8	24.7	0.299	0.170
Yes (n=41)	39.0	46.3	14.6		
Young children					
No (n=163)	31.3	47.2	21.5	0.664	0.851
Yes (n=44)	31.8	40.9	27.3		
Perceived adequacy of fence					
No (n=92)	54.4	43.5	2.2	**<0.001**	**<0.001**
Yes (n=115)	13.0	47.8	39.1		
Uses some other method to prevent pool drowning					
No (n=28)	35.7	32.1	32.1	0.247	0.193
Yes (n=179)	30.7	48.0	21.2		
Pool owners with young children (n=44)					
Perceived bath skills*	14.57	12.62	11.08	0.699	0.341
Perceived general skills*	15.04	17.01	12.73	0.376	0.428
'Drownproofed' chidren?					
No (n=14)	14.3	57.1	28.6	0.190	0.207
Yes (n=30)	40.0	33.3	26.7		
Surveillance of young children in the pool*	2.7	2.93	2.68	0.613	0.541
Pool owners without young children (n=90)					
Recent visit by small child					
No (n=34)	32.4	55.9	11.8	0.621	0.197
Yes (n=56)	35.7	46.4	17.9		
All pool owners					
Education/occupation indicator†	1024.59	1025.34	1053.01	0.085	**<0.001**
Economic resources indicator‡	1055.91	1088.45	1082.93	**0.011**	**<0.001**

* Mean scores reported and compared (see table 1). Significant values are in bold.
CPR=cardiopulmonary resuscitation.
†Socioeconomic indicator for area score representing education and occupation profile of the district.
‡Socioeconomic indicator for area score representing economic resources of the district.

pool fencing significantly more important than pool owners. Moreover, after adjustment for differences in the demographic profiles of pool owner and non-pool owners, this remained statistically significant.

The quality of pool fencing among our subsample of 207 pool owners was measured as a trichotomous variable according to three types of fencing configurations, as mentioned above.

Assessment of the effects of caregiver factors on the adequacy of pool fencing are given in table 3. They indicate that only perceived importance of having a childproof fence ($p<0.001$), perceived adequacy of the pool fence ($p<0.001$), and the two socioeconomic status measures (education and occupation ($p=0.085$) and economic resources of the district ($p=0.011$)) were significantly associated with more adequate pool fencing. These associations were strengthened when adjusted for demographic differences between householders.

Discussion

We have reported an exploratory analysis of a data set that was not designed for this purpose. Consequently, in some cases, small sample sizes (for example pool owners with toddlers, n=44) considerably limit statistical power. In addition, key questions were often only asked of a participatory subgroup of respondents to minimise respondent burden.

Nevertheless, the study has identified some issues that are relevant to the current debate regarding compulsory pool fencing. Caregiver factors did not distinguish households with a swimming pool from those without. Nor were they associated with the quality of pool fencing among pool owners. Pool owners, in fact, were less likely to perceive a childproof pool fence as being important. Several explanations are possible. It may be that pool owners compensate with (i) increased vigilance and control when children or non-swimmers visit (ii) increased cardiopulmonary resuscitation training, or (iii) they may feel less susceptible to injury. However, none of these explanations are supported by the study results. Moreover, no such compensations appeared even when young children were present in the household. This is in contrast to the arguments from opponents of compulsory pool fencing that legislation is not needed as pool safety is being achieved, and can be achieved, through compensatory caregiver factors such as those included in this study.

As these data show, 62% of households with a pool were visited by small child (aged 6 years or less) in the last six months. It would seem that pool owners to not perceive their pool to be a hazard for young children, and there may be a role for the health belief model (or similar health behaviour theories) to assist in raising the spectre of the hazard potential of domestic swimming pools among pool owners, whether or not they have children of their own.

The most powerful correlates with the adequacy of a pool fence were the two socioeconomic indicators for the surrounding districts. Adequate pool fencing is relatively expensive and there may be significant financial barriers to the erection of such structures.

Financial assistance through subsidies may be an important strategy to address the inequitable distribution of adequate pool fencing. Another possible strategy would be to require adequate fencing included in the price of the swimming pool at the point of sale.

A vital issue in the debate about pool fencing adequacy is the question of intended access. Drownings that occur in these circumstances (in many cases, drowning victims are visitors) will not be prevented simply by a fence. An increase in vigilance, surveillance, and subsequently, resuscitation skills by attendant relatives, friends, and visitors may make the difference. Clearly, more research is needed into the complex association between caregiver attitudes and behaviours, social class and equity factors, and multifamily utilisation of a swimming pool such as occurs in higher density housing.

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Appendix Definitions of caregiver factors

Caregiver factors	*Scope*	*Basis of measures*	*Coding*
Beliefs			
Perceived susceptibility to home accident	All householders	Self-rating of the chance of an accident occurring in your household (1=extremely unlikely to 7=extremely likely)	Susceptible (≥5) Not susceptible (<4)
Importance of childproof pool fencing	All householders	Direct question (1=very important to 4=not at all important, 5=no opinion)	High (1) Low (≥2)
Perceived behavioural control	All householders	Response to two statements: 'Most accidents in home could be prevented' and 'Home safety really a matter of commonsense' (1=disagree strongly to 5=strongly agree)	Mean response
Children's general skills	Householders with young children	Responses to age at which a child can 'safely manage stairs', 'know danger of putting a plastic bag over their head', and 'play in kitchen without saucepan handles turned away'	60 minus average age in months
Children's bath skills	Householders with young children	'Age at which a child can have a bath without an adult being in the bathroom'	60 minus age in months
Perceived adequacy of pool fence	Pool owners	Self description of fence	Adequate Not adequate (being built or absent)
At least one non-'drownproofed' child present?	Pool owners with young children	'Which of your children do you think would be able to regain the side of a pool without assistance if they fell in?'	Yes (all could) No (at least one could)
Skills			
CPR training in last two years	All householders	Direct question	No Yes
Use of at least one method (other than childproof fencing) to prevent drowning	Pool owners	Direct question (multiple choice)	Yes No
Behaviours			
Surveillance of young children	Pool owners with young children	'How often are your children watched by an adult while they are swimming in your pool?' (1=never to 4=at all times)	Average score for young children who use the pool

CPR=cardiopulmonary resuscitation.