

# Pool Drownings and Their Prevention

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AMERICANS are bringing the bathing beach into their communities and backyards. Twenty years ago, of an estimated 10,800 swimming pools of permanent inground construction in the United States, 2,500—less than 25 percent—were connected with homes or private residences (1). By 1966, when permanent pools of all classifications had increased to more than 700,000, more than 500,000 of these were home pools. Permanent pools are now estimated to be increasing by upwards of 50,000 each year. The following data (2) show the growth of pools in various categories over the past 20 years:

Category	1946	1966
Community—municipal and other public	4,000	34,000
Institutional—school, college, youth-serving, and athletic organization	2,400	18,000
Hotel, motel, or apartment	600	103,000
Clubs—country, health, or neighborhood	1,100	38,000
Residential	2,500	500,000
Miscellaneous	200	15,000
Total	10,800	708,000

In addition to pools of permanent construction, there are about 2 million portable onsurface swimming pools, and it is predicted that this number will grow to about 4 million over the next 5 years because of low unit costs made possible through mass production (3). Accurate figures for plastic wading pools are not available, but they are estimated already to number upwards of 10 million.

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Transient and multiple residences—motels, hotels, apartments, and condominiums—no longer are considered complete without one or more swimming pools. These facilities have increased during the last 20 years from about 600 to more than 103,000 (1). One motel chain now operates more than 500 pools, a number comparable to all the pool facilities of the Y.M.C.A.

Although the growth of nonresidential pools has not been as dramatic, private club pools have grown from about 1,100 to 38,000 in the 20-year period (1). Municipal and other public pools have also increased, from 4,000 to approximately 34,000. Institutional pools, including those facilities located at youth-serving organizations and at schools and colleges, have grown the least—yet more than sevenfold—from 2,400 to approximately 18,000.

The population presently at risk in pool use may be as high as 45 million persons. About 25 million of this number probably use residential facilities; another 20 million probably swim in nonresidential facilities.

## Need for Data

Unfortunately, the mushrooming growth in numbers of pools and pool users seems to have outpaced the owners' knowledge and ability to operate their facilities safely. Nor have public health and related agencies of the State and community developed adequate controls for the prevention of injuries and fatalities. Because of the mounting exposure of the population to accidental drownings and the disproportionate toll of children and youths these accidents take, the Public Health Service has given priority

to seeking ways to prevent them. It has found itself handicapped, however, by the lack of recent data on the number and circumstances of the deaths and the characteristics of the victims. To supply some of the missing data, the Injury Control Program initiated an investigation which represents one phase of a comprehensive study of drowning fatalities in the United States.

### Methodology of Study

A contract was made with a commercial service to supply newspaper clippings on all drowning fatalities which had occurred during 1965 in the United States or which involved U.S. residents. Because of the lack of any national data on fatalities in skin and scuba diving (4) and in pools, these classifications were selected for initial study. Pool incidents were separated by type of pool (decorative and fish, plastic wading, onsurface portable, and pools of permanent inground construction) and by categories of pool ownership and sponsorship. Significant information was then transferred to optical scanning forms. These forms were designed with the aid of Isabelle Crawford, data processing supervisor, and James Walker, principal statistician, of the Illinois Department of Public Health; machine tabulations of the data were made at facilities of that health department, under the guidance of Dr. Edward Press, chief, division of health planning and resource development.

### Summary of 1965 Fatalities

A total of 484 pool fatalities in 1965 were identified from accounts in the newspaper clippings.

*Geographic distribution.* In only 5 of the 50 States (Delaware, Kentucky, North Dakota, Rhode Island, and Wyoming) and the District of Columbia, were there no drownings reported (table 1). California led in fatalities with 127, followed by Florida with 42, Texas with 30, Pennsylvania with 28, and New Jersey with 22. These five States accounted for more than half of all 1965 pool fatalities. An additional eight States each had 10 or more pool deaths. Thus, 363, or 75 percent of all fatalities, occurred in 13 States.

Of the 484 victims, 429 drowned in pools sit-

uated in their own States of residence. Of 55 victims not resident in the State where they drowned, nine drowned in Florida and seven in California; the sites of the other 39 drownings were distributed among 22 other States. Two Americans also drowned in pools in other countries.

*Victims per episode.* Twelve multiple drownings in 1965 claimed two victims in each occurrence. In 3 of the 12 double drownings, one victim had apparently been trying to rescue the other; this possibility also existed in a few of the other double drownings. In 7 of the 12, the victims were related—usually children within the same family. The other 460 drowning incidents claimed a single victim.

*Period of year.* As expected, the warm months, May through September, accounted for 379 of the 1965 pool fatalities, or approximately 80 percent of the total 484. The peak month was July, in which 110 deaths occurred, followed by June and then August. The 29 fatalities in

**Table 1. Pool drownings in the United States in 1965, by State of occurrence**

State	Number	State	Number
Alabama-----	5	Montana-----	2
Alaska-----	2	Nebraska-----	1
Arizona-----	20	Nevada-----	3
Arkansas-----	1	New Hampshire-----	1
California-----	127	New Jersey-----	22
Colorado-----	2	New Mexico-----	3
Connecticut-----	12	New York-----	18
Delaware-----	0	North Carolina-----	4
District of Col- umbia-----	0	North Dakota-----	0
Florida-----	42	Ohio-----	17
Georgia-----	10	Oklahoma-----	4
Hawaii-----	4	Oregon-----	7
Idaho-----	5	Pennsylvania-----	28
Illinois-----	16	Rhode Island-----	0
Indiana-----	10	South Carolina-----	3
Iowa-----	3	South Dakota-----	1
Kansas-----	3	Tennessee-----	4
Kentucky-----	0	Texas-----	30
Louisiana-----	11	Utah-----	1
Maine-----	4	Vermont-----	1
Maryland-----	5	Virginia-----	9
Massachusetts-----	9	Washington-----	6
Michigan-----	9	West Virginia-----	2
Minnesota-----	3	Wisconsin-----	4
Mississippi-----	2	Wyoming-----	0
Missouri-----	5	Total-----	<sup>1</sup> 481

<sup>1</sup> Two additional drownings of Americans in 1965 took place in other countries; site of another drowning was not given.

**Table 2. Pool drownings of Americans in 1965, by age group and sex**

Age group (years)	Male	Female	Both sexes
0-4.....	145	62	207
5-9.....	60	15	75
10-14.....	45	16	61
15-19.....	38	8	46
20-24.....	18	2	20
25-39.....	17	4	21
40-64.....	25	14	39
65 and over.....	12	2	14
Total.....	<sup>1</sup> 360	123	<sup>1</sup> 483

<sup>1</sup> Excludes 1 male victim whose age was not stated.

March and the 24 in April may possibly be explained by increased exposure of youngsters with longer daylight hours and better weather for out-of-doors play. The number of victims by month was as follows: January—3, February—8, March—29, April—24, May—46, June—93, July—110, August—89, September—41, October—20, November—12, and December—7. The month for 2 of the 484 incidents was not stated.

*Day of week and time of day.* Weekends, with 157 of the 484 drownings—83 on Sundays and 74 on Saturdays—were the peak periods for pool fatalities. Although Wednesdays accounted for the lowest number of tragedies, the distribution of deaths was fairly consistent throughout weekdays. Holidays, both on weekdays and on weekends, accounted for 21 deaths.

About three of every four pool fatalities happened in the daytime. From 6:00 a.m. to noon was the period of 63 deaths. Afternoons from 12 until 6 p.m. accounted for the most fatalities—220, or 45 percent. Eighty-six occurred in the hours from 6 p.m. until midnight. Twenty-five fatalities occurred during the period of relative nonuse of pools, midnight until 6 a.m.

By day of week, 50 drownings, the peak number of daytime fatalities (6 a.m. until 6 p.m.), occurred on Sundays. The greatest concentration of nighttime incidents—24—occurred between 6 p.m. Monday and 6 a.m. Tuesday. No explanation for this nighttime pattern is apparent.

*Age and sex of victim.* Over half, or 282, of the 484 total pool-drowning victims in 1965

were infants and children under 10 years of age. The peak age group for drownings was from birth through age 4; it accounted for 207, or 43 percent, of the total 1965 drownings (table 2). Five victims were under 1 year, 52 were 1, 68 were 2, 47 were 3, and 35 were 4. Thus, the peak year of life for pool fatalities was age 2, followed in order by ages 1, 3, and 4 years. Three of every four of the 1965 victims were males.

The same age distribution as for all drownings was found to apply to drownings in residential pools (hotel, motel, apartment, and home). The number of child deaths was particularly high in residential pools; 185, or 55 percent, of these 335 victims were under 5 years of age (fig. 1). Twenty of the drownings in the age group 0-4 years took place in apartment pools, 12 in fish and decorative pools, 10 in hotel or motel pools, 5 in public pools, and 3 in pools of private groups. Five of the 230 persons who drowned in home pools were less than 1 year old; one was only 7 months of age.

*Ownership and type of pool.* Swimming and wading pools in homes or private residences, exclusive of fish or decorative pools, were the sites of 230, or 47 percent, of the 1965 fatalities (fig. 2). The 86 drownings in public pools represented about 18 percent of the total. Hotels and motels, with 53 reported fatalities, and apartment houses, with 52, each accounted for slightly more than 10 percent of the occurrences.

In 122, or almost half, of the home pool fatalities, the victims perished in pools owned by their immediate families. Neighbors' pools accounted for roughly a third of the tragedies, while those of relatives and others accounted for a smaller number. A few victims were employees of the homeowner or his guests.

*Last activities of victims.* Because of the frequent occurrence of drownings to which there were no eyewitnesses, activities of many of the victims at the time of the accident were determined from accounts of parents and relatives, playmates, and other persons who reported what the victims were doing or planning to do when last seen. Additional information on the victims' activities was deduced from evidence obtained at the accident scenes.

Playing adjacent to the water, particularly by youngsters, accounted for the greatest number of deaths—184. The play activities included ball

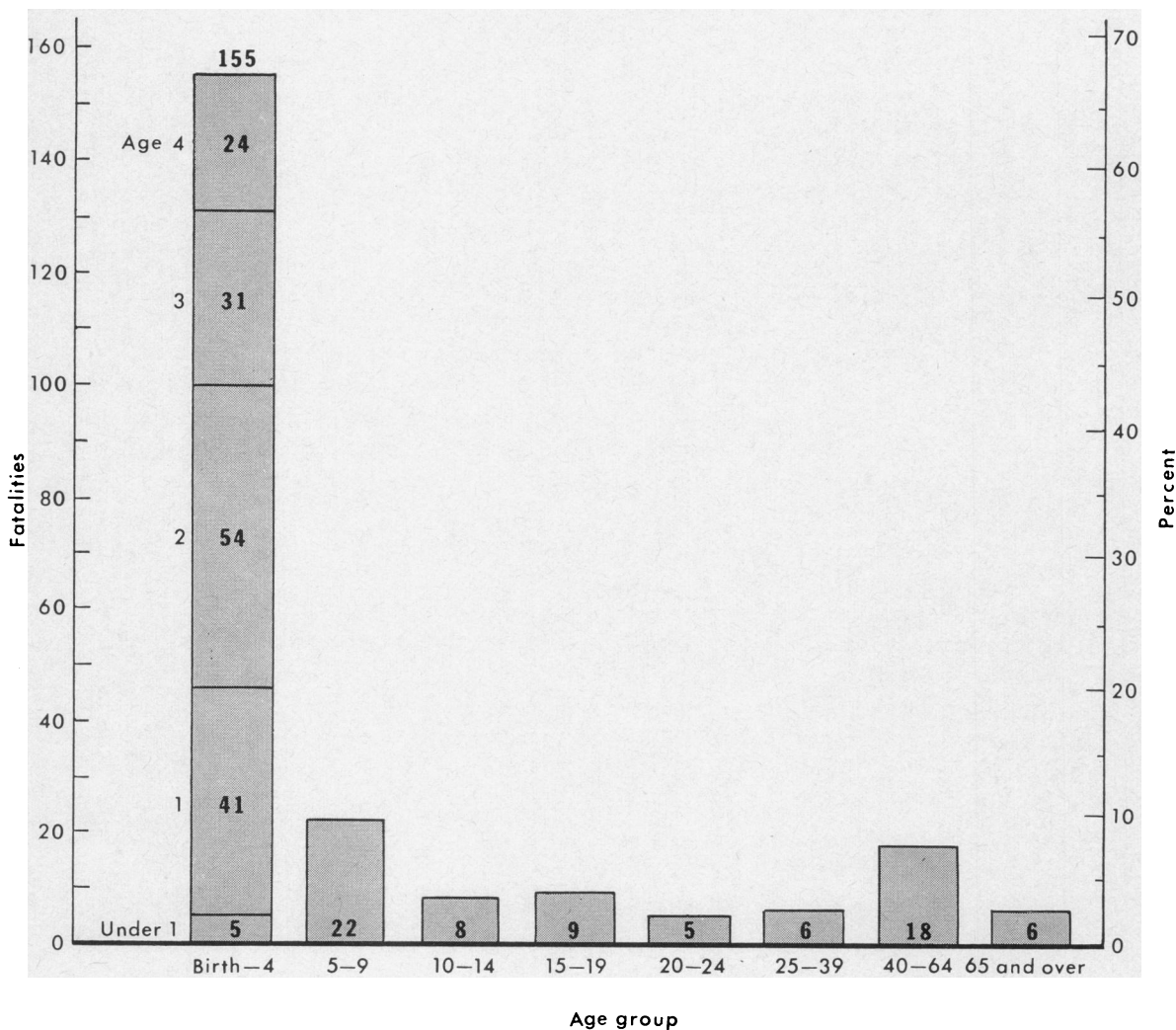
tossing, sailing toy and imaginary boats, retrieving floating objects, and riding tricycles or participating in other juvenile recreation adjacent to the pool edge. Bathing or playing in a facility designed for this purpose accounted for the next highest number of fatalities—102, followed by swimming and diving into these pools—96 fatalities. Standing and walking at poolside resulted in 47 fatalities, frequently involving elderly or chronically ill persons. Ten deaths resulted from persons working alone in, or adjacent to, the pool while engaging in such activities as lawn mowing, pool repair, chlorination, and cleaning.

Swimming under water for endurance, with the accompanying danger of hyperventilation,

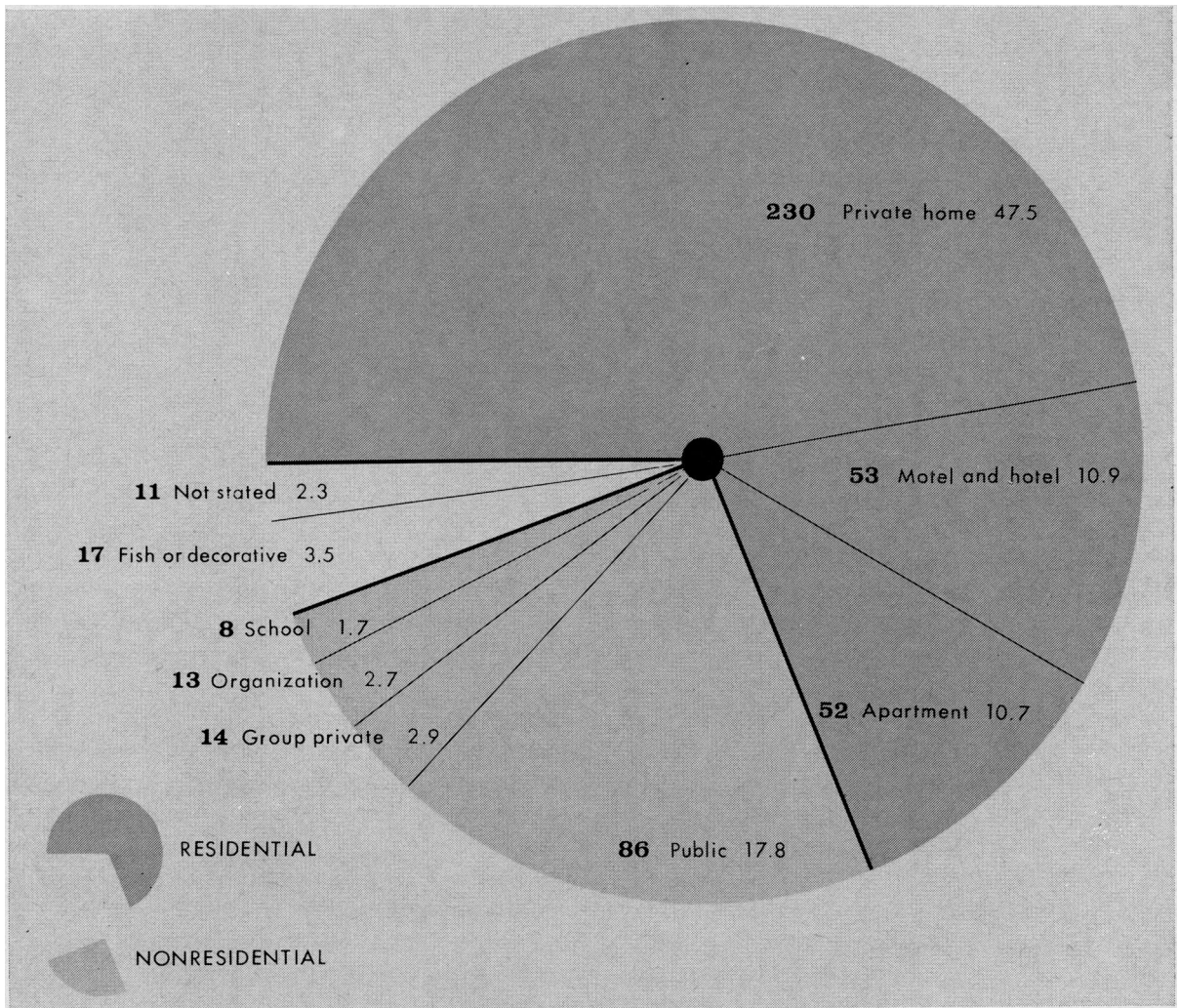
accounted for six deaths; revival of these victims was not possible even though the accidents in most instances were witnessed and the victims were quickly brought out of the water for application of first aid. Six deaths also resulted from playing or walking on pools covered with ice or snow. Six deaths occurred while the victims were playing with flotation devices or rafts. The victim's testing of skin and scuba diving gear while alone resulted in three separate deaths. An identical number of victims died while using facilities not intended for swimming, for example, a pool at a cemetery and a fire-protection pool at an industrial plant.

Six other victims were engaged in various other activities, and the activities of eight vic-

**Figure 1. Fatalities in swimming or wading pools at private homes, by age groups, 1965**



NOTE: The 230 total fatalities include 1 victim whose age was not specified.



**Figure 2. Pools in which fatalities occurred in 1965**

NOTE: Bold figures—fatalities; light figures—percent of total fatalities.

tims at time of drowning were not stated in the newspaper accounts.

*Causes of fatalities.* Usually more than one factor was involved in a pool tragedy. The tabulations used were based on those factors considered to have contributed most to the course of events. The most frequent proximate cause was unintentional falling or slipping into the water—accidents which were believed to account for 228 fatalities (table 3). Next in frequency was the victim's exhaustion, usually related to overestimation of his ability and to his lack of skill in water survival techniques.

The most frequent contributing cause appeared to be the lack or inadequacy of adult

supervision of children and second, the victim's inability to swim. Such inability, however, was not considered as significant in the drownings of children under 5 as the lack of supervision. In drownings among youngsters over age 4 and in adults, trespass through or over protective walls or fences was believed to contribute more to fatalities than lack of swimming ability. Previous indulgence in alcoholic beverages was identified as a contributory factor, or suspected to be one, in many adult drownings and was related frequently to trespass.

Attacks of physical illness or seizures were reported to be associated with 20 fatalities, including 12 in which the victim's physical con-

dition had been previously recognized. In an additional 17 deaths, the victims were known to have had physical impairments, but it was not known what contribution, if any, they made to the incident.

In at least 5 of the 51 instances in which victims stepped or were swept into deep water, an abruptly changing slope in the bottom of the pool caused the victims to slide into depths with which they could not cope. Other unexpected hazards included electrocution and underwater entrapment; these hazards accounted for 10 fatalities. The victims' failure to heed or obey instructions or warnings contributed to 16 deaths. Ironically, six fatalities occurred during swimming class instruction. Slipping or falling from a flotation device or raft or the sinking of the device also resulted in six fatalities.

*Supervision at pool.* In over half of the 484 pool drownings, the victim was alone (table 4). In an additional 64 instances, the only other persons present were children. The drowning victims of 1965 were most often toddlers and preschool children—223, followed in frequency by students in elementary through graduate schools—156. At the time of the incidents, 157 of the preschool children were alone.

In residential pools (transient, multiple-residence, and home), almost two-thirds of the 335 drownings happened when only the victim was present (table 4). In only six instances were lifeguards present. Many adult drownings at

transient and multiple-residence pools involved trespass, use of the pool at unauthorized hours, or party high jinks. At home pools, temporary absence of qualified adult supervision was a major factor in 174 of the 224 fatalities. Often parents or guardians had left a child unattended for only a few minutes—to check the dinner in the oven, answer the telephone, or carry on a conversation with a neighbor over the backyard fence. The importance of constant and immediate supervision is pointed up by an incident in which a toddler fell into the deep end of a club pool unseen by his father, a professional instructor, who was teaching a swimming class at the shallow end.

In nonresidential pools, 77 of the 121 fatalities occurred while a lifeguard was on duty. An even higher proportion of the drownings in public pools, 58 of 86, occurred while professional supervisors were present. Three fatalities at facilities of youth organizations occurred in camp pools. In numerous public-pool fatalities, overcrowding and murky water may have prevented the victims from being observed by the bathers about them and onlookers. The majority of drownings in public and other nonresidential pools when lifeguards were not present resulted from trespass by youths and adults when the pool was closed.

*Inadequate protection or equipment.* The inadequacy of the measures designed to prevent trespass, the complete lack of such measures,

**Table 3. Principal causes of pool fatalities**

Personal causes	Total fatalities	Proximate cause							
		Fall or slip into water	Exhaustion	Not stated	Stepped or swept into deep water	Attack of illness	Struck object	Support sank	Trapped or caught
All causes.....	484	228	85	75	51	20	15	6	4
Inadequate supervision....	226	185	8	19	9	1	3	1	0
Not stated.....	68	6	19	34	2	4	3	0	0
Nonswimmer.....	51	9	11	3	25	0	1	2	0
Trespass.....	41	17	11	5	5	0	2	1	0
Ability overestimated.....	37	0	23	3	5	2	4	0	0
Physical impairment.....	29	7	4	3	2	12	0	1	0
Disregard of warnings.....	16	2	8	2	2	0	2	0	0
Uninformed of hazard.....	10	1	0	2	1	1	0	1	4
Possible suicide.....	5	1	1	3	0	0	0	0	0
Possible homicide.....	1	0	0	1	0	0	0	0	0

**Table 4. Persons present at drownings, by kind of pool and school or occupation of victim**

Kind of pool <sup>1</sup> and victim's status	Total victims	Person present (highest level of supervision)					Not stated
		No one	Child	Youth	Adult	Life-guard <sup>2</sup>	
All pools and occupations.....	484	250	64	17	50	85	18
<i>Status</i>							
Preschool child.....	223	157	35	2	12	8	9
Student <sup>3</sup> .....	156	31	25	12	16	65	7
Nonprofessional.....	29	15	1	1	7	5	0
Status not reported.....	29	17	1	1	6	3	1
Housewife.....	17	13	2	0	2	0	0
Patient or inmate.....	10	3	0	0	3	4	0
Professional or administrative.....	9	5	0	1	3	0	0
Retired.....	9	8	0	0	1	0	0
U.S. serviceman <sup>4</sup> .....	2	1	0	0	0	0	1
<i>Pool <sup>1</sup></i>							
Home wading and swimming.....	230	155	42	8	16	0	9
Permanent inground.....	190	130	36	5	13	0	6
Portable onsurface.....	34	23	6	2	3	0	0
Kind not specified.....	6	2	0	1	0	0	3
Transient and multiple residence.....	105	59	13	5	22	6	0
Hotel or motel.....	53	26	2	4	16	5	0
Apartment or condominium.....	52	33	11	1	6	1	0
Public.....	86	15	5	1	5	58	2
Decorative and fish.....	17	12	1	1	2	0	1
Group private <sup>5</sup> .....	14	2	1	1	3	7	0
Youth or athletic organization.....	13	2	2	0	0	8	1
School.....	8	3	0	0	0	4	1

<sup>1</sup> Total for pools does not add to 484 because category of 11 pools was not specified.

<sup>2</sup> Including swimming teacher or coach.

<sup>3</sup> Ages 13 through 20 years.

<sup>4</sup> Not in combat.

<sup>5</sup> Country club, swim club, or other club with private membership.

or defects in the facility or equipment contributed to more than half of all pool fatalities. Absence of surrounding walls and fences or dependence on walls and fences of inadequate design and construction, together with failures to latch or lock doors and gates securely after use, contributed to 249 pool fatalities, or more than half of the 484 in 1965.

Protection from trespass was particularly poor at residential pools of all categories and contributed to 221 of the 335 fatalities at such facilities. The failure of owners to erect and maintain adequate protective barriers from the time of excavation of the pool and to inspect them frequently, especially after severe storms and during the winter months, enabled many children to enter pool areas and to drown while playing around the water. In some instances, small children were able to crawl under fences which had not been built into the ground or

could enter the area through depressions made by animals or rainwater or where sections of a fence were blown down during storms. In nonresidential pools, 10.7 percent of the fatalities were related to inadequate barriers; in fish and decorative pools, 76.5 percent, and in pools type not stated, 18.2 percent (table 5).

Fences constructed of unsuitable materials provided children hand- and footholds, which often enabled very small youngsters to scale them easily.

A particular hazard was found to exist where a home or other building served as a side of the pool enclosure and had sliding or swinging doors which youngsters could open and thereby reach the pool. In many drownings, the absence of self-latching gates and the failure of the previous pool users to lock the gate or door securely led to tragedy. One new pool owner found that her youngster had drowned because she and the

builder had returned to the house and left the gate unfastened. In a few cases, small children were able to enter a pool, including those of on-ground portable construction, by climbing on a chair, other furniture, or on the equipment for water recirculation.

A variety of defects in equipment and the pool facility resulted in fatalities. Most frequent were abruptly changing bottom slopes and slippery bottoms, particularly in pools where no surface float lines were provided. One teenage girl drowned in a puddle of water at the bottom drain—the only water in an otherwise empty pool. While cleaning the bottom of the pool, she slipped and struck her head against the end wall.

Three victims were reported to have been electrocuted by short-circuited underwater lights or other electrical devices. Four victims lost their lives by being entrapped under water in drains and other obstructions. One nighttime tragedy might have been averted had a burned-out underwater lamp been replaced so that the victim could have been seen.

In an unusual fatal accident, a toddler fell into accumulated rainwater while bouncing in the middle of a so-called protective pool cover.

A number of fatalities resulted from the victims striking their heads on pool walls or bottoms while diving in pools where they did not realize the depths or these were not indicated.

*Discovery, retrieval, and revival efforts.* Discovery that a person was missing or had disappeared and his subsequent retrieval usually took place within an hour (table 6)—but too late for revival efforts to be successful. The first person to become aware of the accident and to retrieve the victim was most frequently a family member; next in frequency were other adults and neighbors. In nighttime incidents, particularly where there were no floodlights, and also in some wintertime accidents when victims fell through ice-covered pools, retrieval often was accomplished much later and by rescue squads, including scuba divers in five instances.

Use of rescue equipment, such as poles, heaving lines, and ring buoys, was not mentioned in the account of any incident studied. This failure to mention such equipment may point to the lack of emergency equipment or the failure to use it because of panic or lack of knowledge. In the

**Table 5. Pool fatalities in which inadequate barriers were apparently factors**

Kind of pool	Fatalities	Inadequate barriers
All categories.....	484	249
Residential.....	335	221
Transient (motel, hotel).....	53	25
Multiple-residence.....	52	25
Private home.....	230	171
Inground.....	190	144
Onsurface.....	34	25
Not stated.....	6	2
Nonresidential.....	121	13
Group, private.....	14	3
Youth and athletic organizations.....	13	2
Schools.....	8	0
Public.....	86	8
Fish or decorative.....	17	13
Others, not stated.....	11	2

majority of instances, however, no one was present to use lifesaving devices had they been available. Likewise, no mention was made in any incident of alarm devices for alerting other persons that an unauthorized person was in the pool.

In a surprising number, 50 of the 484 drownings, no attempt to revive the victim was reported, possibly because of delays in discovery of the incident and in retrieval of the victim (table 7). Where a resuscitation effort was reported, the type usually was not specified. When the method was mentioned, it was most frequently the mouth-to-mouth technique. Mechanical devices brought to the scene by rescue squads and ambulances usually included resuscitators or inhalators.

### Observations and Recommendations

The circumstances surrounding many of the 1965 drownings suggest steps that might have been taken to prevent them. There are a number of positive measures and activities which persons, State and local health departments, and other concerned groups should institute to help prevent pool accidents. Purity of swimming pool water and sanitation have been traditional responsibilities of health departments, but the departments have long neglected the implementation of services to provide the standards, in-



struction, inspection, and advice that will help prevent fatalities and injuries at pools. Yet it is evident that accidents in swimming, wading, and other types of pools contribute to needless loss of life. Further, persons under 20 years of age represent 80 percent of the victims and the major target group for prevention programs (in the under-20 group, particular attention needs to be directed to children under 5). Among the various kinds of pools, those at residential facilities—particularly at homes—should be the major target. No argument about invasion of privacy seems a justifiable excuse for the owner of a home pool to fail to make it comply with established or recommended safety standards. A man's home may be his castle, but when it poses a threat to the well-being of the neigh-

borhood children, it becomes a community concern.

No single action, of course, will prevent all pool fatalities or all injuries. Yet, two measures—enforced by mandate if necessary—could prevent as many as half of the drownings, namely, competent adult supervision while the pool is in use and adequate enclosure to prevent or discourage trespass when it is not. The number of deaths could be further reduced if a concerted effort was made to orient pool owners and users to accepted safety practices, to provide owners with the essential knowledge and skills for safe operation, and to instruct all persons, but particularly youngsters, in water-survival skills and emergency procedures.

**Table 6. Discovery of incident and retrieval of victim**

Person discovering or retrieving victim	Minutes between incident and discovery <sup>1</sup>					Minutes between discovery and retrieval				
	Total	0-15	16-30	Over 30	Not stated	Total	0-15	16-30	Over 30	Not stated
All persons .....	484	171	30	76	207	484	170	48	103	163
Family member .....	187	70	18	34	65	165	77	19	26	43
Bystander or passerby .....	115	27	4	25	59	126	41	20	26	39
Playmate or companion .....	87	54	6	4	23	15	7	2	4	2
Not stated .....	63	4	1	7	51	77	5	1	12	59
Lifeguard <sup>2</sup> .....	23	16	1	3	3	62	39	3	7	13
Other .....	9	0	0	3	6	2	0	0	1	0
Rescue squad <sup>3</sup> .....	0	0	0	0	0	37	1	3	27	6

<sup>1</sup> From time victim was noticed to be missing or to have disappeared.

<sup>2</sup> Including swimming teacher or coach.

<sup>3</sup> Includes 5 recoveries by scuba divers.

**Table 7. Revival effort and person administering it**

Person administering	Total 1965 fatalities	Artificial respiration method <sup>1</sup>			
		Manual and mouth-to-mouth	Not specified	Mechanical device	Cardiopulmonary resuscitation
Total .....	484	163	132	55	3
Not stated .....	146	2	12	1	0
Ambulance or rescue squad .....	135	31	50	53	1
Bystander or passerby .....	76	47	29	0	0
Family member .....	64	39	25	0	0
Lifeguard .....	60	42	15	1	2
Companion .....	3	2	1	0	0

<sup>1</sup> Highest level used. In 50 drownings no artificial respiration was administered; in 81 others the method used was not stated.

*Supervision.* Competent adult supervision is essential to prevent accidents. Leaving children temporarily unattended contributes to more drownings than any other single cause. Even a child of 2 years quickly learns that a pool, unlike a muddy pond, is intended only for fun. A wading or swimming pool is a magnet to any youngster. It must be impressed upon parents, guardians, babysitters, and the young adults who soon will become heads of their own families that children can never be left alone near water, even for one minute.

Provision of professional lifeguards should be mandatory at all pools other than those at private residences. The 1965 average of two fatalities weekly in pools at transient and multiple residences points up this need. A manager of a facility seldom has time to constantly watch over a pool, and supervision must be competent and constant. Adults responsible for youngsters at a pool need to realize that the mere presence of a lifeguard does not relieve them of their individual responsibilities. Two sisters, aged 9 and 11, drowned in Massachusetts while other bathers were nearby in the water and 50 others were at poolside.

Mere presence of lifeguards will not provide adequate pool protection. The fact that 56 of the 86 drownings in public pools in 1965 occurred while a lifeguard was present suggests a need for reevaluation of what the permissible ratios for swimmers to lifeguards and swimmers to pool size should be. Overcrowded pools may indicate a need for public support for additional community facilities. Overcrowding in municipal pools is believed to have contributed to the murkiness of the waters and therefore to have made it easier for victims to drown unnoticed.

An American National Red Cross study of water accident victims who were revived has disclosed that, unfortunately, drowning persons seldom cry out or thrash about, as popularly believed. They are more likely to sink quietly under the surface. Thus, a kind of sixth sense of observation is fundamental to drowning prevention, but it is a difficult skill to teach lifeguards. Pool management must share with the lifeguards responsibility for protection against drownings in crowded pools. Obviously, lifeguards should not have duties such

as rental of chairs and umbrellas if these will detract from their main function of guarding lives. Salaries need to be high enough to insure the selection of well-trained guards of mature personality. Persons with Red Cross, YMCA, Boy Scouts of America, or equivalent lifesaving certification need additional training for these responsibilities and duties, as is advocated by the Council for National Cooperation in Aquatics and its affiliated organizations. Many municipalities will undoubtedly in the future enact more restrictive requirements for lifeguard eligibility, certification, and licensing.

*Barriers against trespass.* Properly designed and constructed barriers to help prevent trespass of the pool area when the facility is not in use represent the first line of defense against human error—such as breakdown in adult supervision. Admittedly, no fence or wall should be expected to stop all trespassers. Properly designed fences, however, can keep small children out and make trespass by older children more difficult. They need not be unattractive. Such barriers may be supplemented by devices for detection of trespass, such as alarms, and also by pool covers. These devices, however, should never be regarded as substitutes for walls or fences.

The following guidelines for construction of a fence or wall around a pool are suggested:

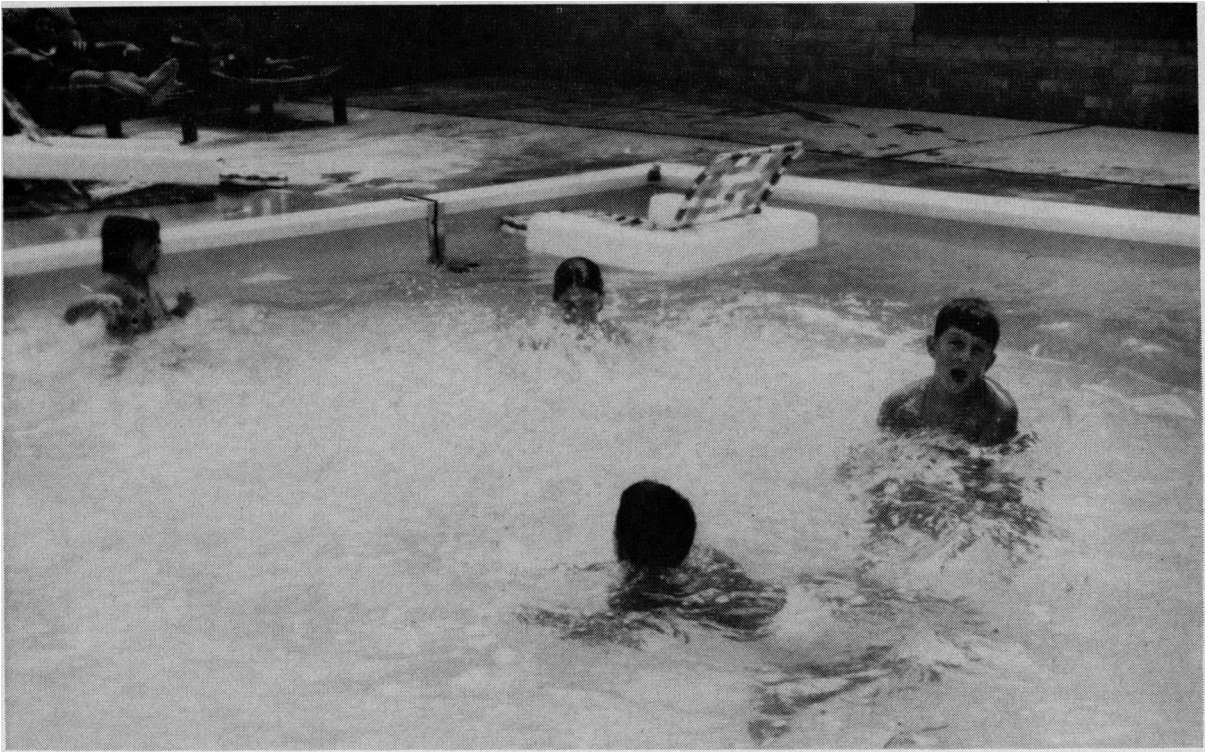
1. The fence should be erected as soon as pool excavation and construction equipment is brought to the site. (A number of the 1965 drownings occurred when children fell into water-filled excavations.)

2. The barrier should be built into the ground, as well as above it, so that children cannot enter through depressions made by rain-water or animals.

3. The barrier should be of sufficient height—recommended minimum 6 feet—so that a youngster cannot grasp the top by reaching or jumping.

4. To eliminate external footholds and handholds, the wall should be constructed of materials such as vertical boards; all braces and frames on the wall should be on the pool side.

5. Basket weave, split-rail, and other decorative fences which children can climb as easily as a ladder should be avoided. Chain-link fence



—National Swimming Pool Institute photograph

ing, which is also easy for small children to climb, should be topped with outward curving or angular barriers.

6. Self-closing and self-latching gates or doors, with the mechanism out of reach of children, should be used.

7. The gate should be locked when the pool is not in use. Combination padlocks will enable informed neighbors to enter in an emergency.

8. The sides of pool enclosures facing homes or other buildings should permit a full view of the entire pool area. On the other sides, periodic vertical gaps, not to exceed an inch in width, are recommended. Drownings have been averted because a passerby happened to notice someone in difficulty in a pool.

9. Because several children drowned after entering a pool area through a door or window of a poolside wall of a home, residence wall should not be used as sides for pool enclosures.

10. Overhanging trees or foliage should be trimmed, both for visibility and to avoid the possibility of someone's unauthorized entry by dropping into the enclosure.

11. Onsurface portable pools with smooth walls may be protected by extending the sides

upward to a height of at least 6 feet with safe types of fencing. Ladders should be securely stored whenever a pool is not supervised unless the ladder is one that swings into place as part of the fence. Furniture and other objects should be removed from the area if they could be used as a means of access.

12. Plastic wading pools may be enclosed with fencing erected on posts or pipe stakes and the opening secured when pool is not in use. Unprotected pools should be dumped and turned upside down following each use.

Automatic alarms to warn of unauthorized pool use can provide supplementary protection. Prices of recently marketed devices are reasonable and increasingly "fail-safe." The person responsible, however, may fail to activate the device following some period of pool use. Also, the device needs to be inspected at frequent intervals. Moreover, during unusual weather or when the residents are temporarily absent, the device may fail to alert anyone. An alarm, therefore, cannot replace a good barrier.

A pool cover, in addition to being essential for water cleanliness during extended periods when the pool is not in use, also serves as a sup-

plementary protection against trespass. Imperious covers, however, which may collect rainwater and become hazards themselves, should be avoided. The tendency to forego putting on the cover during brief periods of nonuse also detracts from its protective value.

Some pool industry representatives insist that mere mention of safeguards such as barriers against trespass can kill a sale because of the fear of accidents which enters the minds of a prospective purchaser. Other representatives claim that they encounter resistance because people consider protective barriers unsightly or an unnecessary expense. The cost of effective barriers—\$400 to \$500 or more—undoubtedly has kept many people from installing them. Only 32.5 percent of all residential home pools in the country in 1965 included fencing in the original contract. Some owners, of course, have subsequently contracted for barriers or installed them themselves.

If a purchaser can afford the luxury of a pool, he should be able to underwrite the expense of safeguards. Fencing should be an integral part of pool installation. An increasing number of municipal codes and building regulations on pools, together with increasing liability suits arising out of alleged negligence, may help bring the need for adequate enclosure into clearer focus. With a positive selling approach, it would appear that pools with adequate barriers might more readily be sold. The salesman could emphasize how adequate protection will help the owner to avoid sleepless nights, needless worry over possible suits, and make premium savings possible if the owner can meet the requirements of insurance carriers. Manufacturers should provide for safe use both under normal and foreseeably unusual circumstances.

*Pools designed for safety.* The pool bottom should slope gradually. A floatline should always be provided, to serve as a lifeline and to keep weak swimmers in the shallow end. Such a line also warns of a change in pitch of the bottom; it should be located on the shallow side, at least a foot before the slope begins.

Depths should be marked on pool decks to show safe jumping and diving areas. The frequency of upper cervical neck fractures in diving accidents has been studied by Rado (5) and pointed up in a recent article by Carper (6).

Communities often are pressured to permit construction of pools which lack adequate protective features and are of insufficient dimensions for use by children and adults, nonswimmers and divers. There is a tendency to construct pools at minimum cost of a scooped-out design and having unsafe bottom slopes. The youngster who has become accustomed to the water depth and slope under the diving board in a public pool will expect to find the same approximate slope and depth at other pools. If conditions vary widely, the chance of mishap is increased.

Recessed step-holes or ladders should be located at the end of the pool for ease of entry and exit and to assist the tired swimmer.

All electrical wiring and connections, underwater lighting, and other equipment or devices should be properly grounded and frequently inspected. They should conform to the national electrical code of the National Underwriters' Laboratory. Whether or not the pool is intended for use at night, there should be a source of artificial illumination for emergencies.

Before a pool is built or purchased, the builder or buyer needs to determine the insurance required and the applicable building and zoning codes and other regulations. The suggested ordinance of the American Public Health Association (7) and the recommended standards of the National Swimming Pool Institute (8) should be considered in developing local requirements.

*Safe conduct in or near pool.* Widespread recognition and acceptance of safe practices in or near the pool would also materially assist in reducing pool accidents and fatalities. No person, regardless of athletic prowess, sex, age, or other condition, should bathe, swim, or work in, or adjacent to, the pool alone. Elderly people who may suffer from chronic illnesses, get unsteady on their feet, or be subject to fainting spells should be restrained from lone visits to a pool. A number of fatalities in ornamental and fish pools, as well as at swimming pools, could have been avoided had the victims been accompanied by another adult.

It is not known how many fatalities were an outcome of drinking, but there is sufficient evidence to show that alcohol contributed to many adult drownings associated with after-hours

parties. It should be a strict rule to swim before, never after drinking, eating, or taking drugs or medications. Measures should be instituted to discourage or prohibit poolside service of alcoholic beverages at public establishments.

In recent years, hyperventilation has been identified as one of the possible causes of drownings. Such drownings have followed displays of underwater endurance swimming for distance or for elapsed time. Such extremely hazardous contests have often claimed the lives of lifeguards, competitive swimmers, and other capable swimmers who seem to have drowned for no apparent reason (9).

Many other drownings would be avoided if people who are not competent swimmers would stay in shallow water. It would also help if everybody would avoid horseplay, ducking one another, and other antisocial acts and determine pool depths before jumping or diving into the water.

*Safe pool operation.* Knowing what to do, being practiced in doing it, and having the essential equipment at hand could help prevent many accidents from turning into tragedies. All pools should be equipped with at least basic rescue devices. A floatable shepherd's crook or a light-weight pole is an excellent lifesaving device, enabling even a nonswimmer at pool edge to pull a distressed bather to safety. Larger pools should also be equipped with heaving lines or ring buoys for throwing to victims over greater distances. Emergency instructions, protected against the weather, should be conspicuously mounted within and outside of the pool enclosure. The instructions should include the location of the nearest telephone and numbers to call in an emergency (including the local rescue or emergency squad, ambulance, physicians, and pool owner) and should list the other actions to be taken, such as basic rescue and first aid procedures.

Instances in which frantic rescuers failed to administer artificial respiration to the victim immediately, running for help first instead, show the universal need for all pool owners and pool users to be trained in the latest artificial resuscitation methods. Poolside instruction and practice in making elementary rescue and assists should be given to all pool personnel, owners, and users.

Professional lifeguards should be provided at all pools other than those at private homes. One of the most important aspects of emergency preparation, however, is the daily inspection of the facility and its enclosure and the immediate repair of anything that presents hazards.

Public health agencies should expand their co-sponsorship of clinics for owners on management and operation, conducted in conjunction with schools and colleges, the Red Cross, YM and YWCA's, and pool dealers and installers affiliated with the National Swimming Pool Institute. Successful completion of a pool-management course might well be a requisite for operators of nonresidential, transient, and multiple-residence facilities. Home-pool owners, also, should be encouraged to enroll in such courses.

Children should be taught water survival techniques and skills at as early an age as their physical and emotional maturity will permit, but they must simultaneously be made to understand their own limitations in respect to water. Children of school age should be enrolled in organized Learn-to-Swim programs offered in the community. School systems should be encouraged to take advantage of such community facilities as "Operation Waterproof 4th Grade," a project of the National Safety Council. If released time cannot be made available during the regular school day, such programs can be conducted during the summer or during holiday recesses. Water survival training should be as much a part of the elementary school curriculum as driver education is of the high school curriculum. A valuable addition to any elementary school is a simple, constant-depth pool for teaching swimming and water safety skills, possibly as part of physical education courses.

### **Conclusion**

The swimming pool has not only contributed to outstanding achievements in competitive swimming, it has also promoted physical fitness, offers therapeutic and social values, and serves as a gateway to participation in other water sports such as skin and scuba diving, boating, water skiing, fishing, and surfing.

Unfortunately, the rapid growth of swimming and wading pools seems to have outpaced people's ability to own and use them safely.

The approximately 500 pool fatalities in 1965 is of public health significance. If pool growth continues without appropriate preventive action being taken to reduce accidents and deaths, fatalities in swimming, wading, and decorative pools in the United States may possibly increase within the next 5 years to as many as 1,000 a year.

The unusual toll that swimming pool accidents take of small children, particularly in home and other types of residential pools, points to the need for concerted action by health departments and organizations concerned with water safety and drowning prevention. Convincing the guardians of children of the necessity for constant adult supervision when children are around water and persuading pool owners to provide barriers against trespass and other physical safeguards could possibly reduce the annual pool fatalities by half. Curbs on drinking before swimming, measures to prevent trespass, and the avoidance of swimming or working alone at a pool could reduce adult tragedies considerably. A combined legislative, educational, and enforcement program is needed.

As much attention needs to be given to safety in pool design, construction, and use as has heretofore been focused on the sanitation aspects of pool operation. Solving the accident problem in pools will assure that they will continue to increase and that their great health and recre-

ational potential will be realized. Part of the solution is to provide more adequate facilities and better protected ones, to teach children the rudiments of swimming and water survival at early ages as part of formal "Pools in Schools" education programs, and to conduct clinics on pool operation for both commercial and private owners and supervisors.

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### Research in Language Processes

The National Institute of Mental Health, Public Health Service, has awarded \$149,861 for the first year to the linguistics group of the Communication Sciences Center at the Massachusetts Institute of Technology. The award, which will total \$1,144,361 over 5 years, will allow the group to continue a broad program of research to increase understanding of language and the way human beings learn to use it. Research will extend from detailed study of individual languages to the nature of meaning, including studies of the understanding and development of language in individual persons.

The group will study theory of grammar to explain how children learn to speak and understand what they hear, formal languages, syntax, phonology, semantics, historical linguistics or the changes in language over a period of time, and language perception and acquisition.