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Risk Factors for Drowning and Near-Drowning Among Children in Hillsborough County, Florida

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Synopsis

The authors obtained data from 700 households in Hillsborough County, FL, in a telephone random survey to determine risk factors for incidents of drowning and near-drowning among children in the county. The survey was conducted from August through December 1991. A combination of forced-choice and open-ended questions was used to assess adults' drowning-related knowledge, attitudes, and prevention behaviors, as well as the incidence of and the circumstances surrounding drowning and near-drowning among children who lived in those households.

The results showed that although most respondents had some knowledge of the epidemiology of drowning and near-drowning among children, deficits were noted in their knowledge of the importance of adult supervision and the recommended age at which to begin children's swimming instruction. Results showed a need for isolation fencing, that which separates a swimming pool from a house and yard. Most respondents reported that they did not know how to perform cardiopulmonary resuscitation (CPR) on an infant or child. More than 40 percent reported not knowing how to perform CPR on an adult.

Respondents reported no drowning or near-drowning incidents among children of their household within the last 3 years. However, the respondents did describe water-related immersions that involved children who experienced difficulty in the water, but recovered by themselves or with the aid of a nearby person. In some instances the child's breathing pattern was altered. There were three episodes during which difficulty in breathing occurred. The respondents reported a total of nine childhood water-immersion episodes within their families, none of which had been reported to treatment facilities. Recommendations are provided for programs for prevention of childhood drowning.

INJURIES ARE THE LEADING CAUSE OF DEATH for children ages 1 through 19 years in the United States (*1*). Leading causes of their injury-related mortality include motor vehicle crashes, homicide, suicide, drowning, and injury from fire or burns (*1*). About 1,700 children and youth, predominately male, were victims of drowning in 1988 (*2*).

The risk for drowning is greatest among toddlers, preschoolers, and male adolescents (*2*). Children younger than 5 years are more likely to drown

in swimming pools or standing household water, and adolescents more often drown in open bodies of water (*2*). Recent statistics have shown that from birth through age 19 years, 1 in every 1,098 males and 1 in every 3,333 females will drown (*3*).

Unlike the statistical reporting of death from drowning, there is no national data source dedicated to water immersion morbidity and related health care utilization patterns, and uniform data for incidents of near-drowning are not available for State and national levels. However, Wintemute (*3*) estimated that nationally in 1986 there were 7,745 hospitalizations and 30,980 hospital emergency department visits for children with nonfatal immersion injuries.

The clinical course of nonfatal immersion injury can be severe. Children who continue to require aggressive resuscitation at a treatment facility usually have a poor prognosis, which may include death or permanent brain damage (*3, 4*).

During the 9 years from 1979 through 1987, the national rate for death by drowning was 2.6 per 100,000 population, and the rate for the State of Florida was 4.4 per 100,000 (*5*). From 1987 through June 1991, the drowning rate for the State among children younger than 15 was 3.9 per 100,000. Drowning is the second leading cause of injury-related death for children in Florida younger than 15 years, exceeded only by death from motor vehicle injury. Drowning is the leading cause of death for children younger than 5 years in Florida (*6*).

We analyzed background statistics obtained from the State and county that showed that, in the period 1990 through June 1991, Hillsborough County ranked seventh among 67 Florida counties in the number of drownings of children ages birth through 14 years. Fifty-seven percent of the drownings of children in the county occurred among those younger than 5 years (data provided by Scott Owens, State of Florida, Department of Health and Rehabilitative Services, Office of Emergency Medical Services, Injury Control Program, March 9, 1992).

In the period 1986 through 1991, 44 children ages birth through 14 years drowned in the county. Twenty-nine of those were younger than 5 years. Most drownings (54.5 percent) occurred in in-ground or above-ground swimming pools. County statistics showed that children younger than 5 years had the highest incidence of drowning. Toddlers aged 12 to 24 months were at the greatest risk. For children younger than 15 years in the county, pools were the most common location of drownings, comprising 65 percent of the total. Toddlers who drowned often had found their way to pools or other bodies of water during temporary lapses in supervision. Most of the toddlers involved gained access to water from inside a house, were not engaged in water-oriented activity, and had access to unfenced pools.

The county's 1992 Land Development Code stipulates that residential pools must be enclosed with a fence not less than 4 feet high with self-closing and self-latching gates. Screened pool enclosures may be substituted for property fencing. However, the code refers only to property fencing, that which encloses a property. No provision is made for what is known as isolation fencing, which would separate the pool from the house and yard.

There are 204,292 single family residences in the county, of which 32,340 have in-ground swimming pools (16 percent). In addition to risks associated with pools, the county has more than 90 miles of coastline and 161 miles of water in three major river basins. Its 122 lakes encompass 11.4 square miles, or 7,305 acres of water. There are about 120 fish farms in the county, many with hundreds of small ponds and large tanks for holding tropical fish.

In 1989, the State of Florida received funding from the Centers for Disease Control and Prevention to establish a State and community-based injury control program. The program led to placing injury control specialists in the county public health units in 5 of the State's most populous counties, including Hillsborough, a west coast county of about 847,000 persons that contains the city of Tampa. Each county health unit with an injury prevention program staff has developed local community coalitions to address injury control through education and prevention, surveillance, and legislation.

The drowning prevention coalition, known as the Stop Drowning Alliance in Hillsborough County, needed data on risk factors that predispose children in the county for drowning or near-drowning. Our study was designed to provide data by means of a telephone survey of county households to determine risk factors for drowning and near-drowning among children. The survey was conducted from August through December 1991.

Methods

For the purposes of the study, a drowning was defined as a fatality and a near-drowning as a water-immersion incident of sufficient duration for

Table 1. Demographic characteristics of respondents in a telephone random survey of 700 households in Hillsborough County, FL, to determine risk factors for drowning among children, 1991

Characteristic	Respondents		County[1]	
	Number	Percent	Number	Percent
Age (in years):[2]				
21–24	57	8.4	51,951	6.2
25–44	314	46.4	284,369	34.1
45–54	100	14.8	86,268	10.3
55–59	43	6.4	34,564	4.1
60–64	35	5.2	35,255	4.2
65–74	81	12.0	61,837	7.4
75–84	38	5.6	31,924	3.8
85 and older	8	1.2	8,372	1.0
Sex:				
Men	265	37.9	406,217	51.3
Women	434	62.0	27,837	48.7
Race or ethnicity:				
White non-Hispanic	572	82.1	606,466	72.7
African American non-Hispanic	56	8.0	107,111	12.8
Hispanic	53	7.6	106,908	12.8
Other	15	2.2	13,569	1.6
Home ownership:				
Own	529	75.6	[3]204,966	63.1
Rent	160	22.9	[3]119,906	36.9
Household income:[4]				
Less than $1,000	6	0.9	...	...
$1,000–$5,000	19	2.7	...	...
$5,001–$10,000	30	4.3	...	...
$10,001–$15,000	41	5.9	...	...
$15,001–$20,000	35	5.0	...	...
$20,001–$30,000	101	14.5	...	...
$30,001–$40,000	69	9.9	...	...
$40,001–$50,000	53	7.6	...	...
$50,001 or more	115	16.5	...	...
Refused information	172	24.6	...	...
Households with children:[5]				
Survey respondents	252	36.0	...	...
Married couple	...	...	75,962	43.7
Woman head of household	...	...	21,567	57.7

[1] County data is 1990 census data.
[2] Median age of survey respondents was 43 years. Median age of county residents was 33 years.
[3] Number of housing units owned and rented is from 1990 census data; occupancy is an average of 2.63 persons per owner-occupied unit and 2.30 persons per renter-occupied unit.
[4] Median household income for 1989 for county residents was $28,477.
[5] County data for children younger than 18 years.
NOTE: Numbers and percents may not add because of incomplete data. Categories of "no answer" and "don't know" are not shown.

the child to experience effects of oxygen deprivation, including brain damage (*7*). Children were defined as those younger than 15 years.

Survey sample. The list of households to be surveyed was provided by the county's Community Services and Planning Office. To generate the list, the county was given a computer-generated random sample of 6,000 addresses of households obtained from a commercial statistics firm. From this list, the County Planning Commission prepared an equal probability random sample of households within each zip code in the county. The sampling procedure was used to ensure that each household in a defined geographic area had an equal chance of being selected so that the findings would be representative of county households.

The list contained zip codes and telephone exchanges for 1,305 county households, 22 percent of the original list. The list subsequently was reduced to 1,121 households because 184 telephone numbers were found to be disconnected or assigned to businesses. Seven-hundred respondent households were used in the study, comprising 62.4 percent of the available telephone numbers, providing statistical accuracy within less than 5 percentage points (*8*). Furthermore, the sampling procedure met time and cost considerations for the study, which were prime factors influencing survey subject recruitment (*9*).

Survey instrument. A combination of forced-choice and open-ended questions was used in a random telephone survey. The survey was developed from a review of State and national childhood injury surveys and recommendations of local and State experts in health education and injury prevention. Examples of surveys examined are the New York State Department of Health Safety Survey, the American Red Cross Safety Survey, and the North Carolina Childhood Injury Prevention Survey. Adaptations were made of survey items from the U.S. Consumer Product Safety Commission's 1987 Child Drowning Study (*10*).

A pilot test of the survey was made with 20 respondents from the list. Recommended revisions were incorporated in the final format. The researchers performed test-retest reliability checks with representative county members, showing a reliability range of 85 to 100 percent for survey items (*9*). Two interviewers were trained for the survey by the project's principal investigator and performed 10 or more practice telephone interviews before the survey began (*9, 11, 12*).

The survey questions assessed the respondent's childhood drowning prevention-related knowledge, attitudes, and behaviors. Other survey items examined the incidences and circumstances surrounding drowning and near-drowning among children living in the households of respondents. For drownings and near-drownings, respondents were asked to describe the child's age and sex, the month and

year of the incident, and the child's relationship to the respondent. Respondents were asked to give a brief description of the incident and to provide information about the child's supervision and swimming ability, if and by whom cardiopulmonary resuscitation (CPR) was performed, and any treatment regimens.

Respondents were asked to discuss those drownings and near-drownings that had occurred within the last 3 years. That time frame was used because it corresponds to detailed data available for Florida for drownings (data provided by Scott Owens). In terms of possible response bias during the 3-year period, research on recall of life events shows that inability to recall information is lessened for instances involving salient life events (*13, 14*). Experience with the study showed that respondents had detailed recollections of immersion episodes that had occurred many years previously.

Survey methods. Households were called an average of five times to complete survey questions. The maximum number of attempts for any household was 20. No messages were left on answering machines. Homes with answering machines were called again. At least three daytime attempts to reach household members were made. If that was unsuccessful, households were called during evening hours and on weekends.

The survey had 23 items and the average interview lasted 4 minutes. The interview completion rate was 99.6 percent, with only three persons not responding to all questions. After calling a residence and getting an answer, interviewers asked to speak to a household member who was 21 years or older. Most respondents having children in the household were the parents, and only one or two were older siblings. A respondent had to be a member of the household to be interviewed, excluding babysitters, grandparents, and other caretakers from the study.

All respondents were informed that their participation was voluntary and that confidentiality would be maintained. The project was approved by the University of South Florida's Institutional Review Board. Data analysis included frequencies, descriptive statistics, cross-tabulations, and chi-square contingency tables.

Results

Demographics. The mean age of respondents was about 46 years, with a 70-year range from 21 to 91 years. Sixty-two percent of the sample was female.

Table 2. Responses and preferred answers to questions on knowledge of the risk factors for children drowning, by respondents to a telephone survey of 700 households in Hillsborough County, FL, 1991

Response	*Number*	*Percent*
Person's age (in years) for highest drowning risk:		
Younger than 1	61	8.7
1–4 (preferred answer)	506	72.5
20–30	46	6.6
50–60	11	1.6
Sex at higher risk:		
Male (preferred answer)	372	53.1
Female	108	15.4
Highest risk location for ages 1–4 years:		
Home swimming pool (preferred answer)	649	92.7
Ocean	12	1.7
Lake	16	2.3
Stream	4	0.6
Best way to prevent children drowning:		
Supervision (preferred answer)	346	50.1
Use of pool barrier	76	11.0
Use of flotation device	23	3.3
Making sure child can swim	246	35.6
Recommended age (in years) to begin swimming instruction:		
Younger than 1	207	29.6
1–4	393	56.2
4–5 (preferred answer)	52	7.4

NOTE: Numbers and percents may not add because of incomplete data or "don't know" categories.

About 82 percent of the sample was white non-Hispanic, 8 percent was African American non-Hispanic, 7.6 percent was Hispanic, and 2.2 percent was described as other. About 76 percent of respondents owned their home. About 16 percent had household incomes greater than $50,000. About 33 percent had household incomes of $30,000 or less. In responding to the question related to income, nearly one-quarter of respondents (24.6 percent) refused to report income data. About 64 percent had no children living in the household. Table 1 summarizes demographic information about respondents and compares population parameters for the county.

Knowledge. Nearly three-quarters of the respondents (72.5 percent) knew that drowning is the leading cause of death of Florida children younger than 5 years. Most respondents (53.1 percent) knew that drowning victims are more likely to be male than female. About half (50.1 percent) of the respondents gave the preferred response that supervision is the best method to prevent child drownings. However, 35.6 percent of the respondents reported

'Educators and other injury prevention professionals can be instrumental in increasing knowledge of the problem and in promoting drowning prevention behaviors among parents and other caretakers to save children's lives.'

incorrectly that making sure that children can swim was the best drowning prevention method. Nearly 57 percent of respondents mistakenly believed that the American Academy of Pediatrics (AAP) recommends 1 to 4 years of age as the age for beginning swimming instruction. More than one-quarter of respondents reported birth to 1 year as the recommended age. Only 7 percent of the respondents chose the AAP's recommended age of 4 to 5 years (*15*). Table 2 summarizes data pertaining to selected knowledge items.

Prevention behaviors. About 17 percent of the respondents owned swimming pools. About 70 percent of those who were pool owners reported having a property fence or screen to enclose the pool, but with direct access to the pool from the house. Only about 10 percent of pool owners used isolation fencing, a fence enclosing the pool but separating the pool from the house and yard. While self-latching gates should be used with pool fences, most pool companies in the county that were asked reported that self-latching gates usually are not included with their isolation fencing, and that they installed gates that are opened and closed manually. We did not learn directly from the respondents whether gates were self-latching. About 75 percent of all respondents (pool owners and nonowners) favored a law requiring pool fencing for all pools, not only newly constructed pools. People who did not own a pool were more likely to report that isolation fencing should be required by law ($P < 0.0001$). Nearly 90 percent of the respondents favoring such a law were not pool owners.

Most respondents (53.3 percent) reported not knowing how to perform CPR on an infant or child. However, 55.7 percent reported knowing how to perform CPR on an adult. We did not learn whether respondents were currently certified in CPR. Table 3 summarizes data on prevention behavior items.

Immersion events. Respondents reported no drownings or near-drownings among children in the household within the last 3 years. However, the respondents did describe immersions that involved children who experienced difficulty in the water, but recovered by themselves or with the aid of a nearby person. In some instances, a child's breathing pattern was altered by immersion. Respondents were asked to describe those episodes in the same detail as drownings or near-drownings. The episodes were divided into those in which the child's breathing patterns were altered and those in which the child was able to breathe without apparent difficulty.

Three episodes involved a child with difficulty breathing after immersion. The first was a 2-year-old boy who fell in while dipping a bucket into the shallow end of a pool. His mother pulled him from the pool. The child was having difficulty breathing, but did not require CPR. Health care personnel were not called.

Another episode involved a 6-year-old boy playing in a family pool. The child, who reportedly had minimal swimming skill, went underwater and his mother immediately pulled him out. The child expelled water and was gagging. No CPR or other assistance was required.

The third episode involved a 7-year-old boy. The event occurred at a beach and the child was not being supervised. The child went underwater twice. His father grabbed him and performed back blows, a practice not recommended for water rescue attempts. The child expelled water and no CPR or other assistance was needed.

There were six reported episodes of children with difficulty in the water, but whose breathing patterns were not altered. All those episodes took place in residential swimming pools. The children, from 1 through 4 years of age, usually had fallen into a pool and were immediately rescued by a parent or other adult.

Other variables. Selected variables differed by race or ethnicity and by sex. Men were more likely to report knowing how to perform infant and child CPR than were women ($P < 0.0009$). Men were more likely than women to report knowing how to perform adult CPR ($P < 0.0001$). In terms of race or ethnicity and performance of CPR, African Americans were more likely than whites to report knowing how to perform infant and child CPR ($P < 0.015$). Whites were more likely than Hispanics to report knowing how to perform infant and child CPR ($P < 0.012$). African Americans were more

likely than Hispanics to report knowing how to perform infant and child CPR ($P < 0.0003$).

Discussion

Knowledge. Most survey respondents had some knowledge of the epidemiology of child drownings and near-drownings. For example, most knew that drowning is the leading cause of death for children in Florida between the ages of 1 and 4, that drownings often occur in home swimming pools, and that boys are more likely than girls to be the victims of drownings. Knowledge related to the recommended age to initiate swimming instruction for children was less accurate. The AAP believes that infants and toddlers cannot swim and breathe at the same time and therefore cannot be taught to swim effectively (*15*). Repercussions from attempting to teach children to swim before they are ready include seizures, hypothermia, a misguided sense of security around water, and other negative side effects, such as incontinence (*15*). The AAP recommends that swimming instruction not begin until the ages of 4 or 5 years. Even after receiving swimming instruction, young children should not be considered safe around water (*15*).

Prevention behaviors. About 10 percent of the respondents who were pool owners reported having pool isolation fencing. Evidence supports the concept that such fencing is a major successful strategy for preventing child drownings and near-drownings. Data from Australia have provided conclusive evidence related to the role of pool fencing in preventing drowning among children (*16–19*). Research has shown that effective pool fencing needs to be at least 5 feet high and have vertical openings no more than 4 inches wide (*7, 20*). In addition, the pool barrier must be well maintained and secured at all times (*21*). An effective pool barrier should supplement and not replace adult supervision. Only 50 percent of the survey respondents reported that adult supervision was the best strategy to prevent child drownings. More than one-third of the respondents incorrectly chose as the best strategy making sure the child was able to swim.

Timeliness is essential for resuscitation efforts in water-immersion incidents. However, more than one-half of the respondents reported that they did not know how to perform infant and child CPR and more than 40 percent reported not knowing how to perform adult CPR. Wintemute and Wright (*22*) showed, in a survey of 795 Sacramento County (CA) households with pools, that 86 percent were in favor of voluntary CPR training and 40 percent favored a requirement for CPR certification for pool owners. The researchers suggested that community trials of CPR training for residential pool owners be given a high priority.

Table 3. Responses in answer to prevention behavior questions on risk factors for children drowning, by respondents to a telephone survey of 700 households in Hillsborough County, FL, 1991

Responses	*Number*	*Percent*
Swimming pool ownership:		
Yes	116	16.6
No	561	80.1
Have wading pool only	22	3.1
Pool barriers:		
Have a fence or screen	94	68.1
Have an audible alarm	2	1.4
Have a pool dome or cover	4	2.9
Pool is fenced from both house and yard	13	9.4
Able to perform CPR on an infant or child:		
Yes	305	43.6
No	373	53.3
Able to perform CPR on an adult:		
Yes	390	55.7
No	285	40.7

NOTE: Numbers and percents may not add because of incomplete data. "Other" and "don't know" categories are not shown. CPR = cardiopulmonary resuscitation.

Our survey results showed that men were more likely to report knowing how to perform both infant and child CPR and adult CPR than women. Because there is no way to interpret what the respondents perceived as CPR performance, or their level of skill, the importance of these findings is not known. Contributing factors may include a lack of self-confidence among women, or an overestimation of abilities among men. Further studies may define these constructs more thoroughly.

African Americans were more likely to report knowing how to perform infant and child CPR than were whites and Hispanics. Because of the relatively small number of African American respondents (56) compared with white respondents (572), further studies need to be conducted to verify that observation. Studies need to be made to determine whether CPR programs should be directed to special populations.

All but one of the immersion episodes occurred in residential pools. This finding emphasizes the dangers to young children associated with pools. None of the episodes was reported to a health facility. Therefore, the magnitude of water-immersion episodes in this county may be underestimated.

'Parents, adults of parenting age, grandparents, caretakers, and other community members need to become more aware of risk factors for child drownings and near-drownings.'

Limitations of the Study

The results are specific to Hillsborough County and not generalizable to other settings. However, they suggest deficits in knowledge and practices with regard to the water safety of young children. We did not perform face-to-face interviews or use other survey methods, because of cost and time constraints. Therefore, the sample included only those persons with working telephones. Future survey efforts should be stratified to obtain cultural and racial diversity among respondent households.

Recommendations

"Healthy People 2000," the national health promotion and disease prevention objectives (*23*), addresses the importance of drowning prevention for children. The objective for children younger than 5 years is no more than 2.3 drowning deaths per 100,000 population (*23*). The State of Arizona created a successful childhood drowning prevention program that involved using public and private organizations and mass media to develop a multifaceted approach to educating the public (*24*). Messages included the need for adult supervision and for increasing general acceptance of passive barriers to augment visual supervision. Prevention groups worked closely with the mass media for support, provided information to elected officials, and participated in local, city, and State public sessions that focused on childhood drownings. Arizona has developed parental support groups for families of drowning and near-drowning victims (*24*).

As a result of legislative efforts, Arizona passed the first pool barrier code in the country, one that requires passive barriers on all newly constructed pools (*24*). Acceptable barriers include various combinations of fencing, gates or doors, and pool safety covers. In addition, the City of Phoenix has mandated retrofitting preexisting pools with passive barriers. Future legislative efforts will involve developing a statewide requirement for retrofitting all preexisting pools with barriers. After a massive community education effort mounted in 1989 in Arizona, life-threatening immersion episodes and childhood drowning deaths decreased almost 50 percent statewide in 1990 (*24*).

Parents, adults of parenting age, grandparents, caretakers, and other community members need to become more aware of risk factors for drowning and near-drowning among children. People need to know the dangers of considering children safe around water and the limitations of children beginning swimming instruction before they are physically prepared or able to perceive risks related to water.

Professionals working in injury prevention need to be encouraged to develop community-wide water safety education programs and activities, to involve the mass media, and to identify legislative issues, such as mandating pool fencing, especially if young children are in a household or frequently visit the setting. Injury prevention advocates can be instrumental in developing, implementing, and evaluating community CPR training. A previous study of postpartum mothers in Florida showed that only 43 percent knew how to perform infant CPR (*25*).

As shown by the Arizona program, community coalitions can be instrumental in spearheading many prevention efforts (*24, 26*). Physicians need to become involved in such activities, as well. Family practice physicians and pediatricians can have an important impact when working in conjunction with broad scale efforts to educate the public (*27*). Pediatricians need to emphasize the importance of constant supervision of children around water and to encourage training for parents, caretakers, babysitters, lifeguards, and rescue personnel in CPR for infants and children (*28*).

The county's Stop Drowning Alliance participants represent hospitals, trauma treatment agencies, public health units, emergency medical services, the American Red Cross, various clubs for boys and girls, parks and recreation facilities, universities, broadcast media, safety councils, and insurance companies. The alliance has applied data from this study to assist its outreach activities.

Examples of outreach activities are developing community education programs, creating public service announcements emphasizing the need for child supervision and adequate barriers, reinstating Learn to Swim Programs for older children through the Department of Parks and Recreation, and promoting community drowning prevention awareness days. The alliance initiated a drowning awareness proclamation by the Board of County

Commissioners. The county prevention days involved teaching infant and child CPR to community residents, teaching water safety activities to children, providing pamphlets and other education material to participants, and having alliance members present drowning and near-drowning data with prevention guidelines at community health functions. Evaluation of these activities is in the preliminary phases.

Future goals of the alliance involve more intensive community outreach and program evaluation, modeled on the Arizona program, and lobbying for isolation fencing ordinances. Alliance members are working with insurance companies to develop consumer rebates for customers whose pools have isolation fencing. Discussions are being conducted with local pool fencing companies to provide discounts to families with small children.

The results of the study show that the county can benefit from childhood drowning prevention program efforts and is beginning to respond to this important issue. Community members need to be aware that injury prevention is an important component of public health. Educators and other injury prevention professionals can be instrumental in increasing knowledge of the problem and in promoting drowning prevention behaviors among parents and other caretakers to save children's lives.

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