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Prevalence of Pools and Adequate Pool Fencing in the United States, 2001–2003

Julie Gilchrist and Karin Mack

The objective of the study was to estimate the proportion of U.S. households with access to a residential swimming pool and the prevalence of adequate pool fencing. Data were collected using national cross-sectional telephone surveys in 1994 and 2001–03. Nearly 15% of households (16.3 million) reported access to a swimming pool at their residence (14.9%, 95% CI 14.1–15.7); only 74% were reported to be adequately fenced. Adequate pool fencing is associated with lower income, renting the residence, and residing in a building with multiple units or an attached house. An estimated 488,633 households with pool access, where the family owns the residence and has children less than 5 years old, were not adequately fenced. Between 1994 and 2001–03, the percentage of pools that were adequately fenced did not change substantially. This study highlights the need for continued efforts to target families with young children with drowning-prevention interventions that include and emphasize adequate pool fencing.

Keywords: drowning, children, swimming pools

Drowning is the second-leading cause of injury death in children age 1–14 years, accounting for almost 800 deaths in this age group each year (Centers for Disease Control and Prevention [CDC], 2004). Almost 90% of these fatal drownings occur in recreational water sites such as pools, spas/hot tubs, and natural water settings (e.g., lakes, rivers, or oceans; Brenner, 2003). In addition, more than 3,200 nonfatal drownings occur each year at these recreational sites (CDC, 2004). Children less than 5 years of age have the highest rates of both fatal and nonfatal drownings at recreational water sites. Among these children less than 5 years old, 50% of fatal drownings and more than 80% of nonfatal drownings occur in swimming pools (CDC, 2004). These commonly occur in residential pools at the home of the child or a caretaker (Brenner, Trumble, Smith, Kessler, & Overpeck, 2001; Morgenstern, Bingham, & Reza, 2000; Present, 1987; Saluja et al., 2006). The total lifetime cost of fatal and nonfatal drownings among 0- to 4-year-olds in 2000 alone totaled more than \$1.8 billion dollars (Finkelstein, Corso, & Miller, 2006).

Previous studies demonstrate the importance of primary prevention of drownings in this population of toddlers and preschool children. These injuries are severe; approximately half of those treated for nonfatal drownings require hospitalization

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or transfer for more specialized care (CDC, 2004). In addition, advanced in-hospital medical care does not seem to significantly alter the outcome (Cummings & Quan, 1999). Finally, attempts to change the behavior of children under 5 years of age (e.g., teaching young children to avoid the hazard) have generally been less effective than other interventions (e.g., parental supervision or environmental changes) in this or other common injury areas (Hardy, Armstrong, Martin, & Strawn, 1996; Rivara, Booth, Bergman, Rogers, & Weiss, 1991). At present, physical barriers to prevent access to the hazardous environment appear to be the most promising strategies to prevent these tragic injuries.

Adequate pool fencing is the only intervention that has been demonstrated to reduce the risk of drowning in this age group (Stevenson, Rimajova, Edgcombe, & Vickery, 2003; Thompson & Rivara, 2000). By definition, adequate fencing (or isolation fencing) is four-sided, completely separating the pool area from the house and yard; has a self-closing, self-latching gate; and is resistant to scaling. Unlike some locations internationally such as Victoria, Australia, no state in the United States requires four-sided isolation pool fencing (Cummings & Quan, 1999). A national survey of households in 1994 estimated that overall, 19% of U.S. households had access to an outdoor swimming pool at their residence, and of these, 76% were adequately fenced (Logan, Branche, Sacks, Ryan, & Peddicord, 1998). In households with children less than 5 years of age, 18% had access to a swimming pool; 78% of these were reported to be adequately fenced. In 2001–03, another national survey assessed the prevalence of risk factors for injury across many topics. This report extends and updates previous work that documents access to residential pools and the presence of adequate pool fencing around residential pools in the United States.

Methods

Participants

The second Injury Control and Risk Survey (ICARIS-2) was a national cross-sectional list-assisted random-digit-dialed telephone survey of English- and Spanish-speaking adults (age 18 years and older) conducted in all 50 states and the District of Columbia from July 2001 through February 2003. The survey was conducted by the Centers for Disease Control and Prevention's National Center for Injury Prevention and Control using a computer-assisted telephone-interviewing (CATI) system. The survey, designed to obtain national estimates on the occurrence of and risk factors for injury, took an average of 21.5 min to complete and covered a wide range of injury topics including smoke-alarm use, helmet use, water safety, automobile-related safety practices, pedestrian injuries, injuries related to physical activity, falls, alcohol use, firearm ownership and use, interpersonal violence, and suicide. Males and minority racial and ethnic groups were oversampled compared with census figures of the U.S. population.

Procedures

During the 2001–03 ICARIS-2 survey, respondents were asked whether they had access to an outdoor swimming pool at their residence. Those who responded

affirmatively were asked whether there was fence at least 4 ft (1.2 m) tall that went all the way around the pool with a gate that closed and latched automatically. Access to a pool with adequate fencing was indicated if both responses were affirmative. Because they are not isolation fences, fences around a yard were not considered adequate. In addition, respondents were asked if in the last 12 months they had found any child younger than 5 alone inside the pool area without an adult's knowledge and supervision.

The original ICARIS survey, conducted in 1994, was also a national cross-sectional list-assisted random-digit-dialed telephone survey of English- and Spanish-speaking adults (age 18 years and older) conducted in all 50 states and the District of Columbia. In that survey, minority racial and ethnic groups were also over-sampled. Participants were asked whether they owned or had access to an outdoor swimming pool. Those who responded affirmatively were asked whether there was a fence around the pool. Participants who had a fence around their pool were asked whether the fence had a self-closing and self-latching gate between their home and the pool and whether they could get from inside the home directly to the pool by going through a door in the home. Adequate pool fencing was defined as fencing that surrounded the pool, had a self-closing and self-latching gate, and prevented access to the swimming pool from inside the house or yard. We reanalyzed data from 1994 for this article.

In both ICARIS surveys, respondents were asked for the highest grade or year in school they had completed. Responses were grouped into six categories: 8th grade or less, some high school, high school graduate/GED, some post-high school, college graduate, and postgraduate education. These categories were further collapsed into college graduate or more, high school graduate or some college, and less than high school graduate to match the analysis of Logan et al. (1998). Respondents were also asked which category best represented the total income in the past 12 months of all members of the household; these categories were also collapsed for comparison. Respondents reported the number of children who lived in their home all or most of the year and the age and sex of the children. Both the 1994 and 2001–03 data were recoded into homes with no children present and other categories based on the age of the youngest child (age 0–4, 5–14, or 15–17 years).

Analyses

In both surveys, households were weighted to adjust for unequal selection probabilities, noncoverage, and nonresponse. They were then poststratified to conform to the distribution of household composition by census region and metropolitan status to produce nationally representative estimates (Battelle, 2005). All analyses were conducted using SUDAAN software to account for the complexity of the survey design (Shah, Barnwell, & Bieler, 1995). Differences between 1994 and 2001–03 data were examined using logistic regression. The results were not substantially different from those presented here with confidence intervals (CIs). The weighted response rate for the 2001–03 survey was 47.9%, computed using standard methods as defined by the American Association for Public Opinion Research (Black, Kresnow, Simon, Arias, & Shelley, 2006). The response rate for the 1994 survey was 56.1%.

Results

Access to Swimming Pools

In 2001–03, overall, an estimated 14.9% (95% CI 14.1–15.7) of households, or 16.3 million, reported access to a residential swimming pool (Table 1). Access to pools increased with income and educational attainment. Access was not significantly different in households with and without children. Households in the south (17.0%, 95% CI 15.6–18.4) and west (17.5%, 95% CI 15.7–19.4) reported access more frequently than households in the northeast (13.0%, 95% CI 11.5–14.6) or north-central (11.1%, 95% CI 9.6–12.9) census regions. Access was higher in households who report renting (22.7%, 95% CI 20.9–24.6) than those owning (12.2%, 95% CI 11.4–13.1) their residence. Similarly, access was greatest in households reporting living in buildings with five or more units (40.4%, 95% CI 37.3–43.6) and lowest in detached homes (10.5%, 95% CI 9.7–11.4) or mobile homes (10.1%, 95% CI 7.5–13.4). The prevalence estimate for access to residential swimming pools declined in the last decade (from 19.1% to 14.9%). The relationships between access to a pool and demographic characteristics, however, remained similar.

Adequate Pool Fencing

In 2001–03, overall, 73.6% (95% CI 70.9–76.1) of swimming pools were reported to be adequately fenced (i.e., isolation pool fencing by which the pool was separated from the residence and yard areas with a self-closing and self-latching gate; Table 2). Lower income households (<\$20,000) were significantly more likely (83.7%, 95% CI 76.4–89.1) than high-income households (≥\$50,000) to have adequate pool fencing (69.6%, 95% CI 65.4–73.5). Households with no children were significantly more likely to have adequate pool fencing (78.3%; 95% CI 75.0–81.3) than households with children age 5–14 years (62.6%, 95% CI 56.3–68.5). Swimming pools at residences where the occupants rent rather than own were significantly more likely to be adequately fenced (87.9%, 95% CI 84.6–90.6; 64.5%, 95% CI 60.8–68.0%, respectively). Swimming pools at residential buildings with multiple units (either owned or rented) reportedly were most commonly adequately fenced (92.1% in buildings with two to four units, 95% CI 85.4–95.9, and 91.6% in those with five or more units, 95% CI 88.3–94.1). Detached homes (58.2%, 95% CI 54.0–62.3) and mobile homes (61.8%, 95% CI 46.4–75.1) reported the lowest prevalence of adequate pool fencing. There were no significant differences in levels of adequate pool fencing by educational status or region.

The prevalence of adequate pool fencing has not significantly changed in the last decade (1994: 75.4%, 95% CI 72.3–78.3; 2001–03: 73.6%, 95% CI 70.9–76.1). Adequate pool fencing continues to be associated with lower income, renting a residence rather than owning, and residing in a building with multiple units or an attached house whether owned or rented.

Households With Children Younger Than 5 Years Old

The prevalence of adequate pool fencing in households with young children is shown in Table 3. Although 82.3% (95% CI 71.1–89.8) of pools at rental residences with young children were adequately fenced, only slightly more than half

Table 1 Estimates of Prevalence of Access to Residential Pools by Demographic Characteristics, United States

Characteristic	1994			2001-03		
	N	Weighted national estimate	Percent (95% CI)	N	Weighted national estimate	Percent (95% CI)
Overall	1,055	18,481,890	19.1% (17.9-20.1)	1,475	16,318,500	14.9% (14.1-15.7)
Income						
\$50,000+	317	5,646,911	24.2% (21.7-27.0)	686	7,252,084	17.6% (16.2-19.0)
\$35-49,000	200	3,559,996	21.6% (18.7-24.8)	226	2,656,173	15.2% (13.3-17.3)
\$20-34,999	234	3,932,426	18.7% (16.4-21.3)	185	2,234,006	12.9% (11.1-14.9)
<\$20,000	197	3,272,483	13.6% (11.7-15.8)	181	2,068,323	11.9% (10.2-13.8)
Education						
college graduate or more	365	6,575,888	24.6% (22.2-27.2)	657	7,074,030	16.6% (15.3-18.0)
high school graduate or some college	599	10,493,956	18.2% (16.7-19.7)	720	8,153,904	15.2% (14.1-16.4)
less than high school	86	1,319,544	11.1% (8.8-13.8)	95	1,058,820	8.4% (6.8-10.4)
Age of youngest child						
0-4 years	167	2,910,000	17.8% (15.2-20.8)	183	2,119,620	14.2% (12.2-16.4)
5-14 years	226	4,140,719	21.4% (18.7-24.3)	311	3,227,985	17.9% (15.9-20.0)
15-17 years	70	1,174,474	20.3% (15.8-25.6)	98	1,037,068	17.2% (14.0-21.1)
no children	592	10,256,698	18.5% (17.0-20.1)	883	9,933,828	14.1% (13.2-15.2)

Home ownership							
own	608	11,279,348	17.1% (15.8–18.6)	890	9,672,114	12.2% (11.4–13.1)	
rent	436	7,018,328	23.3% (21.2–25.5)	557	6,373,264	22.7% (20.9–24.6)	
Region							
south	500	7,282,729	21.5% (19.7–23.5)	670	6,638,866	17.0% (15.6–18.4)	
west	281	4,634,667	22.8% (20.3–25.6)	319	4,067,802	17.5% (15.7–19.4)	
north central	139	3,136,938	13.4% (11.3–15.8)	178	2,856,465	11.1% (9.6–12.9)	
northeast	135	3,427,556	17.6% (14.9–20.7)	308	2,755,368	13.0% (11.5–14.6)	
Type of home							
building with 2–4 units	105	1,594,554	19.6% (16.1–23.8)	127	1,567,427	21.1% (17.8–24.8)	
building with ≥5 units	315	5,109,710	42.9% (38.9–47.0)	462	5,012,414	40.4% (37.3–43.6)	
mobile home	68	1,222,733	17.3% (13.4–22.0)	47	593,033	10.1% (7.5–13.4)	
attached house	104	1,838,373	25.6% (21.1–30.6)	101	1,088,720	14.2% (11.6–17.4)	
detached house	452	8,564,610	13.9% (12.6–15.3)	711	7,828,926	10.5% (9.7–11.4)	

Table 2 Estimates of Prevalence of Adequate Pool Fencing by Demographic Characteristics, United States

Characteristic	1994			2001-03		
	N	Weighted national estimate	Percent (95% CI)	N	Weighted national estimate	Percent (95% CI)
Overall	798	13,939,693	75.4% (72.4-78.3%)	1,053	11,773,555	73.6% (70.9-76.1%)
Income						
\$50,000+	200	3,692,975	65.4% (59.3-71.0)	472	4,987,563	69.6% (65.4-73.5)
\$35-49,000	165	2,928,265	82.3% (75.3-87.6)	156	1,850,411	71.6% (64.8-77.6)
\$20-34,999	188	3,005,318	76.4% (69.4-82.3)	138	1,701,150	77.4% (70.1-83.3)
<\$20,000	161	2,655,415	81.1% (74.1-86.6)	149	1,675,030	83.7% (76.4-89.1)
Education						
college graduate or more	281	5,194,742	79.0% (74.0-83.2)	468	5,109,548	73.7% (69.6-77.4)
high school graduate or some college	446	7,686,784	73.2% (69.0-77.1)	509	5,794,789	72.6% (68.8-76.1)
less than high school	66	965,664	73.2% (60.6-82.9)	74	840,704	80.2% (69.3-87.9)
Age of youngest child						
0-4 years	132	2,267,823	77.9% (70.0-84.3)	119	1,435,629	68.2% (60.3-75.1)
5-14 years	154	2,828,412	68.3% (61.1-74.7)	194	2,003,419	62.6% (56.3-68.5)
15-17 years	39	666,503	56.7% (43.4-65.2)	71	757,235	74.4% (63.4-82.9)
no children	473	8,176,956	79.7% (75.8-83.2)	669	7,577,271	78.3% (75.0-81.3)

Home ownership								
own	397	7,510,685	66.6% (62.2–70.7)	571	6,178,450	64.5% (60.8–68.0)		
rent	395	6,345,312	90.4% (86.9–93.1)	463	5,398,915	87.9% (84.6–90.6)		
Region								
south	383	5,518,153	75.8% (71.2–79.8)	468	4,619,629	71.4% (67.1–75.4)		
west	207	3,492,498	75.4% (69.4–80.4)	243	3,134,192	78.1% (72.9–82.5)		
north central	108	2,369,422	75.5% (66.8–82.5)	130	2,136,291	76.3% (69.3–82.1)		
northeast	100	2,559,620	74.7% (66.0–81.7)	212	1,883,443	69.3% (62.9–75.0)		
Type of home								
building with 2–4 units	101	1,511,743	94.8% (86.2–98.2)	113	1,431,011	92.1% (85.4–95.9)		
building with ≥5 units	293	4,772,193	93.4% (89.7–95.8)	395	4,378,157	91.6% (88.3–94.1)		
mobile home	55	932,145	76.2% (61.8–86.4)	29	366,321	61.8% (46.4–75.1)		
attached house	94	1,665,741	90.6% (82.5–95.2)	78	870,085	82.3% (72.6–89.1)		
detached house	246	4,930,502	57.6% (52.4–62.6)	415	4,531,252	58.2% (54.0–62.3)		

Table 3 Prevalence of Adequate Pool Fencing by Ownership Status for Households With Children Less Than 5 Years of Age, 2001–03

Home status	Pool adequately fenced	Pool not adequately fenced
Owners	55.9%	44.1%
95% CI estimate	(44.8–66.5)	(33.5–55.2)
	619,741	488,633
Renters	82.3%	17.7%
95% CI estimate	(71.1–89.8)	(10.2–28.9)
	786,165	169,356

(55.9%, 95% CI 44.8–66.5) of those at owned residences with young children were adequately fenced. Over 480,000 households in which the family owned the home and had children less than 5 years of age were not adequately fenced. In addition, an estimated 563,002 (3.5%, 95% CI 2.6–4.8%) households with pool access and young children reported finding a child less than 5 years alone in the pool area in the last 12 months (not in table).

Discussion

Toddlers and preschool children are active and curious. Although parents generally make an effort to be vigilant when supervising these young children around water, constant visual supervision might decline when the children are not expected to be in or around the water. Unfortunately, children often “escape” their caregiver’s watchful eye for varying periods of time, from seconds to minutes or more. This can be particularly dangerous when there is an inadequately fenced swimming pool in the area.

Four-sided isolation fencing is the only intervention with demonstrated effectiveness in preventing drownings in this age group by serving as a barrier to prevent access to the hazardous environment (Thompson & Rivara, 2000). Despite efforts to increase the prevalence of pool fencing in the United States through education and local or state pool-fencing regulations, results suggest that many young children still have access to a swimming pool at their residence that is not adequately fenced.

Results presented here should be interpreted with consideration of several limitations in the data. The information on access to and fencing of swimming pools was self-reported. Researchers did not have the opportunity to observe and document actual fencing configurations; respondents might have misunderstood or given socially desirable responses. Second, the questions asked in the 2001–03 survey had slightly different wording than those used in the 1994 survey, making comparisons between the two time points inexact. The actual influence of the changes in wording is unknown. Third, because of the relatively small sample sizes and the resulting low statistical power, we were unable to examine relationships between households with preschool children and other factors in great depth. Fourth, because this study was designed as a nationally representative survey, we were unable to examine the relationship between the adequacy of pool fencing and the existence of state or local fencing regulations. Finally, results should be interpreted

in light of the 48% response rate. Although lower than we would have liked, the response rate is comparable to those of other random-digit-dialed studies currently being conducted (CDC, 2005). As a means of assessing the representativeness of our data, we compared the demographics of our sample with those of the 2002 population. The sample was similar with respect to age, race and ethnicity, gender, employment status, and household income. Respondents were slightly more likely to be more highly educated and married and own their own homes than the general population, but even here, differences were only on the order of about 6–10%.

U.S. households with children less than 5 years of age were not more likely to have adequate pool fencing than were households without any young children. Similarly, homeowners were less likely to have adequate pool fencing than renters. Homeowners might be reluctant to fence pools because of the cost of installation and maintenance or the perceived negative aesthetic effect. Our results suggest that owners and operators of rental properties were more likely to adequately install and maintain swimming pool fences. This might be because of liability issues or differences in building codes and policies that apply to rental or multifamily properties. Inadequate pool fencing was most often associated with residing in a detached house, owning the residence, and the presence of children in the home. Although it is reassuring to note that the injury-prevention community often targets these households for pool-fencing education, it is concerning that the number of swimming pools inadequately fenced has not changed substantially in the last decade, nor does the presence of young children in the household seem to positively influence the prevalence of adequate fencing around pools.

Although isolation pool fencing itself is a passive environmental intervention, there are several key behavioral actions necessary to ensure that it is protective. Key behavioral actions important in ensuring adequate pool fencing include maintaining the fence and the self-closing and self-latching gate and ensuring that the gate is never propped open when unmonitored. Research is needed to identify other adjunctive passive strategies that might be beneficial (e.g., pool alarms, door alarms, door and window locks, pool covers). Nonetheless, because isolation pool fencing has been proven effective in preventing childhood drowning, communities in the United States should support policies and programs that require and actively enforce isolation fencing. Any legislation or regulations should be accompanied by education and enforcement to maximize compliance with the goal of protecting our children.

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