

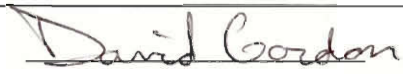

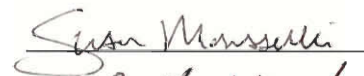

Q3B014 I
RRB-SW11-~~HE~~
47

DROWNING RISKS IN RESIDENTIAL SWIMMING POOLS

An Interactive Qualifying Project Report
Submitted to the Faculty of
WORCESTER POLYTECHNIC INSTIUTE
In partial fulfillment of the requirements for the
Degree of Bachelor of Science

Submitted to:
Professor Ronald Biederman
Professor Elise Weaver
Washington, D.C. Project Center

By:

David Gordon	
Basiliki Karachristos	
Susan Moussalli	
Robert Vlad	

December 16, 2003

In Cooperation with the
U.S. Consumer Product Safety Commission

Roy Deppa, P.E. Associate Director CRC FER Office of Compliance U.S. Consumer Product Safety Commission Washington, DC 20207-0001	Mark Kumagai Acting Director, ESME Directorate for Engineering Sciences U.S. Consumer Product Safety Commission Washington, DC 20207-0001	Debra Sweet Mathematical Statistician Directorate of Epidemiology U.S. Consumer Product Safety Commission Washington, DC 20207-0001
--	---	--

This report is submitted in partial fulfillment of the degree requirements of Worcester Polytechnic Institute. The views and opinions expressed herein are those of the authors and do not necessarily reflect the positions or opinions of the U.S. Consumer Product Safety Commission or Worcester Polytechnic Institute.

Abstract

This project was performed with the support of the Consumer Product Safety Commission (CPSC) and involved the development of effective methods to reduce drowning rates of children under five years old. We analyzed drowning prevention programs, local and national data, legislation and enforcement policies for measures of effectiveness, and innovative ideas. From this, we have specific recommendations for the CPSC to improve data collection, increase public awareness, encourage the use of built-in products, and introduce new legislation and enforcement standards.

Authorship Page

Chapter I: Executive Summary	Gordon, Karachristos, Moussalli
Chapter II: Introduction.....	Gordon and Moussalli
Chapter III: Background and Literature Review	
In-Home Drowning	Moussalli and Karachristos
Pool Drowning	Moussalli and Karachristos
Market Information	Gordon
Drowning Related Deaths by Location and Other Variables.....	
Location.....	Gordon
Hazard Pattern.....	
Existing Hazards in Residential Swimming Pools.....	Moussalli
Counter Measures.....	
Efforts of the CPSC.....	Karachristos
Safety Products on the Market	Karachristos
Supervision.....	Moussalli
Drowning Prevention Programs	
Government Laws and Building Codes for Pool Safety	Vlad
Studies Regarding the Importance of Isolation Fencing.....	Gordon
Retroactive Laws.....	Gordon
Detailed Incident Reports.....	Gordon
Inspections and Enforcement	Gordon
Concluding Remarks	Moussalli and Gordon
Chapter IV: Methodology	Moussalli
Interviews	Karachristos
Products Analysis.....	Moussalli
Analyzing Trends	Moussalli
Supervision Analysis.....	Karachristos
Case Studies	Gordon
Chapter V: Results and Conclusions.....	Moussalli
Interviews	Karachristos
Public Awareness	Karachristos
Products.....	Moussalli
Legislation.....	Gordon
Data Collection.....	Vlad
Chapter VI: Recommendations	
Interviews	Karachristos
Public Awareness	Karachristos
Products.....	Moussalli
Legislation.....	Gordon
Data Collection.....	Vlad
Chapter VII: Appendices.....	
Appendix A - Consumer Product Safety Commission.....	Moussalli
Appendix B - In-Home and Pool Drowning Deaths (Under 5).....	Moussalli

Appendix C - Number of Pools in a Variety of States (End 2002).....	Gordon
Appendix D - Number of In-Ground Pools in the US and Pool and Product Prices.	Gordon
Appendix E - Drowning Deaths and Rates by State and Age.....	Gordon
Appendix F - Drowning By Falling In: Risks and Prevention.....	Gordon and Vlad
Appendix G - Body Entrapment and Hair Entrapment.....	Moussalli and Karachristos
Appendix H - CPSC Guidelines.....	Gordon
Appendix I - Safety Products on the Market.....	Vlad and Gordon
Appendix J - Location and Supervision During Drowning Incidents.....	Gordon
Appendix K - Government Laws and Guidelines.....	Vlad and Karachristos
Appendix L - Maricopa County Drowning Incident Statistics.....	Vlad
Appendix M - Maricopa County Attributed Cause Charts.....	Gordon
Appendix N - Orange County, CA Pool Code.....	Vlad
Appendix O - Australia Guidebook for Pool Owners.....	Vlad
Appendix P - Interviews.....	Karachristos
Appendix Q - Maricopa County, AZ, Drowning Incident Report Form and Emergency Medical Services California Form.....	Vlad
Appendix R - States with Pool Codes.....	Gordon
Appendix S - Retroactive Pool Code Calculations.....	Gordon
Appendix T - CPSC Databases.....	Vlad
Appendix U - Drowning Prevention Efforts and Programs.....	Vlad
Chapter VIII: References.....	ALL

Acknowledgements

We would like to thank first and foremost our advisors and liaisons, Professor Biederman, Professor Weaver, Roy Deppa, Mark Kumagai, and Debra Sweet for their guidance and assistance throughout the course of the project.

We would also like to express our gratitude to members of the CPSC who gave us vital information throughout our seven weeks at the agency, and were always open to answering our questions.

We would like to thank members of other organizations both domestically and internationally, who have helped to make our research more thorough and complete.

Table of Contents

Abstract	i
Authorship Page	ii
Acknowledgements	iv
Table of Contents	v
Tables and Figures	vii
Chapter I: Executive Summary	1
Chapter II: Introduction.....	3
Chapter III: Background and Literature Review.....	6
In-Home Drowning	6
Pool Drowning	6
Market Information	6
Drowning Related Deaths by Location and Other Variables.....	7
Location.....	7
Hazard Pattern.....	8
Existing Hazards in Residential Swimming Pools.....	8
Counter Measures.....	9
Efforts of the CPSC.....	9
Safety Products on the Market	10
Supervision.....	10
Drowning Prevention Programs.....	11
Public Awareness and Government Laws and Building Codes.....	11
Studies Regarding the Importance of Isolation Fencing.....	12
Retroactive Laws.....	13
Detailed Incident Reports.....	13
Inspections and Enforcement	14
Background Summary.....	16
Chapter IV: Methodology	17
Interviews.....	18
Products Analysis.....	19
Analyzing Trends	20
Supervision Analysis.....	20
Case Studies	21
Chapter V: Results and Conclusions.....	23
Interviews.....	23
Public Awareness	25
Drowning Prevention Programs.....	25
Media Campaigns.....	27
Pediatricians	28
Products.....	28
Product Failure and Fencing	29
Lack of Isolation Fencing.....	30
Open/Unlocked Gates Attributed to Drowning.....	30
Legislation.....	32
Laws and Codes	32

Enforcement	35
Penalties	38
Data Collection.....	38
Summary of Findings	41
Chapter VI: Recommendations	43
Public Awareness	43
Products	44
Built-in Safety Products	45
Passive Products	45
Legislation.....	46
Laws and Codes	46
Enforcement	47
Penalties	48
Data Collection.....	48
Chapter VII: Appendices.....	51
Appendix A - Consumer Product Safety Commission.....	51
Appendix B - In-Home and Pool Drowning Deaths (Under 5).....	54
Appendix C - Number of Pools in a Variety of States (End 2002).....	55
Appendix D - Number of In-Ground Pools in the U.S and Pool and Product Prices. ..	56
Appendix E - Drowning Deaths and Rates by State and Age.....	58
Appendix F - Drowning By Falling In: Risks and Prevention.....	59
Appendix G - Body Entrapment and Hair Entanglement	61
Appendix H - CPSC Guidelines.....	65
Appendix I - Safety Products on the Market.....	66
Appendix J - Location and Supervision During Drowning Incidents	69
Appendix K - Government Laws and Guidelines	70
Appendix L - Maricopa County Drowning Incident Statistics	72
Appendix M - Maricopa County Attributed Cause Charts	74
Appendix N - Orange County, CA Pool Code	76
Appendix O - Australia Guidebook for Pool Owners	77
Appendix P - Interviews.....	78
Appendix Q - Maricopa County, AZ, Drowning Incident Report Form and Emergency Medical Services California Form	80
Appendix R - States with Pool Codes	82
Appendix S - Retroactive Pool Code Calculations	84
Appendix T - CPSC Databases	85
Appendix U - Drowning Prevention Efforts and Programs	87
Chapter VIII: References	90

Tables and Figures

Table I – Presence and Type of Fencing in Swimming Pools where Drownings in Children under Five Occurred, 1999.....	30
Table II – How Child Accessed Swimming Pools where Drownings in Children under Five Occurred, 1999.....	30
Figure 1 – Why Children Drown.....	24
Figure 2 – Where Should Efforts be Focused.....	24
Figure 3 – Tucson, Arizona Drowning Deaths Under Age of 5.....	26
Figure 4 – Total Drownings in New Zealand.....	27
Figure 5 – Number of Child Drowning Deaths in Western Australia.....	28
Figure 6 – Drowning in Queensland, Aged 0 to 4 Years, 1983-2001.....	34
Figure 7 – Child Drowning Deaths Resulting from Inadequate Fencing.....	37

Executive Summary

The Consumer Product Safety Commission (CPSC) recently made one of its ten year strategic goals the reduction of the drowning rate for children under the age of five in the United States. In the past, the CPSC has undertaken a number of strategies to reduce the frequency of drowning in residential swimming pools and in-home products with limited success. However, child drowning still remains the second leading cause of unintentional death (following motor vehicle accidents) in this age group.

Our project goal was to determine how the CPSC can strengthen their drowning prevention program in order to further reduce the rate of child drowning. Data was collected on current drowning prevention efforts from locations throughout the world through interviews, product analysis, supervision analysis, and case studies to pinpoint which areas of drowning prevention need CPSC focus. Our research was concentrated on drowning in residential in-ground swimming pools, since most drowning incidents among children under the age of five occur in these types of pools. Our research suggests that a reduction in the drowning rate of children under the age of five will occur if the CPSC implements the following recommendations.

Our research and analysis of data from Australia, New Zealand, Arizona, California, and Florida, shows that legislation could be effective in these areas. This suggests that the CPSC should draft and distribute a model retroactive pool bill that local governments can adopt and implement. In order for the laws and codes to be enforced properly, the CPSC should create a set standard for local pool inspections. Also, we recommend that a fine be issued to pool owners who do not comply with local legislation and inspection rules.

In collecting data from several counties across the country, it is clear that drowning prevention programs reduce the number of deaths that occur in residential swimming pools. We recommend that the CPSC develop and implement programs that:

- Initiate a sustained public awareness campaign.
- Develop a VHS Video/DVD distribution program.
- Present a safety course on “Pool Safety”.
- Distribute pamphlets to pediatricians.
- Broadcast frequent media campaigns.
- Require the completion of a “Pool Safety” course prior to obtaining a pool permit.

Anecdotal data from the CPSC’s databases suggests that gates and fences around swimming pools are not being locked by pool owners, and that many are defective. The Commission should promote the use of built-in barriers with passive qualities (i.e. little necessary human interaction). Also, all pool gates should be constructed to automatically close and latch, and be able to accommodate a lock.

After analyzing the data from the CPSC, it was evident that incident reports lack critical details about drowning incidents. The CPSC should conduct more In-Depth Investigations to collect details about circumstances of drowning incidents. In order to collect more data at the scene of the incident, the CPSC should develop a model incident report for local Emergency Medical Technicians and fire departments to complete at the scene of a drowning incident.

Chapter II: Introduction

Every year, more than two hundred-fifty children under the age of five drown in residential swimming pools nationwide, making drowning the second leading cause of death in this age group among unintentional injuries (following motor vehicle accidents). In addition, more than two thousand children are treated in hospital emergency rooms for submersion injuries and near-drowning incidents. These incidents include both drowning in and around the home, as well as in backyard swimming pools.

The U.S. Consumer Product Safety Commission (CPSC) has adopted several strategies to reduce the rate of child drowning. The rate of pool drownings of children under 5 has been decreasing. The rate of deaths was about 20 per million population of children in 1991 and about 16 per million in 1998. From 1998 to 2000, the drowning rate of child drowning dropped again to 12.9 per million. The CPSC has set a goal for reducing the pool-drowning rate for children under the age of 5 by ten percent in the next ten years. The pool drowning rate would be reduced to 11.6 per million children by 2013. In the early 1990's, the CPSC developed both pool entrapment guidelines and pool barrier guidelines. The CPSC has also participated in the development of voluntary standards for pool owners. Annual press releases on pool drowning hazards have been published, and a home drowning prevention campaign was launched for pool covers, pool and door alarms, residential swimming pools, suction fittings, and safety vacuum release devices. Yet, despite these efforts, child drowning still remains a leading cause of injury-related deaths.

Child drownings that occur in and around the home are generally classified as either in-home or pool drownings. In-home drownings involve products in the home

such as bathtubs and toilets. In-Home drownings accounted for approximately 30% of residential child drownings in 1999 (NEISS, 2003). Pool drownings, which occur in either in-ground or above ground swimming pools, accounted for approximately 70% of child drownings around the home (NEISS, 2003). This clearly shows that the CPSC should focus on child drowning in residential swimming pools.

Swimming pool drowning is broken down into two main categories, based on Center for Disease Control classifications:

- Drowning by falling into a swimming pool (E-Code W68).
- Drowning while in a swimming pool by complete submersion resulting from body part entrapment or hair entanglement in a drain (E-Code W67).

Currently there are several safety products on the market designed to reduce the risks of drowning in each of these categories. Products to reduce the risks of falling in are designed to be placed outside of the water, such as barriers and alarms. The prevention of drowning from entrapment requires a different set of products that focus mainly on drains and filtration systems. In all cases, the products must be properly implemented in order to work effectively.

Drowning mortality rates can be examined with respect to demographic variables, such as age, race, and gender. Other variables that can be taken into consideration include the geographic location of the incident, the type of pool in which the drowning took place, where the drowning occurred, and the level of supervision during the incident. By analyzing these variables, we can see how they relate to the actual problem of why so many children are drowning.

A comparative review of data across states is helpful in understanding what various states have done to combat drowning. For the CPSC to reduce the rate of drowning on a national level, it needs to know which states have made headway in attacking this problem. It is also important to look at the differences between the United States and other countries, to see where our drowning prevention efforts may be similar, as well as different.

The CPSC desires to find out where their resources could be most effectively spent to reduce the rate of drowning deaths in children under five years old. In order to make effective recommendations to the Commission, we focused on effective methods for reducing drowning rates in states and other countries. By analyzing these programs in a variety of areas, we decided where the CPSC should focus to most effectively achieve their goal of reducing the national drowning rate of children under the age of five.

Chapter III: Background and Literature Review

This review includes an investigation of existing hazards contributing to the drownings, the different types of drownings, current guidelines for pool products, and safety recommendations for consumers by the CPSC and other organizations.

In-Home Drowning

The primary products related to in-home drowning deaths are bathtubs, 5-gallon buckets, spas and hot tubs, and toilets. From 1996 to 1999, there were 459 reports of children under five who died from drowning in products in or around the home. Assuming that these deaths are evenly distributed by year, Table I in Appendix B presents a breakdown of deaths with respect to the products involved (Sweet, 2002).

Pool Drowning

The CPSC has record of at least 275 children who died from drowning in backyard swimming pools during the year 1999. This number is neither a statistical estimate, nor a complete count. These deaths occurred in both in-ground and above-ground pools. As seen in Table II in Appendix B, drowning deaths among children under five involving in-ground swimming pools are much more frequent than those involving other types of pools during the year 1999 (NEISS, 2003).

Market Information

By the end of the year 2002, there were 4.27 million in-ground residential swimming pools in the United States. The top four states in number of in-ground residential swimming pools were California, Florida, Texas, and Arizona. These states accounted for more than half of the in-ground swimming pools in the country. However,

only 20% of above-ground pools were located in these states (ANSI/NSPI, 2003).

Appendix C has further detail. The average life of residential in-ground swimming pools tends to be about thirty years. Using this average pool life, we can conclude that roughly 25% of existing in-ground swimming pools were built by the year 1975, before building codes were established with respect to barriers and other obstacles (Leland, 2003).

Appendix D provides further detail on the number of pools in the United States and prices of pools.

Drowning Related Deaths by Location and Other Variables

Location

Drowning rates vary between different states. There are many factors that contribute to these differences, which include climate, number of pools, population, amount of coastline, and other variables. California, Texas, Florida and Arizona have high rates of drowning deaths among children under five when compared to Georgia, Maryland, Minnesota, and Nevada (Mortality Reports, 2003). These high drowning rate states have much warmer climates, larger populations, and longer swimming seasons than the other states. Arizona does not have a coastline or many inland bodies of water. This may indicate that swimming pools are more of a factor in drowning incidents than other bodies of water in this state. Other land-locked states, such as Nevada, also do not have many bodies of water. States with a similar population to Arizona, such as Minnesota, have different climates and abundance of bodies of water. However, regardless of having similar climates or populations, Minnesota and Nevada's drowning rates are not as high as those in Arizona. Such discrepancies show that there are certain complexities that

result in similar states having significantly different drowning rates. See Appendix E for further details.

Hazard Pattern

Existing Hazards in Residential Swimming Pools

Owning a residential swimming pool presents certain drowning hazards, especially for children under the age of five. For instance, a child may easily fall into a pool if he or she has easy access to the pool area. A child may also easily gain access to the pool area when latches on pool gates are insufficient or no barriers exist between the house and the pool. Barriers around the pool area are the simplest precaution that can be taken to prevent a child from falling into a pool and drowning. Barriers fail when the latch for the gate is not sufficiently out of the reach of children, the latch itself malfunctions, or the gates are not secured. Parents may forget to lock the gate or not believe that the child will be able to reach the handle to open it (Appendix F). In addition to the risk of falling into the pool, there exists the hazard of a child's body part becoming caught in a main pool drain. This phenomenon, which is called body entrapment, occurs when a limb becomes caught in a drain cover, or the trunk of a swimmer's body covers the drain, resulting in a vacuum that holds the swimmer under water. Hair entanglement, another hazard caused by drains, occurs when a swimmer's hair becomes caught and entangled in the drain cover, causing the swimmer to become trapped underwater (Appendix G).

The National Center for Health Statistics classifies drowning deaths into two different categories; they include E-code W-67 ("Drowning and Submersion while in Swimming-pool") and E-code W-68 ("Drowning and Submersion Following Fall into

Swimming Pool”) (U.S. Department of Health and Human Services, 2002). These are new E-codes, as of 1999, that help distinguish pool drowning from drowning in other bodies of water. The new codes will help the CPSC to better count the number of pool drowning deaths each year (NCHS, 2002).

Counter Measures

Efforts of the CPSC

Prior to the 1990s, the CPSC focused their efforts towards reducing the number of child drownings primarily by addressing the aspect of supervision. Despite these efforts, the number of children drowning in swimming pools increased, and the CPSC needed to move forward with other efforts. Consequently, the Commission decided to concentrate on the environment surrounding the swimming pool. They collected data in the late 1980’s that indicated that 98% of children who drowned were seen in the home five minutes prior to their drowning, and less than 2% of the children that drowned were in a neighbor’s swimming pool. This data provided an answer for how the CPSC could address the issue. They focused primarily on barriers and obstacles for children who attempt to gain unsupervised access to the swimming pool (CPSC, 2002, “How to Plan for the Unexpected”).

The CPSC developed several barrier guidelines and model building codes in the late 1980’s to deny, delay, or detect unsupervised entry to swimming pools. These recommendations were voluntary, allowing states to decide how they wanted to implement the standards. These voluntary recommendations included: a door alarm acting as a perimeter with a three-sided fence, self-closing/self-latching doors leading to

pools, and automatic power safety covers (CPSC, 2002, “Safety Barrier Guidelines for Home Pools”).

The CPSC released a report entitled “How to Plan for the Unexpected (CPSC, 2002).” This report contains guidelines for increasing pool safety. Included in the report is a list of Rules for Pools, which highlights the major actions that should be taken by the child’s supervisor(s) to prevent a drowning incident from occurring. Some of the main guidelines to follow are listed in Appendix H.

Safety Products on the Market

There are currently many products available to consumers that are designed to reduce the risk of children falling into swimming pools. These products can be used either on their own, or as layers of protection, which create a series of obstacles designed to impede a child from accessing a pool unsupervised. Such products include barriers, pool alarms, gate alarms, door alarms, power and manual pool covers, wristbands, and other safety alarm systems. More detailed information on these products can be found in Appendix I.

Supervision

Supervision needs to be used in combination with barriers to create an obstacle for children trying to access a swimming pool. Unless a child is within visual contact of the supervisor, a barrier may be climbed over or broken into. Supervisors are less watchful and alert when children are not expected to be in the pool area. The CPSC has reported that 69% of drowning victims were not expected to be near the pool at the time of the incident. Supervision is only an effective safety measure when the supervisor is

aware of the child's situation at all times (CPSC, 2002, "How to Plan for the Unexpected"). See Appendix J for further details.

Drowning Prevention Programs

Public Awareness and Government Laws and Building Codes

States such as New Jersey, North Carolina, Pennsylvania, Florida, California and Arizona have taken action in an effort to alert their residents to the risks of drowning. New Jersey, North Carolina and Pennsylvania have made efforts to raise the awareness of pool safety. States such as Florida, California and Arizona have made further efforts to address the problem of drowning in residential swimming pools by establishing barrier requirements. For more details, see Appendix K.

Australia has taken significant action toward reducing the risk of child drowning. It has passed laws requiring fencing around public and residential pools. The Public Health Group of the Victorian State Government Department of Human Services in Australia works to improve the health and well-being of the population. It is responsible for the policy development, funding, monitoring, and legislation in relation to drowning prevention. One of its main focuses is on the regulation and setting of standards for the management of swimming pools. The Public Health Group published a pool operator's handbook, which gives advice and guidance on pool operation and water treatment for those who are involved in the pool industry. The guidebook is further described in Appendix O.

Studies Regarding the Importance of Isolation Fencing

Another group in Australia that has taken a role in reducing the risk of childhood drowning is the Public Health Association of Australia. Through their research on child drowning, they recognized that drowning is the most common cause of deaths of children ages one to four, half of whom drown in residential pools. Many of the studies that they have conducted show that the most effective way to prevent these children from drowning is for homeowners to use fencing to separate the pool from their house. The Public Health Association of Australia (PHAA) believes that fencing standards will prevent toddlers from entering swimming pools without supervision and lower the risk of drowning, providing that the barriers are installed and maintained. The PHAA also recommends that the public should be educated in the risks of child drowning. Such education should include reinforcing the importance of parental supervision and of installing and maintaining effective fencing (Public Health Association of Australia, 2002).

A recent study was conducted by the Injury Research Center in the School of Population Health, University of Western Australia, in 2002. The purpose of the study was to investigate the causes of child drowning and implement changes in legislation. The Injury Research Center recommends improvements for barriers surrounding private pools. The results of the study showed that over a period of twelve years, fifty children under the age of five drowned in private swimming pools in Western Australia. 68% of drownings occurred in pools that were not equipped with a four-sided fence (also called isolation). About two-thirds of the pools in which children drowned had a three-sided fence (also called perimeter). Perimeter fencing allows for child access to the pool area through a door or other type of direct access to the pool area (Stevenson, 2003).

Retroactive Laws

The city of Phoenix is the only area in the United States where there is a retroactive law regarding pool fencing requirements (Kerr, 2003). The city council approved the law in April of 1990. All new swimming pools constructed after May 4, 1990 would have to abide by the pool barrier code (same as Maricopa county and state code). After May 4, 1991, a barrier between the house and the pool was required on all existing and newly constructed pools that were accessible to a child under the age of six. Also, if additions or renovations were made to an existing pool in excess of a thousand dollars, the new work must comply with the barrier standards (Phoenix, 2003).

Detailed Incident Reports

The people of the state of Arizona are aware that they live in an area prone to drowning incidents, particularly swimming pool incidents. Arizona has a warm climate, prolonged swimming season, and approximately 276,000 residential swimming pools (ANSI/NSPI, 2003). Maricopa County, Arizona, keeps statistics on drowning incidents in which the fire department was called for assistance and the incident was life-threatening. Maricopa County relies on its fire departments to accurately complete a standard Report of Drowning or Near-Drowning form for every incident. These forms are sent to the Arizona Department of Health Services (ADHS), where they are received by a single person. A different person reviews the data and determines whether the incident was life-threatening, and files the report (Flood, 2003).

Through this system, Maricopa County is able to compile many different types of data from drowning and near-drowning incidents which they can examine and analyze to pinpoint major problems with pool safety. In 2002, 63% of water-related incidents

involved children under the age of five, and of those drownings, 83% occurred in swimming pools (Flood, 2003). The ADHS also uses their collection of data to examine factors and variables in different drowning incidents. See Appendix L for further information relating to these variables.

Another variable collected by the Maricopa fire departments is the attributed cause of every drowning incident. For each incident, there are six general categories of causes: no barrier, inadequate barrier, gate/latch failed, supervision problem, safety door failed, or other or unknown. These attributed causes are categorized by the time of year they occurred (cold months which are October through April, or warm months which include May through September), as well as by the result of the incident (“Normal or Unknown”, or “Died or Impaired”). It is evident that the leading cause of the incident in both the warm and cold seasons was the lack of a barrier around the pool (Flood, 2003). See Appendix M for further detail.

Inspections and Enforcement

Orange County in California has a set of guidelines for the installation of residential pools and spas. By the third of four inspections (required and completed by the county during construction), the pool or spa must have an enclosure. Refer to Appendix N for further detail. A retroactive law, which would make the code effective for all pools not just for newly constructed ones, was proposed to the county legislature. It was defeated through efforts by lobbying organizations such as realtors and pool manufacturers, who saw a threat to their customer base with the addition of such requirements (Kerr, 2003).

All domestic swimming pools in New Zealand are required to be fenced by the Fencing of Swimming Pools Act 1987. Swimming pools that were built prior to the Act are legally required to follow and meet the standards set by the Act (Hasting District Council, 2003). Ten years after the introduction of the Act, a study was conducted to identify the status of compliance and enforcement of the Act. According to the study, “Pool owner resistance was considered to be the main difficulty with enforcing the act (Morrison, 2003).” Although the Act provides a means for preventing children from drowning, its effectiveness is limited. These limitations include inconsistencies between authorities in their enforcement of particular requirements, and authorities making little attempt to locate pools or monitor compliance (Morrison, 2003).

Background Summary

After looking at the extensive background of pool hazards, we have a much better idea of where the problem with pool safety actually lies. Of course the answer is not clear. However, there are a couple areas of drowning prevention that, if effectively implemented across the country, might significantly reduce the number of child drownings in United States.

The first area of focus is barriers. Australia has focused on this subject in the past. Maricopa County in Arizona has also taken great strides towards implementing barrier codes. This particular area appears to be a major concern of leaders in the field of drowning prevention. Very few of the current building codes are retroactive, so they do not address barriers around existing swimming pools, only those around newly constructed pools. Although barriers are the most prevalent form of obstacle, other safety products are also effective when used properly. The idea of having multiple layers of protection is a system highly regarded as effective in the drowning prevention community.

The second area in need of a closer look is drowning prevention education. Places such as Australia have decided that the public should be educated in safe swimming practices and proper life saving techniques. Teaching pool owners and their children how to reduce their chances of drowning might significantly reduce the rate of drowning each year. Also, there are many drowning prevention videos and literature that may benefit pool owners if these materials were included with the purchase of new pools.

Chapter IV: Methodology

Our project goal was to determine how the Consumer Product Safety Commission could strengthen their drowning prevention program in order to further reduce the drowning rate among children under the age of five. Given the short amount of time available, we chose to focus our efforts where the largest number of child drownings occurs. Data collected from the CPSC, the Center for Disease Control, and the Arizona Department of Health Statistics have confirmed that falling into residential swimming pools is the leading cause of drowning in children under five years old.

We have collected and compiled data with respect to consumer behavior and product usage. We have also analyzed incident reports from the National Electronic Injury Surveillance System to determine which safety products consumers are using, and the level of supervision given to the child during the drowning incident. Knowing which variables had the largest impact on child drownings helped us determine what components should be emphasized in our recommendations to the Commission.

Our research also consisted of examining educational and regulatory measures taken by Arizona, Australia, and other locations with model drowning prevention programs. We have contacted public interest groups for information on drowning prevention, such as drowning data and current pool safety education programs. These groups include, but are not limited to: the Arizona Drowning Prevention Coalition, the Foundation for Aquatic Injury Prevention, the Injury Research Group of Western Australia, and New Jersey Foster Care.

Interviews

In our research, we interviewed CPSC staff members from departments such as economics, human factors, engineering and hazard analysis. These staff members showed us what efforts the CPSC has made in the past to reduce the rate of child drowning. Robert Ochsman, Head of the Division of Human Factors at the CPSC, informed us about such issues as how much supervision can be expected from a parent, and why pool owners may object to pool barriers. Other CPSC staff members include Marcia Kerr, a field investigator for the CPSC in Orange County, California, and Troy Whitfield, a mechanical engineer who was responsible for a report on pool alarms in the year 2000, and Jacqueline Elder, who is head of the office of Hazard Identification and Reduction.

Interviews were conducted with the National Spa and Pool Institute about issues their organization addresses concerning child drowning and pool safety. The NSPI is a trade organization that represents pool manufacturers and distributors in the United States. We spoke to Carvin DiGiovanni, Vice President, and Bernice Crenshaw, Standards Director and Technical Information. Ross Lister, manager of Education of NSPI of Canada provided us with information about the pool guidelines for Canada.

Manufacturers and pool companies have been able to provide us with information about technologies on the market that are used in drowning prevention. We have interviewed and sought more information from pool safety companies who produce alarms, fences, pool covers and wristbands. It was necessary to research what goes into purchasing a pool; in particular, what products or safety instructions may be included in the purchase of a new pool.

We also interviewed Linda Quan from the American Academy of Pediatrics. She has been working in the injury prevention department, particularly with drowning. She provided us with information from her publications in the Injury Prevention Journals.

Other interviewees who assisted our research included Lester Kowlasky, Aquatics Consultants, Lee Baxter, who is the former regional director of CPSC in the west coast, and Nadina Riggsbee, founder of the Drowning Prevention Foundation.

We also interviewed insurance agents for information on the feasibility of insurance companies giving homeowners with pools an incentive for taking certain pool safety precautions (i.e. discount on homeowner's insurance). Christos Satrazemis from Lamburt Corporation provided us with information on home owners insurance such as prices with or without a pool.

Product Analysis

In order to understand what the pool industry and the CPSC can do to make residential swimming pools safer, we examined the existing products developed to reduce the risk of drowning. This examination was accomplished by collecting data through interviews and through the databases in the National Electronic Injury Surveillance System (NEISS). The Injury and Potential Injury Incident file database (IPII) contains incident reports of drownings and near-drownings that the CPSC has recorded. We studied a total of 41 incident reports for children under the age of five who drowned in 1999. These reports showed us which products were present during most drowning incidents, the type of fencing surrounding the pool in question, and how the child had accessed the pool.

Analyzing Trends

The ideal method to determine the effectiveness of individual pool safety products is to collect statistics on the drowning rates before and after each product was released into the market. However, pools and pool safety products phase in and out over a number of years, which is a result of long pool life. In many cases pools last up to three decades. Thus, the time period we would need to look at before and after each product's introduction would not be an accurate indicator of the product's effectiveness. Therefore, we looked at trends in drowning rates among locations with new laws regarding types of fencing, and gates. In analyzing these statistics, we identified the types of products that were associated with reducing drowning rates most dramatically after they were released onto the market. With these products identified, the CPSC will know what measures it should take to make these particular products more widely used.

Are isolation fences and gates with secure latches actually being purchased and used properly by consumers? If these products were not, then there is a need to make the public aware of the risk of drowning and the steps they could take to prevent their child from drowning.

Supervision Analysis

Pool owners need to be fully aware of pool safety guidelines for actions in and around pools. If supervision is neglected, a lack of consumer and child education in drowning prevention may be a substantial cause of child drowning in a drowning incident.

For a child to drown by accident, it is likely that no one was watching the child while he or she drowned. To address this issue, we looked at available cases of drowning

incidents. It is important to know who was responsible for watching the child at the time of the incident (i.e. parent, babysitter, sibling, neighbor, etc.). Perhaps more importantly, it is necessary to evaluate exactly what a parent is capable of in terms of attentiveness for prolonged periods of time and their awareness of drowning risks. By looking at this information, we determined what steps can be taken to improve supervision of children in and around residential swimming pools.

For each drowning incident we looked at, we examined the specific aspects and data provided in each case. Although data on specific incidents are hard to find, we used whatever information the CPSC and other organizations have collected. The data we looked for included such factors as safety products put in place and safety precautions pool owners might have taken to prevent an incident from occurring. Knowing what precautions are most effective helped us make recommendations of what should be emphasized most in a drowning prevention education program.

Case Studies

The United States, as a whole, is not currently as far ahead in the field of effective drowning prevention as other countries. For us to see what kind of drowning prevention programs work well, we examined a number of case studies, including those of Western Australia and Maricopa County, Arizona. Also, a number of public interest groups have recommendations regarding the types of pool safety products that should be used in or around certain types of pools. States such as California, Florida, and Arizona require barriers of different specifications to be built, or other safety measures to be taken, when a pool is installed. Maricopa County, Arizona, is known by many in the drowning prevention community for keeping the best statistics in the country on drowning

incidents. We used some of their data collection methods to model a nationwide system of compiling drowning data.

A thorough examination and analysis of the effectiveness of the pool drowning prevention programs in the different case studies we look at will help us make good recommendations to the CPSC. After analyzing the case studies we found what programs were effective, as well as which ones needed improvement or had serious flaws. We can use elements of the effective drowning prevention programs to advise the CPSC where they should revamp their own program.

Chapter V: Results & Conclusions

The interviews with CPSC staff members and public interest groups, and reviews of data from NEISS, the Center for Disease Control and Arizona Department of Health Statistics revealed valuable information to assist in improving the Commission's current drowning prevention program. In this section we present the results from our studies in consumer behavior, product usage, and drowning prevention programs in locations such as Arizona, Australia, and New Zealand.

Interviews

Interviews provided us with information regarding child drowning in residential swimming pools. Each individual has previously worked with drowning and was able to provide us with background information. The interviewees also provided recommendations on where they would like to see the CPSC focus their efforts.

The common questions that were asked to all the interviewees included: Why do you think most child drownings occur?; What has your department/organization done to address the issue of child drowning?; and Where do you feel the CPSC should focus their efforts of reducing the rate of child drowning? The majority of experts that we interviewed attribute the main cause of drowning to a lack of barriers and a lack of supervision (see Figure 1). Figure 2 indicates that most experts believe the CPSC should focus its efforts on public awareness. See Appendix P for more detailed information on the interviews.

Figure 1

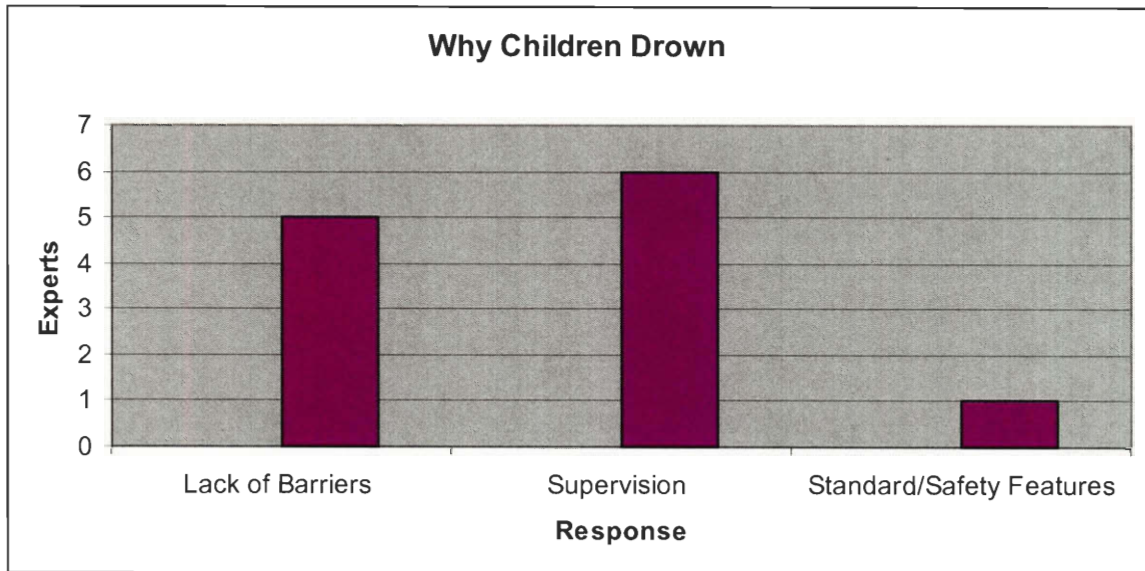
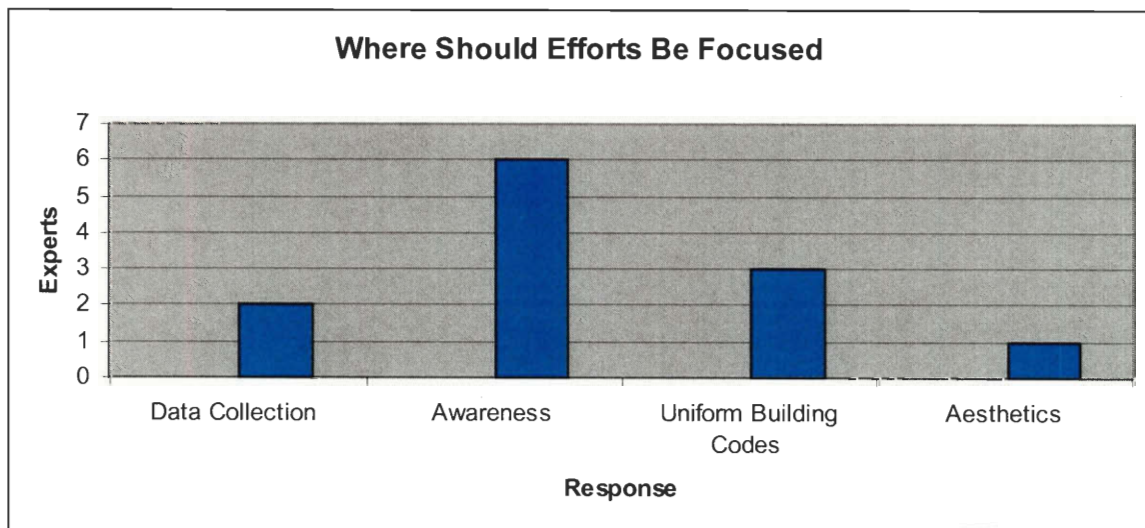


Figure 2



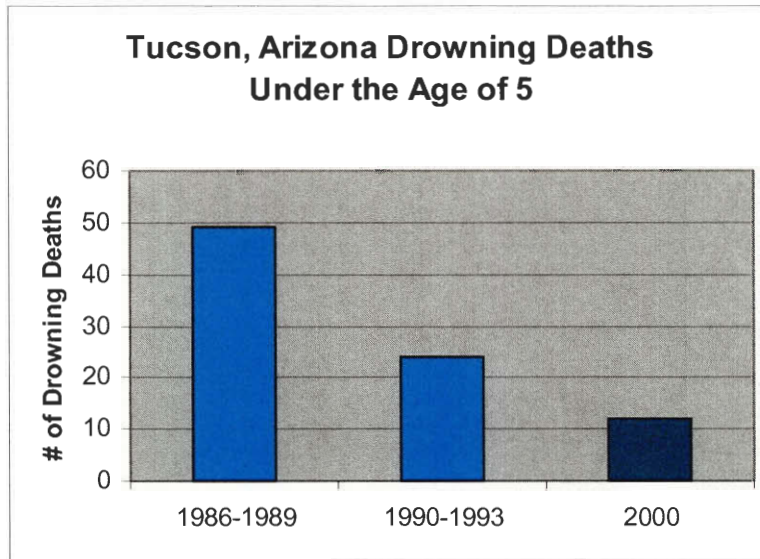
Public Awareness

A few areas across the country have set up drowning prevention programs to increase public awareness about the dangers of children playing near swimming pools. These drowning prevention programs were developed by local fire departments, hospitals, legislators, media, physicians, courts and others. In collecting data from various counties across the country, it is evident that drowning prevention programs reduce the number of deaths that occur in residential swimming pools.

Drowning Prevention Programs

In 1990 the Tucson, Arizona, emergency medical and fire services formed a coalition with other communities to develop a drowning prevention program. They worked with local citizens, hospitals, media, physicians, courts and other valued partners to create and implement a community program. The program was a combination of a public awareness campaign, changes to school curricula and multimedia presentations to the community. As shown in Figure 3, in Tucson, between 1986 and 1989 (prior to the drowning prevention program), there were 49 deaths from drowning; between 1990 and 1993 there were 24 deaths from drowning. The drowning prevention program in Tucson, Arizona reduced the drowning death rate by half after it was implemented. The number of drowning deaths continued to drop through the year 2000.

Figure 3



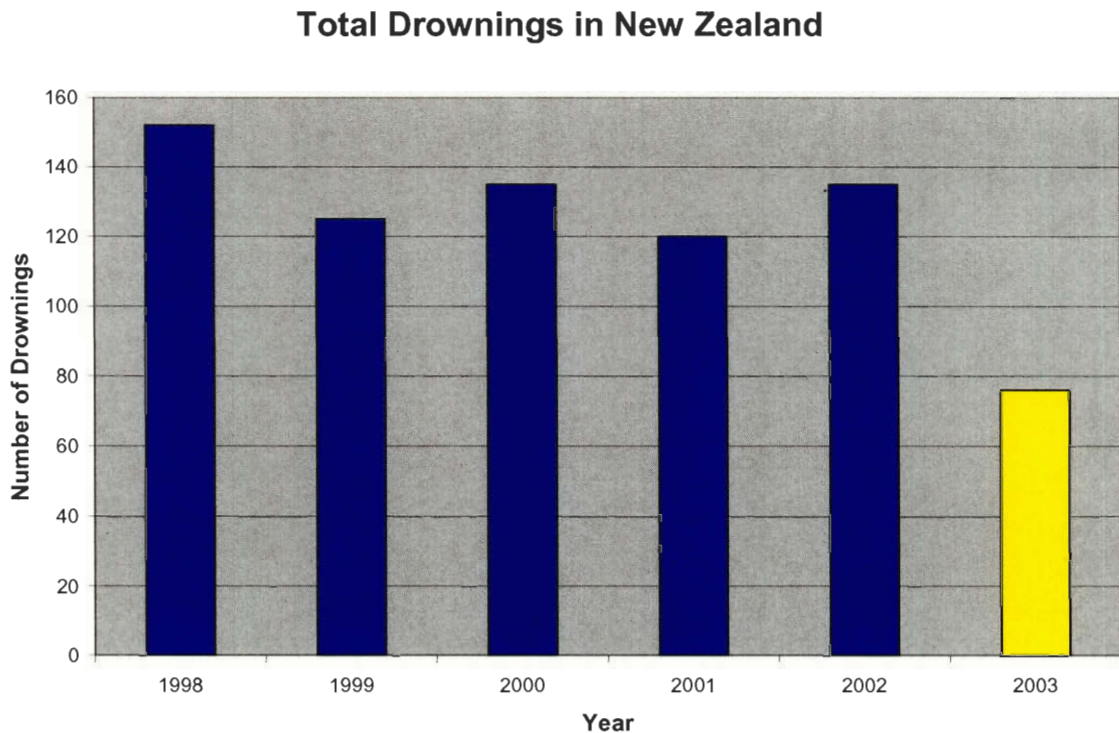
(Community Partnerships, 2003)

To address the drowning problem in West Covina, California, the Covina Fire Department created the SEALS program (Safety Education Aquatic Life Safety) in collaboration with Citrus Valley Health Partners, the West Covina Lions, Boy Scouts, and WCCT Channel 56. This drowning prevention program includes inspections, CPR and swimming lessons, and equipment loans to reduce the risk of drowning in backyard swimming pools. Through an application, pool owners may request financial help in the installation of fencing, pool alarm systems, self-closing self-latching gates, locks for sliding doors and other safety equipment. Since the program was established, there has been a 75% reduction of drowning incidents (West Covina Fire Department, 2003).

New Zealand has been promoting a water safety organization program for the year 2003. As shown in Figure 4, there have been fewer drowning deaths in 2003 than in the previous years. Over the past five years there has been an average of ten deaths

among children under the age of five. In 2003, so far, there has been half that number of drowning deaths (Muir, 2003).

Figure 4



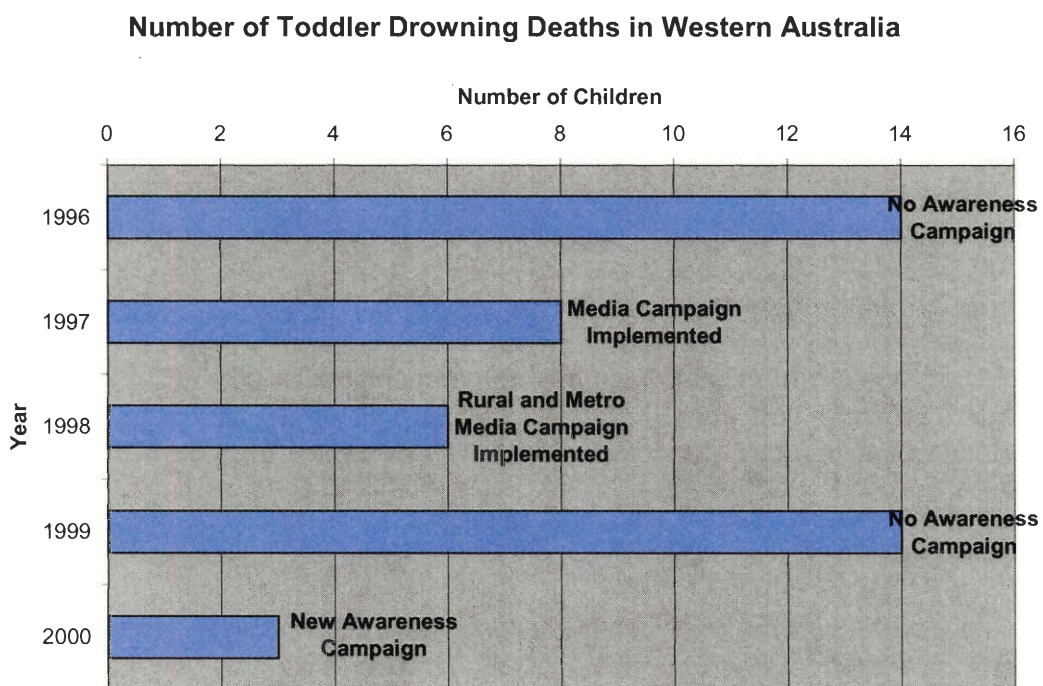
(Muir, 2003)

Media Campaigns

A study conducted in Western Australia indicates that public awareness reduces the number of child drownings. Over the last decade The Health Department of Western Australia has worked to improve the awareness level of its residents. In 1996, when there was no media campaign to raise awareness on the issue of child drowning, there were fourteen toddler drowning deaths. When a media campaign was implemented the following year, the number of deaths decreased to eight. The decrease continued through 1998 with increased media campaigns. In 1999 there was no awareness campaign and the number of drowning deaths increased to fourteen. The following year, a new

awareness campaign was introduced, and the number of toddler drowning deaths decreased to three (Tate, 2000). The graph below (Figure 5) displays the trends in drowning deaths over this time span, showing the effectiveness of the media campaigns in Western Australia. This study reveals that public awareness for risks of residential swimming pools reduces the number of drowning deaths. Public education can help increase the awareness for drowning prevention programs and reduce the number of residential swimming pool drownings.

Figure 5



(Tate, 2000)

Pediatricians

Pediatricians play a significant role in educating parents on the issue of child drowning. Studies reveal that pediatricians are a good source for making the public aware of the risks associated with backyard swimming pools.

The survey *Water Safety Advice Varies With Child's Age* found that eight out of ten pediatricians routinely discuss drowning prevention with parents of toddlers one to four years old. The survey also revealed that most pediatricians attribute the drowning-related incidents they have treated to a lack of supervision (American Academy of Pediatrics, 2003).

The Pediatric Injury Mortality Report in Los Angeles County, California, found that drowning prevention efforts should be directed at care givers of children and owners of residential pools in order to reduce the risk of children drowning in residential swimming pools. The 1990-1994 rates for drowning deaths were lower than the average annual mortality rate of 1989-1990 in the Los Angeles County after the drowning prevention program was implemented. The study found that increasing awareness of drowning risks makes parents more vigilant of risks associated with residential swimming pools (Pediatric Injury Mortality Report: Drowning, 1994).

Products

We studied 41 incident reports from the year 1999 using the Injury and Potential Injury (IPII) file database. These reports contain anecdotal data. Of these, information on the type of fencing (see Table I) was available for 23 reports, and information on how the child access the pool area (see Table II) was available for 29 reports.

Table I. Presence and Type of Fencing in Swimming Pools where Drownings in Children under Five Occurred, 1999*

Presence and type of fencing	Number of Pools
Perimeter or Three-sided fencing in place <i>(barriers that fence the pool in and keep trespassers out)</i>	10
No fence in place	8
Four-sided fencing in place (also known as isolation fencing) <i>(encloses the pool on all four sides providing a static physical access barrier between the house and the pool)</i>	5
Fence in disrepair (defective gate)	1

Table II. How Child Accessed Swimming Pools where Drownings in Children under Five Occurred, 1999*

How access was gained	Number of Pools
No fence, no separate fence, or fence in disrepair	8
Open/unlocked gate or ineffective gate latch	7
Access directly from house	6
Ladder to above-ground pool left down	3
Child known or allowed to be in pool area	3
Climbed over fence, gate, or side of the pool	2

*Drowning deaths as reported to CSPC's databases.

Product Failure and Fencing

In Table I, the three categories of fencing that are of interest are *Three-sided fences/Perimeter fences*, *No fences*, and *Four-sided fences*. We found that of these 23 pools where drownings occurred, only 5 occurred in pools that had four-sided fencing in place. For the pools enclosed by three-sided/perimeter fencing or no fencing at all, the

barriers will always fail to keep children residing in the pool owning household out of the pool area. This is because three-sided fencing and no fencing is designed to keep neighbors out, and does not restrict access to residents of the pool owning household. These types of barriers that allow children access (see Table II) have accounted for the majority of pool drownings in Table I.

Lack of Isolation Fencing

Our observations with respect to consumers neglecting to use four-sided fencing are consistent with that of Garen J. Wintemute and Mona A. Wright from the University of California. In a survey of 795 pool-owning households regarding their attitude towards an isolation fencing requirement, only 39% of respondents were in favor of a requirement that barriers be placed around all pools. However, only 35% of respondents who endorsed a complete barrier requirement for all pools actually had a fence surrounding their own pool (Wintemute, 1991). The proportion of the pool-owning population endorsing these risk reduction behaviors is substantially larger than the proportion actually adopting them. These results suggest that pool owners are not likely to voluntarily fence their pool with isolation fencing, and that there is a need to remove the option of purchasing a barrier by including barriers with pool installments. With pool barriers being only an option, consumers are less likely to purchase barriers.

Open/Unlocked Gates attributed to drowning

In all of the incidents where the recommended four-sided fencing was in place, unaided access to the pool area was attributed to open or unlocked gates. These data

suggest that had these gates been closed or locked, the four-sided barrier would have prevented the child from accessing the swimming pool.

In addition to the CPSC data, a study in done by the University of Western Australia has also confirmed that drownings can occur in four-sided barrier equipped swimming pools where gates are being left open or unlocked. During a 12 year observational period (1988 – 2000), 50 children younger than 5 years old drowned in private swimming pools in Western Australia, with an overall rate of drowning of 4.4 per 100,000 children per year. Of these, 30% occurred in pools with four-sided fencing but open or unlocked gates. Had the gates been closed or locked, those 30% of children who drowned in pools enclosed by four-sided fencing would not have gained access through the fence. However, closing and locking gates require user intervention, which is not always guaranteed. Consequently, we conclude that passive technology is necessary for pool gates because it eliminates the responsibility of the user. So, provided that the gate is not defective, it would always close and lock automatically.

Legislation

Laws and Codes

Legislation has been used in an attempt to decrease the rate of child drowning in different locations. Most places have similar laws and codes in place, often with minor discrepancies. The locations that provided us with the most relevant results were Australia, New Zealand, and states within the US such as Arizona, California, and Florida.

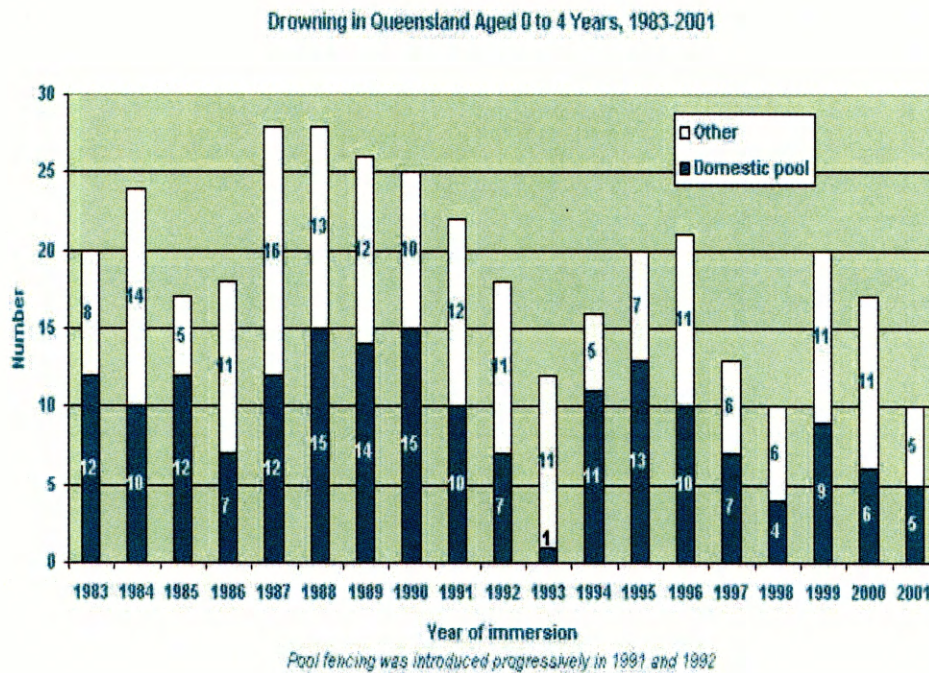
Legislation concerning pool building codes in Queensland, Australia, began in

1991. Since then, their codes have evolved into the current Building Amendment Bill 2003. Their current bill is retroactive, and requires new pools to have isolation fencing surrounding the pool area; however, existing pools only need a three-sided fence, provided that all doors and windows leading to the pool area have alarms and locks. This legislation has been responsible for cutting the number of child drowning in residential pools in half over the last twelve years. This was accomplished despite the fact that the number of pools in Queensland has more than doubled since 1991 (Jarred, 2003).

A study done in Australia in 1997 shows that four-sided fencing around a swimming pool, as opposed to three-sided fencing or no fencing, can reduce drowning of children under five by approximately 75% (Pitt WR, 1991).

The number of child drownings in Queensland, Australia, has significantly decreased in the time following the passing of legislation in 1991-1992 that requires isolation fencing around newly constructed pools (The State of Queensland, 2003). Figure 6 shows the effect of this legislation. The number of drownings decreased significantly in 1993, but rose again afterwards. This was a result of the legislation not being retroactive at that time. It became retroactive in 1996, which shows why the numbers continue to decrease after that year.

Figure 6



(Jarred, 2003)

Some pool building codes require that every new pool fence be equipped with a self-closing, self-latching gate. A study conducted with a large, well-defined, urban population with a high pool ownership, concluded that fencing effectiveness can be improved with compliance with local gate closure requirements (Pitt WR, 1991).

The effectiveness of these barriers and gates lead us to conclude that a four-sided barrier between the house and the pool, fitted with a self-closing, self-latching gate, is necessary. Currently, most legislation only requires three-sided fencing around the pool, which is not ample protection against children accessing the pool area unattended.

Another aspect of legislation is whether it is just prospective, or also retroactive. Almost all current codes and laws cover only newly constructed swimming pools.

However, current legislation ignores most of the pools in the United States. Last year, approximately 161,000 in-ground pools were constructed in the United States. At the same time there were already four and a half million in-ground swimming pools already in existence. By looking at what year twenty different building codes were introduced in twenty different states, counties, and cities, we can estimate that most local legislation was introduced around 1994 (Appendix R). By assuming that roughly the same numbers of in-ground pools are constructed every year, current legislation has affected a mere 30% of in-ground residential swimming pools. Only retroactive laws can apply to the remaining 70% of residential in-ground swimming pools.

Retroactive legislation applies to nearly three times more pools than prospective legislation. Such legislation, applied to the United States, would have a dramatic effect on decreasing the nationwide rate of child drowning in residential swimming pools.

Enforcement

Legislation can be ignored and ineffective if it is not enforced. Only about a quarter of the studies on pool drowning we examined addressed the issue of code or law enforcement. Of the studies that address enforcement, inspections and penalties for non-compliance with local codes and laws are the most widely used methods of enforcing pool safety requirements.

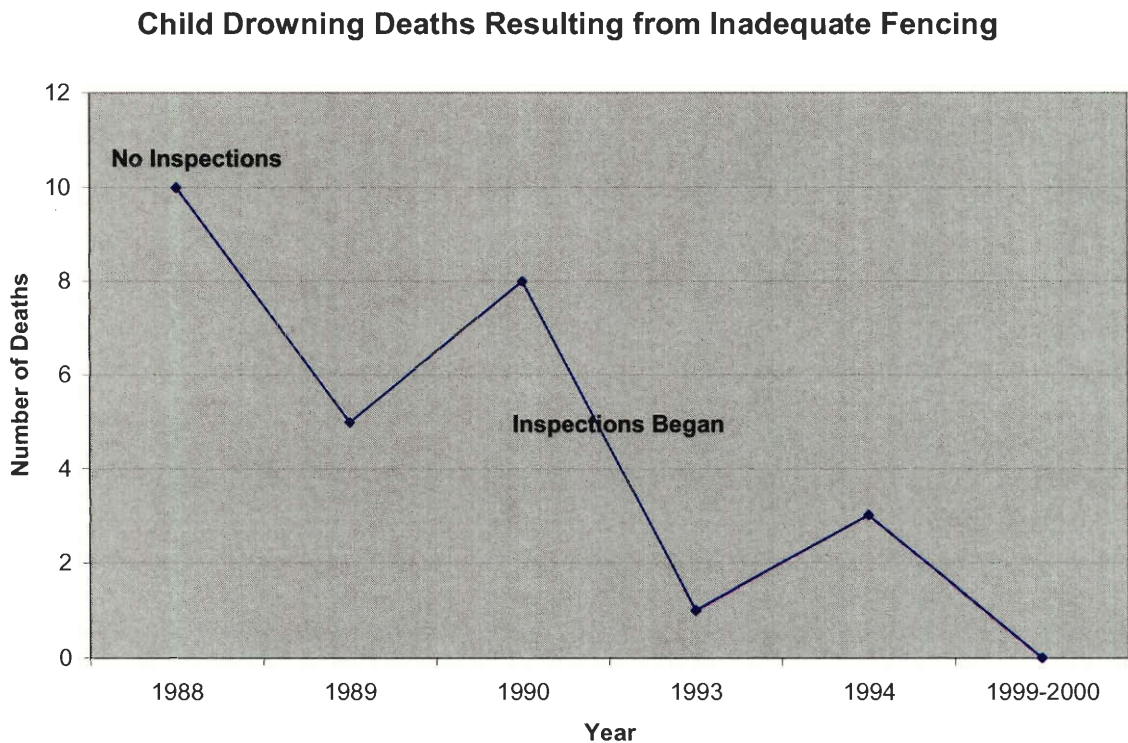
Inspections are conducted in a number of different locations, such as Maricopa County, AZ, Orange County, CA, and Western Australia. However, each location has different regulations regarding their method of inspecting residential swimming pools.

Maricopa County, AZ, relies on its local fire departments to detect pools that do not meet the local codes. Orange County, CA, requires a four step inspection process in order to obtain a pool permit. Compliance with state codes is required in the third inspection. In Western Australia, local inspectors travel to houses with pools at least once every four years to make sure every pool meets the pool safety requirements.

The Injury Research Center in Western Australia in 2001 conducted an audit of the 500 inspection records, selecting twenty randomly from each of the Shire or City Councils throughout the State. Also, the Center conducted one interview with a local swimming pool inspector from each Shire or City Council. Of the 162 properties considered in the study, only 45% of them met compliance standards at the time of their first inspection. If the pool did not meet the standards, it took the pool owner an average of one month to fully comply with the standards. Compliance with legislation increased to 57% by the second inspection (less than four years later), and further to 71% by the time the pool was inspected a third time (Stevenson, 2003).

Another study, which was conducted in Stirling, Western Australia, showed a decrease in the number of deaths of children under the age of five as a result of regular inspections. Before 1990, the numbers of drowning deaths were between five and ten annually. After the inspection program was introduced, the number of drowning deaths per year has been between zero and three. A graph of this trend is shown in Figure 7 (Building Surveyors Private Swimming Pool Inspection, 2003).

Figure 7



Note: These numbers are from the city of Stirling in Western Australia. (Building Surveyors Private Swimming Pool Inspection, 2003)

Other studies show that enforcement is a major issue, and that inspections are necessary. One such study showed that through an inspection program, compliance can be raised by 79% (Sayer GP, 1996). The inspection program in this case included using non-compliance notices and re-inspection at a later time to make sure the notice had been received and followed.

The studies and drowning prevention programs we examined lead us to conclude that regular pool inspections significantly increase compliance. A local pool inspection program is necessary for legislation to be most effective.

Penalties

Penalties are part of the enforcement system in New Zealand and Australia. The Fencing of Swimming Pools Act of 1987 in New Zealand states that the maximum fine for non-compliance is \$500 plus an additional \$50 for each day of continuing non-compliance. However, 54% of territorial authorities want to increase the maximum level of these fines, and even replace their present notice of non-compliance with an immediate fine (Heney, 2002). Queensland, Australia, has also proposed to authorize local authorities to issue on-the-spot fines to pool owners whose pools do not meet current standards. Immediate penalties for non-compliance with local standards can be an effective part of a drowning prevention program. We conclude that penalties, specifically fines, are necessary in order to pose such a deterrent to pool owners that they will comply before having to pay a fine.

Data Collection

The CPSC maintains several databases that contain information about consumer product related incidents. Some of these databases include NEISS, IPII, and the death certificate databases. More detail on these databases can be found in Appendix T. These databases have a number of limitations, such as their structure and the amount of information entered by health officials. From reading reports in the databases, it is unknown whether or not certain safety precautions were taken, if there was a well-maintained fence in place, if the child defeated the barrier, if there were layers of protection in place, etc. Often from entries in these databases, one cannot be certain that the incident occurred in an in-ground swimming pool, since most entries are coded as

occurring in an unspecified pool. Also, due to the structure of the databases, data can often be entered *multiple* times; hence, there is a need for cross-referencing each and every entry relating to drowning incidents (i.e. a coroner submits a death certificate in IPII, and then the same certificate shows up in the death certificate database).

The CPSC can conduct an In-Depth Investigation (IDI) for cases involving any type of hazardous product that falls under their jurisdiction. It conducts these either through a telephone interview or in person. Missing information relating to drowning incidents can be collected through such an investigation. Presently, the CPSC does not conduct many IDIs (i.e. 1 in the year 1999) relating to drowning in residential in-ground swimming pools. The CPSC conducted a study in September 1987 in the Sun Belt states from eight counties (two in Florida, one in Arizona, and five in California). The study involved phone interviews as well as IDIs, which were conducted by field operations personnel. The phone interviews were designed to gather information about the general population of household pools, such as the type of barrier in place (if applicable), the distance from house to the pool, etc. Field operations staff conducted IDIs of all drowning and near-drowning incidents involving children under the age of five where the accident occurred between May 1st and September 30th, 1986 in a private residential pool in the studied counties. The CPSC was able to draw conclusions about the type of fencing that should be used, house door security, supervision, and new pool installation (CPSC, 1987). From the conclusions that the CPSC drew from this study, it developed Model Barrier Guidelines, which have since been revised. If it was to conduct a similar study, it would be able to determine where their drowning prevention techniques are lacking.

Water Safety New Zealand maintains DrownBase, the official drowning database of New Zealand. DrownBase was created in 1980, and records all drownings in New Zealand. Data is collected via police notification and media clippings, and is validated against coronial files. Data fields in DrownBase include name, age, ethnicity, gender, region of drowning, activity at time of drowning, and text fields for more specific information. It must be noted that this database contains provisional statistics only (Blomquist, 2003). With their data, officials in New Zealand can draw conclusions about national drowning trends, and where their drowning prevention efforts should be focused. Such a database, if it were to be implemented in the United States, would provide a more direct data link from the local to the national level. The CPSC would instantly know if a drowning incident had occurred and the circumstances surrounding it.

There have been many attempts over the past decade by regional and global authorities to explain and solve the problem of drowning by collecting better data. In a report by the World Health Organization in 2000, the agency calls for public health officials to collect data and research drowning, as well as present a cost-benefit analysis of societal costs (WHO, 2000). Some common problems included the lack of data on a state and local level, and the inability to find a quick solution to the problem. Representatives from different states have called for better data; such individuals include Marcia Kerr (CPSC California), John Schwartz (NSPI Florida), Randy Beard (pool builder from California), and Carvin DiGiovanni (NSPI National Executive Vice President). Arizona, specifically Maricopa County, has been collecting the best statistics in the country on drowning over the past few years. Maricopa County is able to focus their drowning prevention program where they see fit, as a result of their data.

Studies have also shown that there needs to be a cooperative effort between local authorities, state authorities, and the CPSC, as far as data collection methods are concerned, in order to effectively address the issue of child drowning. For example, in New Zealand, a survey of regulatory authorities showed that the Fencing of Swimming Pools Act was not being enforced on a local level due to ambiguities in the Act. Some authorities were making little attempt at locating pools that violated the Act, or monitoring compliance in other, non-consistent ways. More detailed information on the studies can be viewed in Appendix U.

Our findings can be summarized as follows:

Public Awareness

- Experts we interviewed attributed the main causes of drowning to lack of barriers and lack of supervision.
- Experts believe the CPSC should focus its efforts on public awareness.
- Public awareness and education on the risks of residential swimming pools reduces the number of drowning deaths.
- Pediatricians are a good source for making the public aware of the risks associated with backyard swimming pools.

Products

- Pool owners are not likely to install isolation fencing without legislation, enforcement, and penalties.
- Purchasing a barrier with a pool needs to be mandatory.
- The only weakness in isolation fencing is open or unlocked gates.

Legislation

- A four-sided barrier between the house and the pool, fitted with a self-closing, self-latching gate, is necessary.
- Retroactive legislation is necessary because it applies to nearly three times the number of pools than current legislation applies to.
- Regular pool inspections increase compliance with legislation.
- Fines are necessary for inspections and legislation to be effective.

Data Collection

- The CPSC databases have a number of limitations such as the structure and amount of information collected.
- The CPSC does not conduct many in-depth investigations with regard to drowning in residential swimming pools.
- New Zealand maintains a useful drowning database known as DROWNBASE
- Data is lacking at both a local and state level.
- A cooperative effort between local authorities, states and CPSC is needed.

Chapter VI: Recommendations

Public Awareness

In order to increase awareness of consumers, pool owners and parents about pool safety and the dangers that a residential swimming pool poses we have come up with several recommendations for the CPSC. We have suggested that the CPSC focus on educating consumers and the public about the hazards, regulations and guidelines about residential swimming pools.

- **The CPSC should implement a yearly national drowning awareness campaign.**

We suggest that this campaign be conducted through the distribution of pamphlets to hospitals and pediatricians, as well as through frequent media broadcasts. The national drowning awareness campaign should emphasize the importance of parental supervision as the first and best defense against toddler drownings. The CPSC can accomplish this through working closely with local hospitals, pediatricians, fire departments, and radio and television stations across the United States. The national drowning awareness program would be in charge of implementing a public service announcement every year, throughout the swimming season.

- **The CPSC should work with pool manufactures to distribute a Video/DVD to everyone who purchases a new pool.**

The video should not be meant to discourage consumers or make them fearful of pools, but rather to raise their awareness about safety features and precautions that they should take. The video should include information about the importance of installing

safety products such as fences, pool alarms and pool covers and express the importance of supervision. We suggest that the CPSC create a video tape similar to the one from the Phoenix, Arizona fire department titled “Enough Is Enough Drowning Prevention”. We suggest that the CPSC work with real estate agencies to distribute the video to new home owners who have purchased a home with a pool. This will help raise the awareness of those who have not previously owned a swimming pool.

- **The CPSC should focus on implementing a “Pool Permit Course”.**

This course would be mandatory for anyone wishing to install a pool in their home. The course would have to be completed before a pool permit could be obtained. The course would educate consumers about the hazards that exist with owning a residential swimming pool. “The Pool Permit Course,” which should be three hours long, would be formatted into three categories: the first hour would be lecture, the second hour would consist of a video and the third hour would be a written exam. The purpose of the “Pool Permit Course” would be to educate people about the risks associated with the dangers of owning a swimming pool.

Products

The data retrieved from the Injury and Potential Injury Incident file database, as well as data collected from the outside studies revealed that the majority of the children studied drowned in three-sided or unfenced swimming pools. In the cases where four-sided fences were installed around pools, children gained unaided access via faulty or inadequate gates, or through gates that were left open. This finding highlights the need for pool owners to install four-sided isolation fences with gates that are self

closing/latching. However, results from the survey done by Garen J. Wintemute and Mona A. Wright from the University of California show that pool owners are not likely to install four-sided pool fences with self closing/latching gates on their own. Therefore, we recommend that the Commission promote the use of built-in barriers with passive qualities.

Built-in Safety Products

- **The CPSC should consider recommending that isolation barriers be included with pool installments, rather than as an optional extra.**

Isolation barriers that are included with pool installments would ensure that all new pools have adequate fencing, and no pools would go unfenced or be enclosed by three-sided fencing. This would require no extra effort on the consumers' part, since this would eliminate the need for pool owners to find and purchase their own barriers. With an automatic installment of four-sided fencing, drownings that occur in new pools that are either unfenced or enclosed by three-sided fences can be prevented, thus decreasing the drowning rate dramatically.

Passive products

- **The CPSC should recommend that all pool gates be constructed to automatically close and latch, and be able to accommodate a lock.**

Our results show that in the instances when drownings occur in pools enclosed by four-sided, isolated fencing, access to the pool area was gained through an open gate. Currently, many gates remain open until the pool owner intervenes and closes it. A gate that has the self closing/latching mechanism embedded into its structure makes it

impossible for gates to be left open for unsupervised children to enter. In addition, we recommend that the gate should be able to accommodate a lock so that pool owners with young children have the option of installing a lock without buying a new gate. When there is no guarantee that users will close the gate every time the pool is not in use, a passive technology such as a self-closing/latching gate is absolutely necessary in order to prevent future children from gaining unaided access to pool area.

Legislation

Although pool building codes and laws are already in place in many cities, towns, counties, and states throughout the nation, there are still many improvements that can be made to existing legislation, as well as encouraging municipalities to adopt pool legislation if they have not in the past.

Laws and Codes

- **The CPSC should create a model pool bill.**

The CPSC needs to draft and distribute a model pool bill that can be adopted by local governments. Such a piece of legislation would take less time to implement than a nationwide bill, and can be focused towards areas of the country where child drowning is most prevalent. The model bill needs a retroactive clause so that it would apply to all pools in the area. Provisions of this model bill:

- Isolation fencing around the pool.
- Self-closing, self-latching gates.
- Height requirement of at least five feet.
- Retroactive clause without exceptions.

The bill would also need to include supportive data as proof to local governments that adopting the proposed legislation will significantly decrease the rate of drowning in their city, county, or state.

Enforcement

- **The CPSC should create a model pool inspection standard.**

Legislation alone is not enough to effectively reduce the rate of child drowning nationwide. The adopted laws and codes need to be enforced properly. Therefore, we recommend that the CPSC create a set standard for local pool inspections. This standard will be sent to all local and state governments, as well as to all of the governments who adopt the model pool bill. Certain necessary provisions in this inspection standard include:

- A set, regular time span between inspections of no less than two years and no more than four years.
- A checklist of violations of local code or law such as barriers that are damaged or missing, gates and latches that are not functioning properly, and other things specific to the local standards.
- A system of appointing a pool inspector for each local government who uses this standard.
- A non-compliance notice after a first inspection. The pool owner must comply within one to two months.

Penalties

- **The CPSC should include a fine in their inspection standard.**

Another recommendation for this pool inspection standard is to impose a penalty on pool owners who do not comply with local legislation within a reasonable amount of time. The penalty for non-compliance on a second inspection should be no less than \$300 and no more than \$500. Non-compliance on a third inspection would result in a much larger fine. The fine will increase compliance because pool owners will often need to spend more to pay the fine than they would to fix their faulty barrier or gate.

A combination of the model pool bill and the pool inspection standard will greatly reduce the rate of drowning in the areas where they are adopted, both separately, as well as together. The key is to provide persuasive data to local governments with these models, show their effectiveness in reducing child drowning rates in residential swimming pools.

Data Collection

- **The CPSC should conduct more In-Depth Investigations, and consider a special study.**

The CPSC can conduct more IDI's in order to find out more details on certain children under five drowning in residential swimming pools. Right now there are not nearly enough IDI's conducted by the CPSC for residential pool drownings (less than 5 per year). This would make up for the lack of data and limitations presented by the CPSC databases. If a study similar to that of 1987 (perhaps, adding more states/counties) were to be conducted presently, the CPSC could gain a further understanding of what

needs to be done as well as what is currently working in the field of drowning prevention. It could also further develop the cooperation among the states, local authorities, and CPSC with respect to drowning.

- **The CPSC should develop a better data collection system, similar to that of New Zealand.**

New Zealand's very complete database of drownings and specifics for each incident can be used as a model for the CPSC. Data collection is easier in New Zealand than in the US due to the smaller population, fewer drowning deaths, and fewer pools in existence or being built. However, New Zealand has had recent success in substantially lowering their drowning rate, especially with respect to unintentional drownings of children under the age of five. New Zealand has had a National Fencing of Swimming Pools Act in effect since 1987. In the United States, it is only possible to present model local legislation, which can be signed into effect by a local government.

- **The CPSC should develop a data collection method for local authorities to use at the scene of drowning incidents.**

Currently, there is no unified method for data collection. The CPSC can develop a model incident report for local municipalities, EMT's, and fire departments to use when they are called to the scene of a drowning incident. Maricopa County, Arizona has developed such a form, which generates very accurate statistics, and allows for a thorough analysis of the environment in which the drowning took place on a countywide basis. California's Emergency Medical Services Authority also has a similar form, yet

without as much detail as the Arizona form (both forms can be viewed in Appendix Q). If more counties used such a form, then they would be able to pinpoint where the issues lie as far as their drowning prevention program is concerned. There may be a need for retroactive legislation, or stricter building codes and code enforcement, or perhaps both. Some states, aside from the Sun Belt states underestimate the risk of drowning; hence, all states should take the time to gather such statistics.

Through cooperation with the CPSC, local authorities and states can begin to see where to focus their drowning prevention programs, in order to find a solution to the problem of child drowning. The solution may not lead to an immediate decrease in the rate of drowning, but long term effects of such recommendations can be substantial.

Chapter VII: Appendices

APPENDIX A

Consumer Product Safety Commission

The CPSC is an Independent Federal Regulatory Agency that was created in 1972 by the passage of the Consumer Product Safety Act, and began operation the next year. Being an Independent Federal Regulatory Agency, they are not part of, nor do they report to any other government departments or agencies. They work to keep people safe by reducing the risk of injuries and deaths associated with consumer products by:

- developing voluntary standards with industry;
- issuing and enforcing mandatory standards or banning consumer products if no feasible standard would adequately protect the public;
- obtaining the recall of products or arranging for their repair;
- conducting research on potential product hazards; and
- informing and educating consumers through the media, state and local governments, private organizations, and by responding to consumer inquiries.

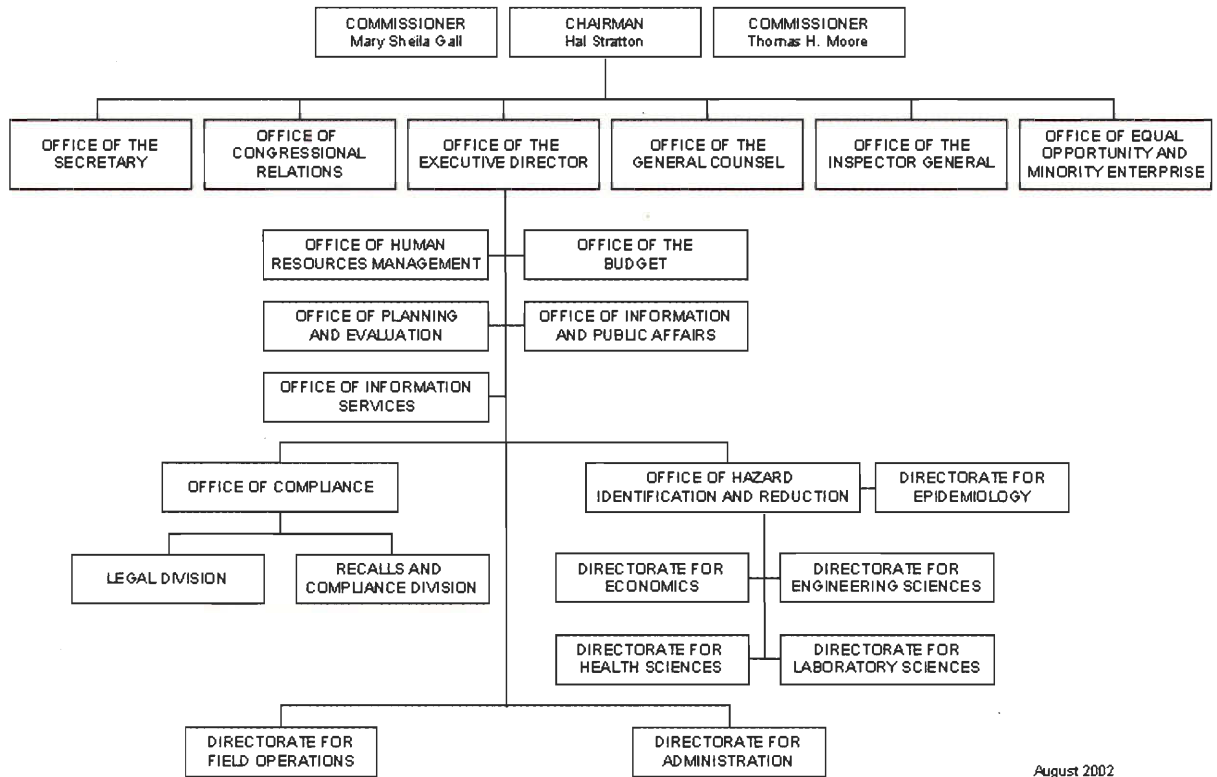
The CPSC has jurisdiction over more than 15,000 types of products. The types of products that they do not have jurisdiction over include automobiles and other on-road vehicles, tires, boats, alcohol, tobacco, firearms, food, drugs, cosmetics, pesticides, and medical devices.

The Commission has an annual budget of roughly \$52.4 million, and employs over 480 people. There are three commissioners who head the agency; they are

appointed by the President and approved by the Senate for staggered seven-year terms. The President appoints one of these commissioners as Chairman of the Commission. The six offices of Congressional Affairs, Equal Employment and Minority Enterprise, General Counsel, Inspector General, Secretary, and Executive Director report directly to the Chairman. The Executive Director oversees Commission policy and administration. Six offices, which implement the policy and administration, report to the Executive Director. They include the offices of Compliance, Hazard Identification and Reduction, Field Operations, Administration, Budget, Human Resources, Information and Public Affairs, Information Services, and Planning and Evaluation.

Our sponsor is the Office of Hazard Identification and Reduction. The Office develops strategies for and implements the agency's operating plans for these two hazard programs. This includes the collection and analysis of data to identify hazards and hazard patterns, the implementation of the Commission's safety standards development projects, the coordination of voluntary standards activities and international liaison activities related to consumer product safety, and providing overall direction and evaluation of projects involving hazard analysis, data collection, emerging hazards, mandatory and voluntary standards, petitions, and labeling rules. The Office assures that relevant technical, environmental, economic, and social impacts of projects are comprehensively and objectively presented to the Commission for decision (CPSC, 2003).

Organization Chart



August 2002

APPENDIX B

Table I. In-Home Drowning Deaths in Children Under 5-Years Old, 1999.*

Total In-Home Product Drowning Deaths	93
Bathtubs	58
5-Gallon Buckets	12
Spas and Hot Tubs	11
Toilets	5
Other Products	7

Table II. Pool Drowning Deaths in Children Under 5-Years Old, 1999.**

Total Pool Drowning Deaths	275
In-ground Pools	79
Above-ground Pools	43
Unspecified Pools	153

*Drowning deaths as reported to the CPSC's databases (NEISS, DTHS, IPII, INDP). The numbers presented here are averages of the 1996 -1999 minimum counts taken from Sweet, 2002.

** Drowning deaths as reported to the CPSC's databases (NEISS, DTHS, IPII, and INDP). The numbers presented here is not a statistical estimate, nor is it a complete count.

APPENDIX C

Number of Pools in a Variety of States at the End of 2002

State:	In-ground Pools:	Above-ground Pools:	Total Pools:	% In-ground:	% Above-ground:
Arizona	236,364	40,224	276,588	85.4	14.5
California	961,184	315,027	1,276,211	75.3	24.7
Florida	621,852	160,502	782,354	79.5	20.5
Texas	382,094	154,827	536,921	71.2	28.8
Total:	2,201,494	670,580	2,872,074	77.9	22.1

State:	In-ground Pools:	Above-ground Pools:	Total Pools:	% In-ground:	% Above-ground:
Georgia	105,790	81,266	187,056	56.5	43.4
Maryland	58,910	49,582	108,492	54.3	45.7
Minnesota	17,624	24,026	41,650	42.3	57.7
Nevada	58,994	12,112	71,106	83	17
Total:	241,318	166,986	408,304	59	41

United States Total	4,274,000	3,350,000	7,624,000	56.1	43.9
% of Pools in Top 4 States	51.5	20	37.7		

(ANSI/NSPI, 2003)

APPENDIX D

Number of In-ground Pools in the United States

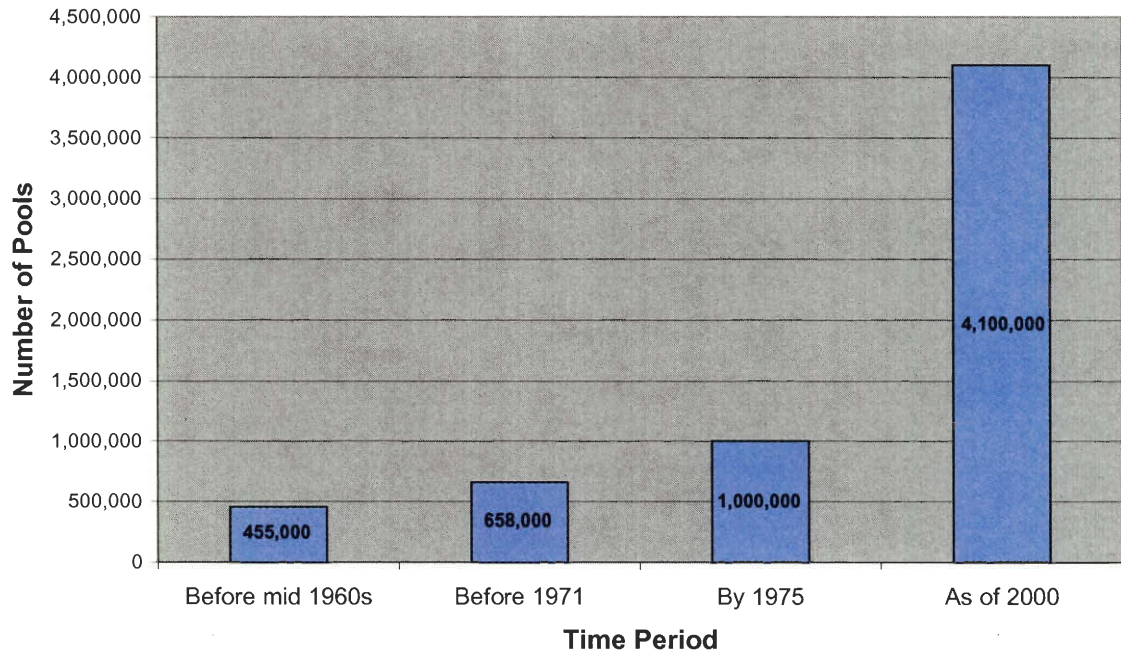


Figure 1
(Leland, 2003)

APPENDIX D (Continued)

Pool and Product Prices

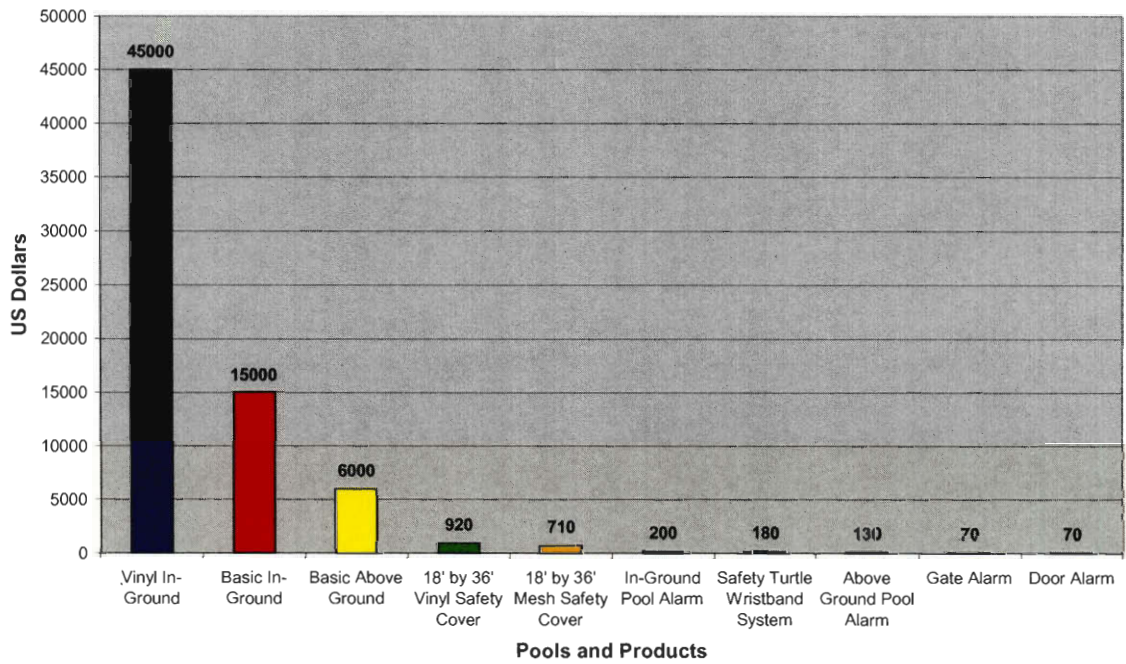
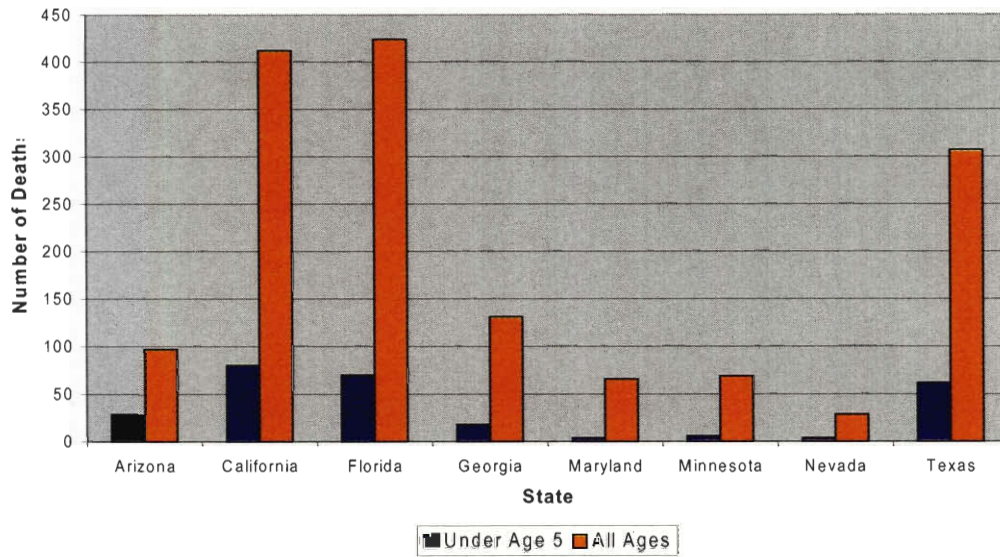


Figure 2
(Leland, 2003)
(Chilsafetystore.com, 2003)
(Poolstore.com, 2003)

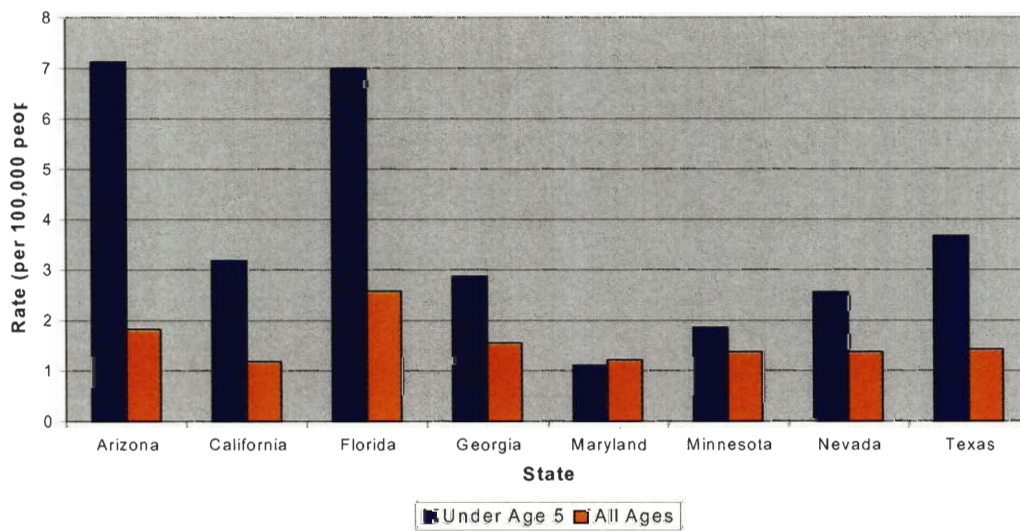
APPENDIX E

Drowning Deaths by State and Age



(Mortality Rates, 2003)

Drowning Death Rates by State and Age



(Mortality Rates, 2003)

APPENDIX F

Drowning By Falling In: Risks and Prevention

In both types of swimming pools there are some more general safety recommendations. The CPSC advises supervisors that if the child they are looking after is missing in or near an area with a pool, the first place they should search for a missing child is in the swimming pool, since time is of the essence. Drowning can occur with out warning. Pool alarms with underwater sensors can be used in both types of pools. Doors leading from a house to a pool should be alarmed. Sometimes children are attracted to reach into the pool for toys, floats, etc. These amusements should be removed from the pool while it is not in use to prevent such a risk.

When the pool is not in use it should be covered. Many different manufacturers make power pool covers. They can be designed and customized to fit any pool. Power covers can be automatic, semi-automatic, or manual. If it is automatic, the cover will be activated as soon as the owner turns the key. Semi-automatic ones will activate with the turn of a key and must be secured in multiple spots when it is covered. Manual covers require the pool owners to turn a crank by hand that will roll up the cover when they want to swim, and turn it the opposite way to roll it back onto the pool when they are done swimming (CoverStar, 2003). Pool covers are available in many types, but safety covers solely include walk-on covers that are stiff and allow people to walk on them and not cave in and vinyl and mesh covers that are secured to the pool edge and will not cave in if a child falls on them (CoverStar, 2003). CoverStar covers meet the ASTM standard set for pool covers. Their vinyl covers, which can be walked on have withstood the test of

fifteen people standing on them at one time. The National Spa and Pool Institute awards owners and retailers promoting safe pools each year. Most of the pools that were honored had CoverStar covers on them. They have been marketing their product to both contractors and individual pool owners (Don, 2003). One must also make sure that there is no excess water on the cover for the child to fall into and drown in. A young child can drown in mere inches of water (CPSC, 2002, "How to Plan for the Unexpected").

The Turtle Company produces wristbands made for children as a safety precaution. The wristbands are linked to a base unit, which will sound an alert if a child falls into a pool. When the wristband is submerged, the alarm immediately sounds, alarming the supervisor of the problem. (Terrapin Communications Inc., 2003). The wristband was developed in 1998 and hit the market for the 1999 swimming season. The manufacturer continues to build on the technology, trying to expand into new areas, including remote systems. The Turtle wristband meets the ASTM standard for pool alarms by having a primary receiver as well as a secondary relay. Terrapin sells their product through distributors, as well as retailers (brick-and-mortar and electronic). They have begun to advertise and market their product to pool manufacturers. Wristbands are especially useful for situations when many children are around a pool or in a backyard atmosphere; hence they have been bought by many daycare centers and resorts. Robert Lyons, an executive from Terrapin further believes that the average age of drowning victims is decreasing, and that, no matter what, eye contact is key (Lyons, 2003).

APPENDIX G

Body Entrapment and Hair Entanglement

Once sucked against a drain cover, the swimmer, being much larger than the drain itself, will seal off the drain cover, causing a vacuum pressure to build, which will prevent the swimmer from escaping, and thus will pose a threat of subsequent drowning. An arm or leg on the other hand does not seal off a drain, but rather can still cause entrapment by becoming stuck by the suction forces of a main drain cover that is either missing or not secured properly (Schroader, 2001).

Other Methods to Reduce Main Drain Suction

The CPSC also recommends having open valves to the skimmer, which is the device that connects to the suction line of the pump that draws water and floating debris from the surface. When the valves to the skimmers are open, the water flow from the pool is not solely from the main drain. When it is solely from the main drain, the main drain becomes a single isolated source of suction, which presents the potential risk of body entrapment. However, since valves can be both opened and closed, there is always a chance that the valves may not stay in an open position, unless there is some sort of locking mechanism on the valves. A locking mechanism will require that the pool owners lock the valves in the open position, but since studies show that most entrapment drownings are due to improper maintenance and negligence, the chances are that a pool owner would not be expected to regularly check to ensure that the valves are locked open. (CPSC, 2002, "Guidelines for Entrapment Hazards... safer")

Secondary Back-Up Systems

Another suggestion by the CPSC is to have a secondary back-up system installed in all residential pools and spas. (CPSC, 2002, “Guidelines for Entrapment Hazards... safer”)

“A secondary back-up system may consist of an anti-vortex cover with an ASME/ANSI A112.19.8M rating ... a large grate (exceeding 12”x 12”) and/or some type of channeling too large to be sealed by a human body, a sensing device that detects an increased suction associated with blockage, or any combination of these. Systems are available that can sense a small increase in suction at the inlet to the pump and shut the power to the pump. By sensing an increase in vacuum, the devices trip electrical relays to the pump, which then removes the suction on the line.” (CPSC, 2002, “Guidelines for Entrapment Hazards... safer”)

Recommendations for Reducing Dangers of Body Entrapment

The Consumer Product Safety Commission has nine reports of entrapment related incidents between January 1990 and May 1996, seven of which resulted in deaths, and two of which resulted in hospitalization. Of these nine cases, seven involved males, two involved females, and all were between the ages of eight and sixteen years of age, with the median age being ten years old. The incidents have occurred in both public and home facilities, with eight of them being in a swimming pool. While the incidents have occurred to an older age group, the hazards are also present for children under the age of five (Rowe, 1996).

One recommendation by the CPSC is to have more than one drain per pump, especially in wading pools where drains are more accessible to small children. Having a second drain reduces the risk of drowning since it divides the suction between the two drains (provided the piping is the same in diameter, and the “T” connecting the pipes is of equal distance to both drains).

CPSC Recommendations on Preventing Hair Entanglement

Hair entanglement occurs when a swimmer's hair becomes entangled in a drain cover. The suction from single drain outlets in pools is so powerful that it can cause entrapment. Drowning incidents that occur from hair entanglement involve people with shoulder length or longer hair (CPSC, 2002, "Children Drown and More Are Injured...Safety Alert").

The CPSC conducts investigations when a drowning incident is caused by hair entanglement. The investigation it conducts helps outline the cause of the incident and how the victim became entrapped in the drain. The investigators also examine the technical background, such as pump size, and look at the incident from an engineering perspective (Schroader, 2003).

The CPSC developed standards to help eliminate hair entanglement. Consumers should be sure they have new drain covers that meet the standards. Other suggestions by the CPSC include keeping long hair away from the main drain cover. If the main drain cover is missing or broken, the pool should be shut down immediately. The CPSC suggests that parents supervise their children while they are in the pool and never allow them to play near the drains. There are also voluntary standards for drain covers that reduce hair entanglement. The voluntary standards address problems for new construction. There have also been studies and guidelines to address problems on older pools that have been built prior to the voluntary standard (CPSC, 1993, "Swim Spa Suction Cover Replacement Program; Hair Entrapment...").

If a pool has a single drain it is important to install another drain system so that there is a minimum of two drains per pump. This will help prevent a single drain from becoming the main inlet for the suction. A multiple drain channel system reduces the risk

of hair entanglement. Not having a significant vacuum in one area would reduce, if not, eliminate hair entanglement.

The Anti-Hair Snare Plus

The mechanical engineering firm Triodyne developed the Anti-Hair Snare Plus drain cover, which would prevent possible future incidents involving hair entanglement. According to the Triodyne manufacturers, “We designed cantilevered grading elements, so that hair entering the drain could escape at the end of the element. We found that elements possessing a greater than 45-degree angle will shred hair, whether it is knotted or wrapped around the element.” The Anti-Hair Snare Plus is the only drain cover which has an anti-hair entanglement design which has an installed self-shedding principal when swimmer’s raise their heads (Valenti, 2003).



(Valenti, 2003)

APPENDIX H

CPSC Guidelines

- Instruct babysitters about potential pool hazards
- Never leave a child unsupervised near a pool
- Do not allow a young child in a pool without an adult
- Do not substitute floatation devices for supervision
- Learn CPR
- Keep rescue equipment by the pool
- Never prop a pool gate barrier open, etc. (“How to Plan for the Unexpected”, p.4).

APPENDIX I

Safety Products on the Market

The CPSC has taken several steps to increase safety in residential swimming pools. Companies are creating products specifically designed to help lessen the risk of drowning by falling into a swimming pool and thus different products are designed to address those hazards. There are differences in hazards associated with above-ground pools and below-ground pools. For example, ladders leading into above-ground pools should be removed when the pool is not in use. If this is not possible, some kind of lock should be used to keep the ladder from being used by a child without permission. The elimination of accessibility to the pool because of a removable ladder is not applicable to in-ground swimming pools.

Custom aluminum and mesh fencing is provided by the Pool Safety Company for in-ground swimming pools. These barriers are available in a free form style that allows it to fit closely around any pool. This particular barrier is designed as a second barrier, inside of a larger fence or wall (Pool Safety Barrier of Sarasota, 2003). Some fences use mesh and polyester connected by aluminum poles, while others strictly use aluminum bars. The mesh and polyester are just as safe as aluminum is, but are more forgiving. This is good for use where children play a lot, so they will not be injured by running into the fence.

Pool gate alarms monitor activity through the gate of a pool. These gate alarms provide an extra layer of protection. If the child is able to manipulate the latch on the

gate, the alarm will alert a supervising adult before the child will be alerted before the child actually has time to submerge in the pool. These products float on the surface of the pool water and alarm sounds and alert when the water has been disturbed (PBM Industries, 2003).

The Poseidon: Lifeguards Third Eye System uses cameras and pagers to monitor activity inside the pool. When a person submerges and is drowning, the alarm is sounded. The Poseidon system recognizes when a swimmer is having difficulty and could possibly be drowning. The system can take as little as ten seconds to detect such activity (Poseidon Technologies, Inc., 2003). Poseidon is a brand new system, a collaboration of five years of effort, and it could very well shape the way pools are built in the future. PoolGuard manufactures poolside alarms that monitor activity within the pool through movements of the water and sends a signal to a receiver.

In both types of swimming pools there are some more general safety recommendations. The CPSC advises supervisors that if the child they are looking after is missing in or near an area with a pool, the first place they should search for a missing child is in the swimming pool, since time is of the essence. Drowning can occur with out warning. Pool alarms with underwater sensors can be used in both types of pools. Doors leading from a house to a pool should be alarmed. Sometimes children are attracted to reach into the pool for toys, floats, etc. These amusements should be removed from the pool while it is not in use to prevent such a risk.

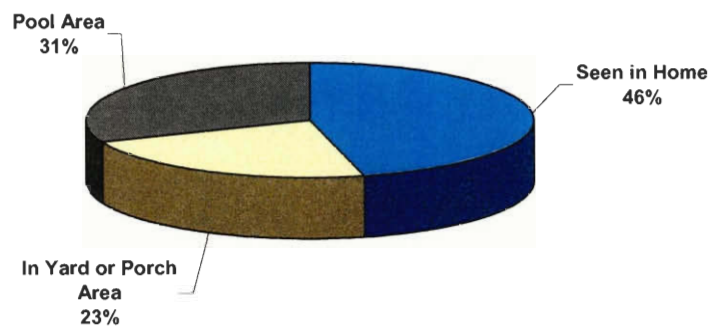
When the pool is not in use it should be covered. Many different manufacturers make power pool covers. They can be designed and customized to fit any pool. Power

covers can be automatic, semi-automatic, or manual. If it is automatic, the cover will be activated as soon as the owner turns the key. Semi-automatic ones will activate with the turn of a key and must be secured in multiple spots when it is covered. Manual covers require the pool owners to turn a crank by hand that will roll up the cover when they want to swim, and turn it the opposite way to roll it back onto the pool when they are done swimming (CoverStar, 2003). Pool covers are available in many types, such as the conventional plastic cover, the solar cover that heats your pool while it is covered, and walk-on covers that are stiff and allow people to walk on them and not cave in (CoverStar, 2003). One must also make sure that there is no excess water on the cover for the child to fall into and drown in. A young child can drown in mere inches of water (CPSC, 2002 “How to Plan for the Unexpected”).

The Turtle Company produces wristbands made for children as a safety precaution. The wristbands are linked to a base unit, which will sound an alert if a child falls into a pool. When the wristband is submerged, the alarm immediately sounds, alarming the supervisor of the problem. (Terrapin Communications Inc., 2003).

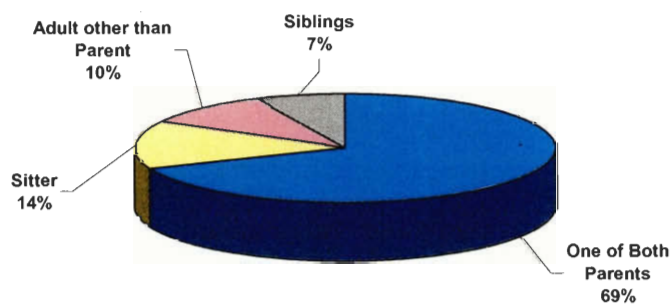
APPENDIX J

Location of Child Before Drowning Incident in the United States



(CPSC, 2002, "How to Plan for the Unexpected")

Supervisor During Drowning Incidents



(Life Saver Pool Fence Systems, Inc, 2003)

APPENDIX K

Government Laws and Guidelines

- New Jersey issued a Water Safety Reminder, which echoed the voice of the National Safety Commission (Dimmemo, 2003).
- In 1998 the State of Pennsylvania proclaimed the week of June 22nd through 28th as “Water Safety Awareness Week” in order to “urge citizens to learn what they can do to make their private and municipal pools safer for everyone and to be careful in and around swimming pools” (The General Assembly of Pennsylvania, 1998).
- North Carolina Department of Insurance issued a report on safety precautions and supervision measures that can be taken to decrease the risk of drowning (Gillen, 2003).
- Florida requires its residents to have a safety barrier in place at their pool (Florida Municipal Code, 2003).
- California requires residents to do one of the following: the pool must be isolated from access to a home by an enclosure, the pool must be equipped with an approved safety cover, all doors and windows providing direct access from the home to the pool must be equipped with an exit alarm that has a minimum sound pressure rating of 85 dB, or all doors providing direct access from the home to the pool must be equipped with a self-closing, self-latching device with a release mechanism placed no lower than 54 inches from the ground.

- Arizona building codes include an interior fence of four feet, self-closing and latching gates, which open outward, and have a latch located at least fifty-four inches above the ground. Measurements from the ground may be different on each side of the barrier. For example, if someone has a brick wall, the yard inside of the wall might be only three feet below the top of the wall, while the outside might be four or five feet from the top of the barrier. Power safety covers are recommended to be used as a primary interior barrier. The state codes are not retroactive. Local jurisdictions, which have enacted a swimming pool barrier ordinance prior to June 1, 1991, are not affected by these codes (Arizona Drowning Prevention Coalition, 2003).
- Maricopa County states that alarms can be used, but only as a secondary barrier. This code is not retroactive to pools built prior to April 16, 1993. Also any climbable structure must be kept at a minimal distance of fifty-four inches from the enclosure (Arizona Drowning Prevention Coalition, 2003).
- City of Phoenix encompasses the state and county codes as far as barriers and alarms go, except that the top of the interior fence must be five feet above the ground rather than four. The major difference is that their code is retroactive to current residents as of May 4, 1990, or new occupants,
- Through sale or lease, with a child six years of age or under (Arizona Drowning Prevention Coalition, 2003).

APPENDIX L

Maricopa County, AZ, Statistics on Pool Drowning (2002)

Location of Drowning Deaths, Arizona, Children 0 to 4 Years of Age

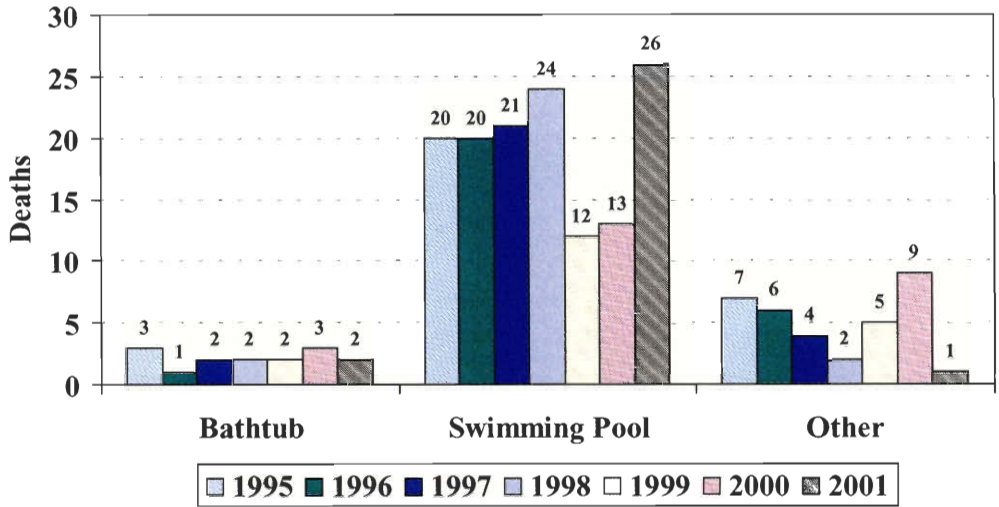


Figure 3
(Flood, 2003)

Body of Water of Incident, Maricopa County 1999 to 2000

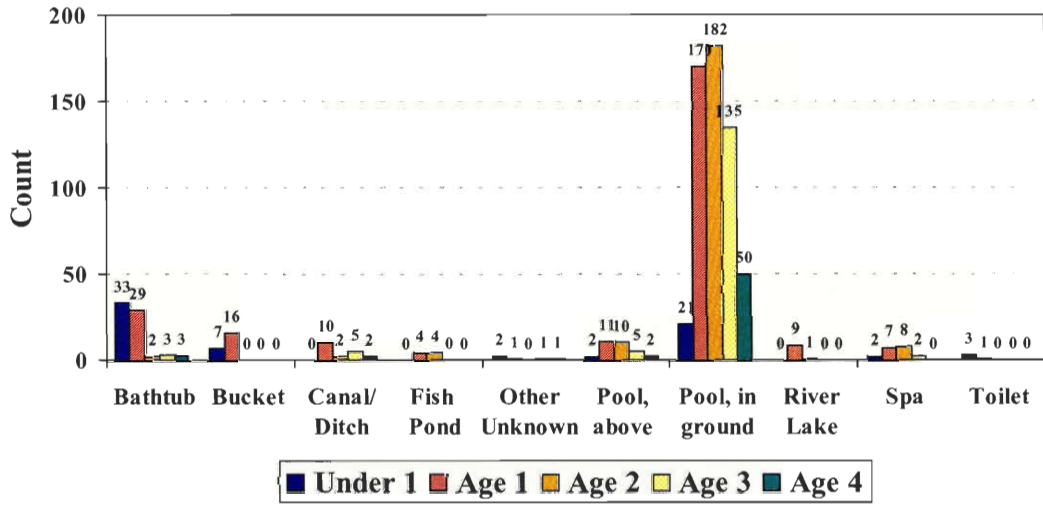


Figure 4
(Flood, 2003)

Drowning Deaths, Boys vs. Girls, 1999 to 2000; Ages 0 to 4

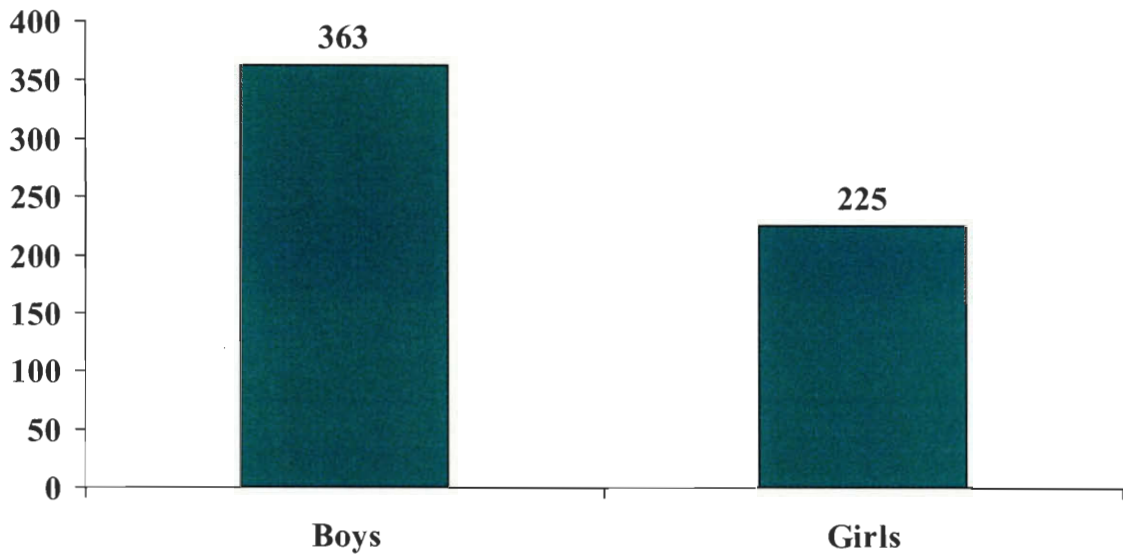


Figure 5
(Flood, 2003)

Presumed Supervisor

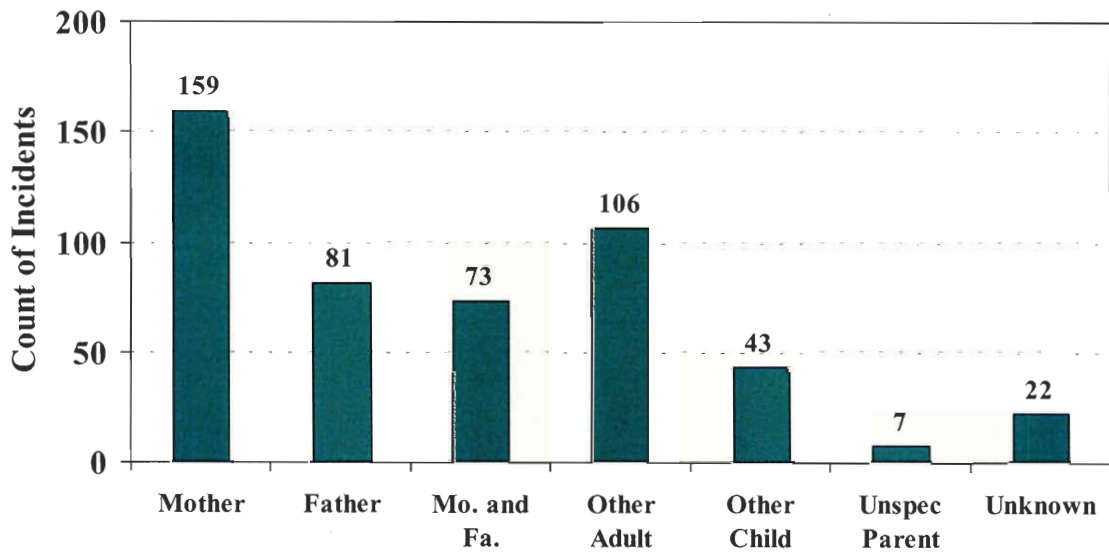
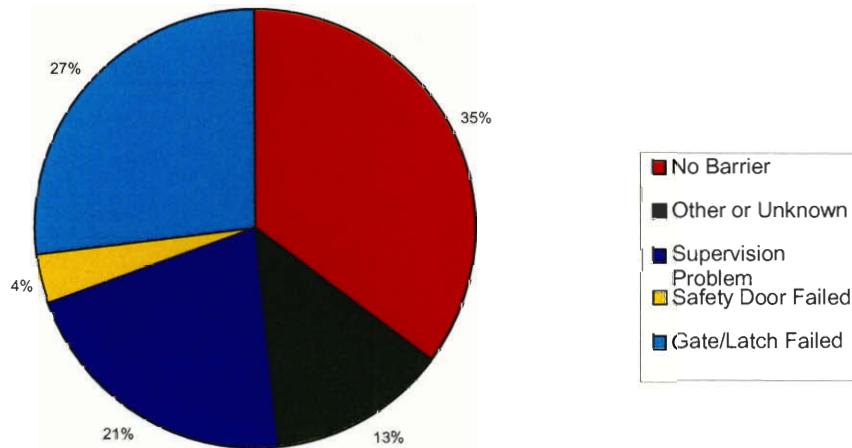


Figure 7
(Flood, 2003)

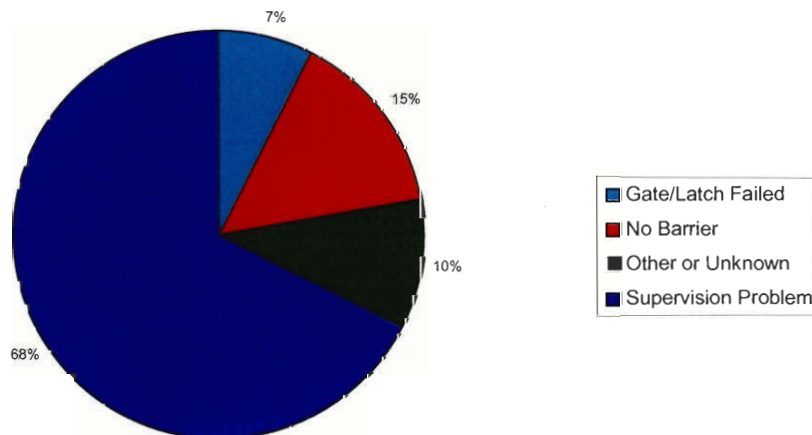
APPENDIX M

Attributed Causes of Drowning in Maricopa County, AZ (2002)

Cold Months (October - April)
Outcome = Normal or Unknown

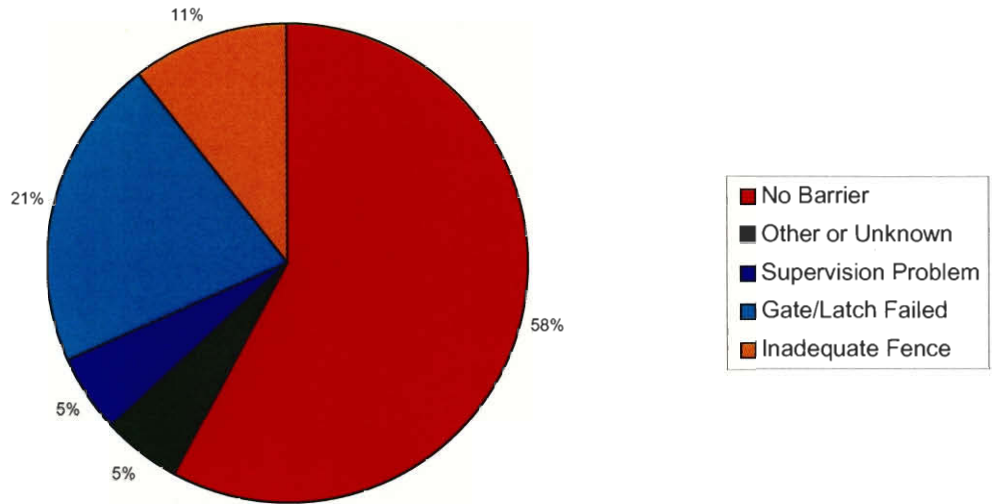


Warm Months (May - September)
Outcome = Normal or Unknown

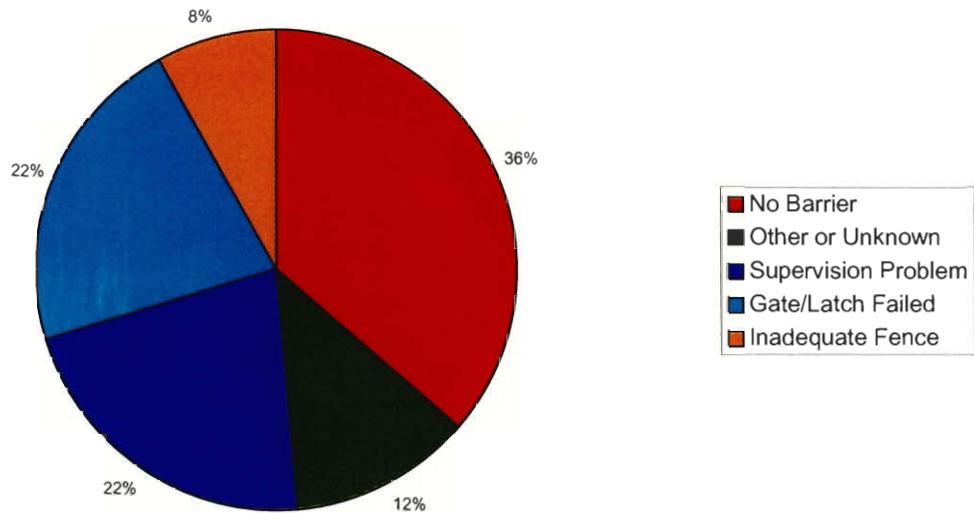


(Flood, 2003)

**Cold Months (October - April)
Outcome = Died or Impaired**



**Warm Months (May - September)
Outcome = Died or Impaired**



(Flood, 2003)

APPENDIX N

Orange County Code

“Every pool or spa must be enclosed with a fence a minimum of five feet in height, with no openings between vertical members or more than four inches and shall not have openings between or protrusions that render the fence easily climbable. Doors and gates providing access to the pool or spa shall be equivalent to the fence and shall be self-closing and self-latching and shall open away from the pool or spa. Doors leading from the house directly to the pool/spa area must be self-closing and self-latching with the latching mechanism located at least fifty-four inches above the floor. As an alternative, such doors may be equipped with an alarm. Such alarm shall be equipped with a manual means to deactivate the alarm for single opening. Such deactivation shall last no longer than fifteen seconds. The deactivation switch shall be located at least fifty-four inches above the threshold of the door (Orange County, October 31, 2003).”

APPENDIX O

Australian Guidebook for Pool Owners

The guidebook suggests that pool owners must arrange drains or other outlets so that there is no risk of swimmers being trapped in them. The handbook suggests that all suction pressures of the pump should be connected to at least two separate outlets. It also suggests that the velocity of the pumped outlet should not exceed .5 m/s (Human Services, 2000).

APPENDIX P

Common Questions Asked

1. Why do you think most child drownings occur?
2. What has your department/organization done to address the issue of child drowning?
3. Where do you feel the CPSC should focus their efforts to reducing the rate of child drowning?

Interviewees

<i>Marica Kerr</i>	Lack of Barriers
<i>Jackie Elder</i>	Supervision
<i>Bob Ochsman</i>	Supervision
<i>Troy Whitfield</i>	False sense of security
<i>Carvin</i>	
<i>DiGiovanni</i>	Supervision
<i>Bernice</i>	
<i>Crenshaw</i>	Supervision
<i>Ross Lister</i>	Lack of Barriers
<i>Lester</i>	
<i>Kowlasky</i>	Supervision
<i>Linda Quan</i>	Supervision
<i>Lee Baxter</i>	Lack of Barriers
<i>Nadina</i>	
<i>Riggsbee</i>	Lack of Barriers
<i>John Schwartz</i>	Standards/Safety Features

1

<i>Marica Kerr</i>	See Appendix Named Efforts of CPCS
<i>Jackie Elder</i>	Child Drowning Study
<i>Bob Ochsman</i>	Not Relevant
<i>Troy Whitfield</i>	Pool Alarms Report (2000)
<i>Carvin</i>	
<i>DiGiovanni</i>	Layers of Protection/Model Barrier Guideline
<i>Bernice</i>	
<i>Crenshaw</i>	Layers of Protection/Model Barrier Guideline
<i>Ross Lister</i>	Complies Data for Swimming Pool Guidelines
<i>Lester</i>	
<i>Kowlasky</i>	Booklet for Educating Public
<i>Linda Quan</i>	Injury Prevention Journal
<i>Lee Baxter</i>	Drowning Prevention Program
<i>Nadina</i>	
<i>Riggsbee</i>	1986 Barrier Guildlines
<i>John Schwartz</i>	Lobbyist for Pool Safety

2

<i>Marica Kerr</i>	Focus on Uniform Building Codes
<i>Jackie Elder</i>	Conducting regional meeting for affectiveness of barriers
<i>Bob Ochsman</i>	Awarness
<i>Troy Whitfield</i>	Education/Awarness
<i>Carvin</i>	Data(Make Standards)

<i>DiGiovanni</i>	
<i>Bernice</i>	
<i>Crenshaw</i>	Awariness/Education
<i>Ross Lister</i>	National Standard
<i>Lester</i>	
<i>Kowlasky</i>	Making Public Aware of Danger
<i>Linda Quan</i>	Awariness
<i>Lee Baxter</i>	Change the Asthetics of fences
<i>Nadina</i>	
<i>Riggsbee</i>	National Standard/Educational Push
<i>John Schwartz</i>	Better Data Collection

REPORT OF DROWNING OR NEAR-DROWNING IN ARIZONA - 2001

DATE OF INCIDENT (MMDDYYR)

HOUR (24:00)

AGE (YRS)

SEX

INCIDENT #

PLAT # or ZIP CODE: _____

____ Fire Dept.
(Reporting agency)

CITY OF INCIDENT:

- Chandler Mesa Rural area
 Gilbert Peoria Scottsdale
 Glendale Phoenix Tempe
 Other: _____

HISPANIC: Yes No Unk.

RACE: White Amer. Indian
 Black Unknown
 Other: _____

WATER TYPE:

- Pool-in ground Spa
 Pool--above ground Bathtub
 Canal or Irrig. Ditch Toilet
 Other: _____

SITE OF INCIDENT: (at whose home?)

- Victim's Home Neighbor's *
 Relative's " Friend's *
 Other: _____

TYPE OF DWELLING:

- Single Home Apt/Condo
 Hotel/Motel Other: _____

ATTIRE OF VICTIM: Swimwear
 None Other Clothes

ACTIVITY AND LOCATION OF VICTIM IMMEDIATELY PRIOR TO INCIDENT:

SUPERVISOR(S) AT TIME OF INCIDENT:

- Mother Father N/A
 Other (Specify) _____
 Age of this person _____

ACTIVITY AND LOCATION OF SUPERVISOR IMMEDIATELY PRIOR TO INCIDENT:

STATUS OF VICTIM WHEN FOUND IN WATER:

- Submerged Floating
 Struggling Unknown
 Other: _____

RESPIRATORY EFFORT WHEN PULLED FROM WATER:

- Present Absent

ESTIM. DURATION OF ANOXIA: _____

DID RESCUER/ BYSTANDER(S) PERFORM CPR?

- Yes No Unknown
 Done right? Comment: _____

LENGTH OF RESIDENCE AT THIS HOUSE (if applicable)? _____

IS THERE A FENCE OR BARRIER?

- Yes No Unknown
 Describe: _____

METHOD OF ACCESS TO POOL OR SPA:

- Supervisor allowed child into pool or deck area
 No barrier -- child wandered in
 Climbed (specify): _____
 Child entered unsecured gate
 Child entered secured gate
 Other: _____

WOULD AN INNER FENCE AROUND THE POOL HAVE PREVENTED THIS INCIDENT?

- Yes No
 Unknown N/A

DISPOSITION:

- DOA Died in E.R.
 Treated As Outpatient
 Admit to: _____

FOLLOW-UP: (Date pt was last seen)

- Died _____ / _____ / _____
 No Impairment _____ / _____ / _____
 Impairment _____ / _____ / _____

DESCRIBE THE APPARENT CIRCUMSTANCES (how/why it happened; how child was found & revived): _____

(Initials) _____

(Today's Date) _____

APPENDIX Q (continued)

PEDIATRIC POOL DROWNING TOOL

Age _____ Years Months

Gender ___ Male ___ Female

Race/Ethnicity Ask patient/parent. If unable to ask use medical record.

May choose more than one.

___ American Indian ___ Black ___ White ___ Unk
___ Asian ___ Hispanic ___ Other _____

Supervised? Y/N/U

Yes By whom?

Age of supervisor

Suspected ETOH/Drugs

Distractions?

No Left unattended at pool

Thought to be involved in other activity away from pool

Child Relationship to Pool – please circle applicable response

Resident

Non-Resident

Invited Guest

Trespasser

Other Non-Resident Please specify _____

Unknown

Fenced yard? Y/N/U

Four sided barrier fencing around pool? Y/N/U

Self-closing/latching gate? Y/N/U

Gate left open? Y/N/U

Safety pool cover in place? Y/N/U

Door or Pool alarm operational? Y/N/U

Emergency Medical Services California Form

APPENDIX R

The next page is a list of all of the states in the US that have some sort of state pool building code, as well as some of the specifics of the different codes. In addition, it shows the date that each one became effective. We used this to calculate the average and median year that state building codes became effective.

Number out of the 50 States that have Pool Codes:

37

Average Year that the State Code became effective:

1997.68

Median Year that the State Code became effective:

1999

Although this gives us a good idea of what states have done to combat drowning in residential swimming pools, there remains the fact that many counties have adopted their own laws or codes before the states they are located in adopted a state code or law. Therefore, our calculations would be more accurate if we factored in counties and cities, as well as states, into the average and median years. This is done in Appendix S.

State	Effect. Date	Law or guideline	Perimeter fence req.	House as one side	Fence Height	Latch Height	"or alarm" provision	Door/pool alarm	Fence to grade
Alabama	1999	Standard Building Code	SBCCI	SBCCI	SBCCI	SBCCI	SBCCI	SBCCI	SBCCI
Alaska	06/01/01	Fire & Life Safety Regulations	Yes	Yes	48"	54"/Btm-Gate	Yes	Yes	2"
Arizona	08/15/01	Health & Safety Code	Yes	Yes	60"	54"	Yes	Yes	
Arkansas		No state residential code							
California	06/18/89	Health & Safety Code	Yes	Yes	60"	60"	Yes	Yes	2"
Colorado	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Connecticut	04/07/00	Connecticut State Building Code	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO
Delaware									
Florida	01/01/02	Building Code	Yes	Yes	48"	54"	Yes	Yes	2"
Georgia	1994	Official Code of Georgia Annotated	94 SBCCI	94 SBCCI	94 SBCCI	94 SBCCI	94 SBCCI	94 SBCCI	94 SBCCI
Hawaii	*	4 counties determine all codes	Yes	Yes	48"	54"/Btm-Gate	Yes	Yes	2"
Idaho	1997	Commercial/Public only. No res	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997
Illinois	1997	Senate Bill 428	BOCA	BOCA	42"	1997 BOCA	1997 BOCA	1997 BOCA	1997 BOCA
Indiana	2000	Indiana Residential Code 2000	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997
Iowa	06/04/97	Ch. 16-Iowa Admin Code-Public Safety 661	UBC 1994	UBC 1994	UBC 1994	UBC 1994	UBC 1994	UBC 1994	UBC 1994
Kansas	03/01/00	Kansas Building Codes	Yes	Yes	48"	54"/Btm-Gate	Yes	Yes	2"
Kentucky	02/15/80	Kentucky Building Code	Yes	Yes	48"	54"/Btm-Gate	Yes	Yes	2"
Louisiana	1994	Louisiana Administrative Code	1994 SBCCI	1994 SBCCI	1994 SBCCI	1994 SBCCI	1994 SBCCI	1994 SBCCI	1994 SBCCI
Maine									
Maryland	10/15/01	Maryland Building Performance Standards	Yes	Yes	48"	54"/Btm-Gate	Yes	Yes	2"
Massachusetts	02/28/97	MA State Building Code	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO
Michigan	07/31/01	Michigan Building Code	Yes	Yes	48"	54"/Btm-Gate	Yes	Yes	2"
Minnesota	10/05/98	MN State Building Code	97 ICBO	97 ICBO	97 ICBO	97 ICBO	97 ICBO	97 ICBO	97 ICBO
Mississippi	1972	State Building Code	SBCCI	SBCCI	SBCCI	SBCCI	SBCCI	SBCCI	SBCCI
Missouri									
Montana	1997	Building Codes Bureau	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997
Nebraska	07/19/96	State Building Division	UBC 1991	UBC 1991	UBC 1991	UBC 1991	UBC 1991	UBC 1991	UBC 1991
Nevada	06/19/05	1997 Southern Nevada Pool Code Amndmnts	Yes	Yes	60"	48"	Yes	Yes	4" / 2"
New Hampshire	1997	Public Safety & Welfare	1997 BOCA	1997 BOCA	1997 BOCA	1997 BOCA	1997 BOCA	1997 BOCA	1997 BOCA
New Jersey	7/6/1998	Uniform Construction Code	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO
New Mexico	12/31/1998	1997 New Mexico Building Code	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997	UBC 1997
New York	6/12/2001	Res Code for 1&2 Fam Dwellings of NY	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC
North Carolina		NC Residential Building Code	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO	95 CABO
North Dakota	9/1/2002	ND Building Code	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC
Ohio	1/1/2002	No State Residential Code/2000 IBC Only	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oklahoma		Oklahoma State Building Code	1999 BOCA	1999 BOCA	1999 BOCA	1999 BOCA	1999 BOCA	1999 BOCA	1999 BOCA
Oregon	4/1/2000	1 & 2 Family Dwelling Specialty Code	1998 ICC	1998 ICC	1998 ICC	1998 ICC	1998 ICC	1998 ICC	1998 ICC
Pennsylvania	2002	Uniform Construction Code	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC
Rhode Island		No State Residential Code	N/A	N/A	N/A	N/A	N/A	N/A	N/A
South Carolina	7/1/2002	State Building Codes	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC
South Dakota		No State Residential Code	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tennessee		No State Residential Code	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Texas	1/1/2002	Health & Safety Code	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC
Utah	1/1/2002	Uniform Building Standards Act	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC	2000 IRC
Vermont									
Virginia	9/15/2000	Uniform Statewide Building Code	96 BOCA	96 BOCA	96 BOCA	96 BOCA	96 BOCA	96 BOCA	96 BOCA
Washington	7/1/1998	Uniform Building Code	97 ICBO	97 ICBO	97 ICBO	97 ICBO	97 ICBO	97 ICBO	97 ICBO
West Virginia	5/1/1998	No Residential Building Code	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wisconsin	7/1/2002	Commercial Building Code	2000 IBC	2000 IBC	2000 IBC	2000 IBC	2000 IBC	2000 IBC	2000 IBC
Wyoming									

APPENDIX S

This is a sample of different states, counties and cities in the United States, along with the year that they introduced a pool building code or law.

The average year that a municipality introduced a pool building code was 1994.55. The median year was 1994. This information can be used, along with the number of newly constructed in-ground swimming pools each year in the United States, to estimate how many pools have been covered by current local swimming pool codes.

Calculations:

Number of In-ground swimming pools constructed in the US in 2002:

161,000

Number of In-ground swimming pools in existence in the US as of 2002:

4,274,000

Number of In-ground swimming pools in existence in the US as of 2002 that have been subject to local or state pool building codes or laws (using median year):

$$2002 - 1994 = 8$$

$$161,000 \times 8 = \mathbf{1,288,000}$$

Percentage of In-ground swimming pools in existence in the US as of 2002 that have been subject to local or state pool building codes or laws:

$$1,288,000 / 4,274,000 = \mathbf{30.14\%}$$

Percentage of In-ground swimming pools in existence in the US as of 2002 that have NOT been subject to local or state pool building codes or laws:

$$100\% - 30.14\% = \mathbf{69.86\%}$$

Maricopa County	1993
State of Arizona	1991
California	1997
Orange County	1995
Florida	1993
Phoenix	1990
LA County	1993
San Bernardino County	1994
San Diego County	1994
Riverside County	1994
Sacramento County	1995
Scottsdale, AZ	1992
Tuscon, AZ	1996
Pima County, AZ	1999
Marana, AZ	1996
Grandview, Missouri	1997
Georgia	1994
Charlotte County, FL	2001
Indiana	1990
Shawnee, Kansas	1997

APPENDIX T

The NEISS (National Electronic Injury Surveillance System) is a database that is linked to one hundred specially chosen hospital emergency rooms throughout the country (CPSC, 2003). This provides a statistical, stratified sample, which conclusions about the United States can be drawn from. Information is collected from all patients who are brought to the emergency room for injuries regardless of product involvement, injury intent, or occurrence at work. NEISS also includes illnesses if a consumer product or recreational activity is associated with the onset of the illness and illnesses casually linked to a work activity. Information taken into the database includes such fields as:

- date of treatment
- case number
- date of birth
- age of patient
- gender of patient
- diagnosis
- body part affected
- disposition of case
- product(s) mentioned
- whether intentionally inflicted
- incident locale
- fire involvement
- whether work-related
- race and ethnicity
- other race and/or ethnicity
- comments

Through other systems such as the death certificate database and IPII (Injury and Potential Injury Incident) database, we can draw situational facts concerning drowning deaths and injuries; however this data is anecdotal rather than statistical (CPSC, 1997). The data are extracted from letter, telephone calls, news clippings and reports received from sources such as individual consumers and consumer groups, coroners, medical

examiners, and fire and police departments from all over the nation. The purposes of this database are:

- to alert the commission of imminent hazards
- to alert the commission of emerging hazards
- identifying compliance issues
- providing cases for follow-back investigations for products of interest

APPENDIX U

Study	Approach/Relevant Data	Possible Solutions
New York (1988-1994)	<p>State officials contacted local investigating authorities to get detailed information about the incident.</p> <ul style="list-style-type: none"> -Ineffective or nonexistent gate or fencing responsible for 50 of 67 incidents (75%). -Few occurred when a parent knew the child was in the pool area. 	<ul style="list-style-type: none"> -Stricter fencing requirements and enforcement for residential swimming pools. -Realization that drowning can occur quickly and silently.
Maricopa County, Arizona (2002)	<p>Report by fire department of drowning or near-drowning in Arizona form included such areas as:</p> <ul style="list-style-type: none"> -type of water -supervisor -method of access -site of incident -attire of the victim -presence of a fence -would a fence have prevented the incident -age/race/gender/sex 	<p>Barriers play a crucial role in preventing most drowning deaths in pools.</p>
Western Australia (2002)	<p>Compliance rate of swimming pools at first inspection was 40% (400 of 1000 pools).</p>	<p>Changes in legislation, inspections processes, and public education.</p>
World Health Organization (2000)	<p>Role of public health is to:</p> <ul style="list-style-type: none"> -describe the magnitude of the problem by collecting data on drowning deaths and mortality. -undertake research to identify risk factors, protective factors, and exposure measures. -identify the economic impact of drowning in order to provide a basis for cost-benefit analysis. -advocate for more attention to drowning prevention. -to promote, facilitate and catalyze the implementation of drowning prevention measures and policies. -to strengthen emergency response services. 	<p>Public health should collect data, research, and produce a cost-benefit analysis.</p>
Injury Research Bulletin	<p>Research project on the adequacy of</p>	<p>It is expected that the</p>

<p>of Western Australia (January, 2003)</p>	<p>inspections of barriers to residential swimming pools in 2001 through randomly selected inspection records. 89% of inspectors reported the inspection process was effective at identifying swimming pools not meeting compliance.</p>	<p>legislative changes coupled with other refinements to the barrier inspection and enforcement process will reduce the incidences of child drownings in Western Australian private swimming pools over forthcoming years.</p>
<p>Canadian Red Cross (2003)</p>	<p>The Canadian Red Cross keeps very accurate statistics on drowning. Half of the approximately 65 near drowning victims (yearly) are under age 5. Near drownings should be investigated further.</p>	<p>Near drowning should be focused on at a higher level than it is currently.</p>
<p>New Zealand (survey of regulatory authorities, 1999)</p>	<p>-74 local authorities were enlisted through questionnaires, and then 12 were selected for a telephone interview follow up: 44% of the households covered by those authorities complied with Fencing of Swimming Pools Act of 1987 4% were granted exceptions 19% did not comply 33% compliance not known/reported -86% of the authorities identified problem(s) with the act: 84% reported pool owner resistance 76% reported difficulty of locating pools 63% reported cost of administration 64% had difficulty interpreting the act 11% would be more vigilant if enforcement costs could more easily be recovered - 2/3 suggested solutions to overcome these setbacks 44% believe education/publicity is the answer 13% believe the act needs to be clarified 11% desire additional resources to cover cost of enforcement</p>	<p>2 problems with the act: -Inconsistencies between authorities in their enforcement of particular requirements, largely due to ambiguities in the legislation. -Some authorities making little attempt to locate pools or monitor compliance.</p>

	8% believe instant fines or other litigation would work	
New Zealand (Consideration of the Fencing of Swimming Pools Act)	54% of territorial authorities stated they would support submissions to increase the maximum level of fines and four would like to see some provision for instant fines or an infringement offence system (a system of penalties for non-compliance).	Provision of fines and other penalties for non-compliance with the FOSP Act.

Chapter VIII: References

- Arizona Drowning Prevention Coalition (2003) Retrieved October 3, 2003, from the World Wide Web: <http://www.preventdrowning.com>.
- American Academy of Pediatrics. (2003) Survey: Water Safety Advice Varies With Child's Age. AAP Division of Child Health Research. Retrieved November 20, 2003 from the World Wide Web: <http://www.aap.org/research/periodicsurvey/ps25a.htm>.
- Bell, J. (2003, September 6) Boy dies after falling in pool. The Los Angeles Times. Retrieved on September 15, 2003, from the World Wide Web: <http://www.latimes.com/news/local/burbank/news/la-blrdrown06sep06,1,2000891.story>.
- Blomquist, S. "Information on Drowning in New Zealand" *Electronic Communication* 5 December 2003
- Brenner, R. (2001, July). Where the children drown – United States, 1995. Pediatrics, 1(1). 85.
- Building Surveyor's Private Swimming Pool Inspection (1999-2000). Local Government Health Department of Western Australia. Retrieved on December 1, 2003 from the World Wide Web: <http://www.stirling.wa.gov.au/transit/newmins/tp/2000/August/TP20000808-11.htm>.
- Childsafetystore.com. Retrieved November 4, 2003 from the World Wide Web: <http://www.childsafetystore.com>.
- Community Partnerships: The Key to Preventing Injuries. National Highway Traffic Safety Administration. Retrieved on November 15, 2003, from the World Wide Web: <http://www.nhtsa.dot.gov/people/outreach/safesobr/12qp/keyinjuries.html>.
- CoverStar, Inc. Retrieved September 15, 2003 from the World Wide Web: <http://www.coverstar.com>.
- Department of Human Services, Victoria (2000). Pool operators handbook. Victoria, Australia. Victorian Government Publishing Service. Retrieved September 28, 2003 from the World Wide Web: <http://www.dhs.vic.gov.au/phd/0010085/downloads/0010085.pdf>.
- Dimmerno, Kate. (2003) Water safety reminder. NJ Department of Human Services. Retrieved September 7, 2003, from the World Wide Web: <http://www.njfostercare.org/water%20safety%20reminder.htm>.

- Fencing residential pools and spas. (2002, September) *Public Health Association of Australia*. Retrieved September 6, 2003, from the World Wide Web:
<http://www.phaa.net.au/policy/Fencing%20residential%20pools%20and%20spasF.htm>.
- Fletcher, A. (2002, February 11). Petition for declaratory statement before the Florida Building Commission. Department of Community Affairs.
- Flood, T. Child drowning: what we know, what we don't. Arizona Department of Health Statistics, presented April 3, 2003, format of Microsoft PowerPoint, pp. 1-19.
- Flood, T. Water-related incidents in Maricopa County, AZ Arizona Department of Health Services, Bureau of Public Health Statistics. Report#2003: 1 October 2003.
- Fuller, N., & Stearns, J. (2003, July 10). Police call 5-year old's drowning accidental. The Boston Globe, pp. B5.
- Gedan, B. (2003, June 17). Successful rescue sparks summer warning over phone, EMT helps mother revive boy pulled from pull. The Boston Globe, pp. B2.
- Gillen, G. (2003, May 13) Supervision and Safety Precautions Key to Avoiding Water Related Tragedies. The Consumer Product Safety Month News.
- Hastings District Council. Swimming Pool Fencing. Retrieved November 3, 2003 from the World Wide Web:
http://www.hastingsdc.govt.nz/PropertyInfo/Swimming_Pools.htm.
- Heney, W. (2002, December 2) Consideration of Aspects of the Fencing of Swimming Pools Act. Retrieved October 28, 2003 from the World Wide Web:
<http://ccc.gov.nz/council/agendas/2002/December/RegulatoryConsents/Considerations/FencingofSwimmingPoolsAct.pdf>
- Jarred, W. The Building Amendment Bill 2003 (Qld): Strengthening Swimming Pool Safety Laws. Queensland, Australia: Queensland Parliamentary Library
- Keeping Little Feet on Solid Ground for Over a Decade. *Life Saver Pool Fence Systems, Inc.* Retrieved September 6, 2003, from the World Wide Web:
<http://www.poolfence.com/safepool.htm>.
- Kerr, Marcia. "Information on Drowning" *Telephone Interview*. 29 October, 2003.
- Leland, Elizabeth. (2003). "Fact Sheet: Electrocution Hazards Project Swimming Pools, Spas, Hot Tubs and Lighting Systems" U.S. Consumer Product Safety Commission Division of Economics.

- Lupton, Eric "Information on Life Saver Pool Fencing" *Telephone Interview*
28 October 2003.
- Lyons, Robert "Information on Turtle Wristbands (Terrapin Corp)" *Telephone Interview*
30 October 2003.
- Morrison, Luke. Achieving Compliance with Pool Fencing Legislation in New Zealand: a Survey of Regulatory Authorities. Injury Prevention Research Unit. 1999;5:114-118.
- Mortality (Fatal Injury) Reports, National Center for Injury Prevention and Control, Center for Disease Control, retrieved via World Wide Web on September 25, 2003: <http://webapp.cdc.gov/sasweb/ncipc/mortrate.html>.
- Muir, A., Ward, B. (2003, November 6) "New Zealanders Take More Care Around Water." *Media Release*. Water Safety New Zealand
- National Safety Council fact sheet library. (2001, April 17). *National Safety Council*. Retrieved September 4, 2003, from the World Wide Web: <http://www.nsc.org/library/facts/drown.htm>.
- Orange County, Planning & Development of Services Department Development Processing Center. Guidelines for the Installation of Residential Pools and Spas. Retrieved October 31, 2003 from the World Wide Web: <http://pdsd.oc.ca.gov/docs/poolspaguidelines.pdf>.
- PBM Industries, Inc.: PoolGuard Alarms. Retrieved on September 13, 2003 from the World Wide Web: <http://www.poolguard.com>.
- Pediatric Injury Mortality Report. (January 1994) Drowning. Los Anglos County.
- Phoenix, Development of Services Department. Inspection Requirements for Pool Barriers. Electronic correspondence from Marilyn Barr.
- Pitt WR, Balanda KP. Childhood drowning and near-drowning in Brisbane: The contribution of domestic pools. *Medical Journal of Australia* 1991; 42 (675):661.
- Pool safety barrier of Sarasota, Products page. Retrieved September 13, 2003, from the World Wide Web: <http://www.poolsafety.com/products2.html>.
- Poolstore.com. Retrieved November 4, 2003 from the World Wide Web: <http://www.poolstore.com>.
- Poseidon Technologies, Inc. *The Poseidon system can save more than just precious seconds*. Retrieved September 6, 2003, from the World Wide Web: <http://www.poseidon-tech.com/us/PoseidonBrochure.pdf>.

- Rowe, W. (1996, October 25) CPSC memorandum to Troy Whitfield, Hair entanglement, entrapment, and disembowelment associated with spas, swimming pools, and wading pools since January 1, 1990. EHHA
- Sayer GP, Steele P. Swimming Pools Act 1992: Regulation and Compliance in New Castle, New South Wales. Public Health Bulletin 1996; 7(8): 83-86.
- Schroader, R., & Lowe, M. (2001, September) Managers Report. Pool and spa safety. Drowning deaths by main drain suction can be prevented. Retrieved September 10, 2003, from the World Wide Web: <http://www.drainsafe.com>
- Simoës, Patricia. Water Safety Program Reduces Drownings. Retrieved on November 15, 2003 from the World Wide Web: <http://www.hq.usace.army.mil/cepa/pubs/dec99/story15.htm>
- State of Queensland (Department of Local Government and Planning). Children, Pools and Drowning Statistics. Retrieved on November 18, 2003 from the World Wide Web: <http://www.poolfencing.qld.gov.au/public/content7.html>
- Stevenson, M.R., (2003, February) Childhood drowning: Barriers surrounding private swimming pools. Pediatrics, 111 (2). 115-119.
- Sweet, D. (2002, May 22) CPSC memorandum to Mark Ross, Fatality information for the In-Home Drowning Prevention Campaign. Division of Hazard Analysis.
- Tate, Greg. Keep Watch 2000-Water Safety. Retrieved on December 1, 2003, from the World Wide Web: <http://www.babymaking.net/information/safety/keepwatch2000.htm>.
- Terrapin Communications, Inc. Retrieved on September 15, 2003, from the World Wide Web: <http://www.safteyturtle.com>.
- The General Assembly of Pennsylvania. (1998, June 2) Senate resolution. Retrieved on September 7, 2003 from the World Wide Web: <http://www.legis.state.pa.us/WU01/LI/BI/BT/1997/0/SR0204P2047.HTM>.
- U.S. Consumer Product Safety Commission. (1997, September). A Description of the Injury or Potential Injury Incident Data Base (IPII). Washington D.C. U.S. Consumer Product Safety Commission
- U.S. Consumer Product Safety Commission. Children drown and more are injured from hair entrapment in drain covers for spas, hot tubs and whirlpool bathtubs: Safety alert. Washington, D.C: U.S. Consumer Product Safety Commission.

- U.S. Consumer Product Safety Commission. (1987, September). Child Drowning Study. A Report on the Epidemiology of Drownings in Residential Swimming Pools of Children Under the Age of Five. Washington D.C.: Paula Present, U.S. Consumer Product Safety Commission
- U.S. Consumer Product Safety Commission. (1996, March 11). CPSC Swim N' Play announce pool ledge cover recall Washington D.C.: U.S. Consumer Product Safety Commission.
- U.S. Consumer Product Safety Commission. (2003, July 1). CPSC warns backyard pool drownings happen "quickly and silently". Washington, D.C.: U.S. Consumer Product Safety Commission.
- U.S. Consumer Product Safety Commission. (2002) Guidelines for Entrapment Hazards: Making Pools and Spas Safer, Washington, D.C.: Pub. No. 363, U.S. Consumer Product Safety Commission.
- U.S. Consumer Product Safety Commission. (2002). How to plan for the unexpected: Preventing child drownings. Washington, D.C.: U.S. Consumer Product Safety Commission.
- U.S. Consumer Product Safety Commission. (2003, June). NEISS Coding Manual: All Injury. Washington D.C.: U.S. Consumer Product Safety Commission
- U.S. Consumer Product Safety Commission. (1993, May 26). Swim spa suction cover replacement program; Hair entrapment, drowning risk cited. Washington, D.C.: U.S. Consumer Product Safety Commission.
- U.S. Department of Health and Human Services Centers for Disease Control and Prevention. (2002, October). Instruction Manual. Hyattsville, Maryland.
- Valenti, M. (2002) Improving Pool Safety. Mechanical Engineers Magazine Online. Retrieved on September 13, 2003, from the World Wide Web: <http://memagazine.org/medes02/poolsafe/poolsafe.html>.
- Wintemute, GJ. (1991) The Attitude-Practice Gap Revisited: Risk Reduction Beliefs and Behaviors Among Owners of Residential Swimming Pool. Pediatrics. 1991 Dec; 88(6):1168-71.
- West Covina Fire Department. Public Education Programs. Retrieved on November 15, 2003 from the World Wide Web: <http://www.westcov.org/council/pubed.html>
- WHO – World Health Organization. (2000). Facts about Injuries: Drowning. Geneva, Switzerland: Injuries and Violence Prevention Division, World Health Organization. Retrieved November 15, 2003 from the World Wide Web http://www.who.int/violence_injury_prevention