5-2008

Pool and Spa Entrapment Among Children

Andrea M. Riendeau

POOL AND SPA ENTRAPMENT AMONG CHILDREN

By

Andrea M. Riendeau

Bachelor of Science, University of North Dakota, 2001

A Scholarly Project

Submitted to the Graduate Faculty

of the

University of North Dakota

In partial fulfillment of the requirements

for the degree of

Master of Science in Nursing

Grand Forks, North Dakota

May

2008

This independent project, submitted by Andrea Riendeau in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.

Chairperson

This independent project meets the standards for appearance, conforms to the style and format requirements of the Graduate School of the University of North Dakota, and is hereby approved.

Dean of the Graduate School

May 7, 2008
Date

PERMISSION

Title Pool and Spa Entrapment Among Children

Department Nursing

Degree Master of Science

In presenting this independent project in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, I agree that the library of the University shall make it freely available for inspection. I further agree that permission for extensive copying for scholarly purposes may be granted by the professor who supervised my independent project work or, in her absence, by the chairperson of the department or the dean of the Graduate School. It is understood that any copying or publication or other use of this independent project or part thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of North Dakota in any scholarly use which may be made of any material in my independent project.

Andrea Riendeau
Signature

5-4-08
Date

TABLE OF CONTENTS

ACKNOWLEDGMENTS

I would like to thank my husband, Donny for supporting me through this sometimes challenging, but always rewarding endeavor. I know it hasn't been easy at times "single parenting" on evenings of study group or dealing with the disturbance of constant phone calls from frantic classmates. But, we made it and I will forever appreciate your love and shared commitment for the future of our family.

And, to my beautiful children Jordan, Kasen, and Keely who have brought continued joy to my life and inspiration to succeed. I wish for you a life of many successes and will always be there to cheer you on.

And finally, I would like to thank my advisor, Dr. Julie Anderson for always believing in me and providing the support I needed to succeed in attaining my goals. I appreciate everything you have done for me.

To my children Jordan, Kasen & Keely

ABSTRACT

Background: Drowning continues to be a leading cause of accidental death in children of all age groups. Furthermore, parents and caregivers are unaware or know little about the issue of suction entrapment and entanglement in pools and spas. This issue is also overlooked in the public eye and when an entrapment or entanglement does occur causing the death of a child, it is simply reported as an accidental drowning. Therefore, suction entrapment and entanglement along with drowning will be explained in great detail to educate the reader on this health risk.

Purpose: The purpose of this project is to examine the problem of hair and body entrapment in pools and spas leading to drowning among children and to provide education on this serious health risk to parents and caregivers.

Audience: The information gathered from this project was presented at the Sigma Theta Tau International Research conference at an upper Midwestern community University on September 21, 2007. It was also presented at the Graduate School 2008 Scholarly Forum. The information was explained utilizing a poster presentation with colorful pictures and diagrams explaining the important points of the project. The poster will be given to the local Safe Kids Coordinator to be distributed in an upper Midwestern community of 50,000 people.

Plan: A review of literature was completed on drowning, entrapment, and entanglement involving children and what research has been completed on this health topic. A poster was created focusing on educating the parent or care provider on the issues explained above and prevention tactics that can be incorporated into homes or healthcare practice.

Theoretical framework: Since children are unable to meet all of their self-care needs, it is the decision of this author to utilize Orem's self-care deficit theory to explain and guide this

project. Children are dependent upon parents or caregivers to meet a bulk of their needs and therefore qualify according to Orem and do not meet the requirements for self-care.

Implications: Research into the health risks involved with entrapment and entanglement leading to drowning is crucial in providing healthcare providers with the information necessary to educate their patients, especially parents of at risk children. Recommendations for nursing practice, research, policy, and education were addressed. Even though parents are unaware of these risks, education will decrease the incidence of these events occurring.

CHAPTER I

Introduction

One mother's worst fear came true for Nancy Baker when her 7-year old daughter was found trapped underwater in a hot tub. She had tried to pull her away, but didn't realize what was so powerfully holding her down (Moharabi, 2006). Finally, two grown men jumped in and had enough strength to pull her free. The force was strong enough to shatter the 8-inch grate that trapped her to the bottom of the hot tub with the force of suction. She was submerged under the water for approximately 10 minutes which unfortunately, provided for minimal survivability (Mogharabi, 2006). Nancy's daughter was unable to be revived that horrible day. This situation raises concerns about children's safety when around pools and spas. More exploration needs to be pursued in the area of pools and spa entrapment since it is an increasing safety concern.

Statement of the Problem

The U.S. Consumer Product Safety Commission (CPSC) (2005) has reported 74 cases of body entrapment, with 13 confirmed deaths, between January 1990 and August 2004. These incidents occurred in both residential and public settings. Thirty-nine of the incidents occurred in spas, hot-tubs, or whirlpools, 31 occurred in swimming pools and three occurred in a wading pool. One location was unknown. CPSC is aware of 43 incidents of hair entrapment or entanglement in pools, spas, and hot tubs between January

1990 and August 2004. Twelve of the incidents resulted in drowning deaths, as a result of hair becoming entangled in the drain grates (CPSC, 2005). From January 1990 through August 2004, CPSC has reported two incidents of evisceration/disembowelment (CPSC, 2005). Additionally, the U.S. Centers for Disease control and prevention (2006) found there were 3,386 unintentional drownings in recreational water settings in 2003. Recreational settings include pools, spas/hot tubs, and natural water settings (e.g., lakes, rivers, or oceans. According to the CPSC (2001), it is not clear how many of the drownings could be attributed to entrapment.

There are multiple protective barriers available for dangerous areas like swimming pools and spas. Some relatively simple techniques utilized to prevent children who are unsupervised from gaining access to a unprotected swimming pool include: locked doors and fences with locked gates. These are two examples of passive safety systems (CPSC, 2002).Installing a fence that is at least four feet high around the pool or spa area that also includes a gate which is self-closing and self-latching. A swimming pool alarm can decrease these unintentional accidents from occurring (Traugott, 2007). Other safety devices include the anti-vortex cover; which is a piece for the drain that is designed to prevent the swirling motion of water that will form a vacuum in the center and will pull the body or hair into the drain pipe. Next, is the anti-entrapment cover which is a dome-shaped drain fitting that is designed to decrease the incidence of creating a body seal around the drain. The old covers were flat in comparison. Another option is installing a safety vacuum release system (SVRS), which is a device that is able to sense when there is an increase in pump suction and power is interrupted, thus relieving the potentially entrapping suction (CPSC, 2005).

There has been a lack of research or publications on this topic and parents need to know the risks involved when their children are around swimming pools or spas. Research has shown that one-third of parents with children under the age of fourteen realize that drowning is a leading cause of accidental death in children, and 66% of parents are unaware or know little about the risk of entrapment and entanglement (Safe Kids, North Central Florida, 2006). Adding to the seriousness of this problem, research shows that owning pools and spas is increasing in popularity (Safe Kids, North Central Florida, 2006).

Purpose of the Project

The purpose of this project is to examine the problem of hair and body entrapment in pools and spas leading to drowning among children and to provide education on this serious matter to parents and caregivers. This will be achieved by performing an extensive literature review on suction entrapment and entanglement, drowning and near drowning among children, and safety devices available to decrease the incidence of this potential safety concern. The information obtained will be presented in poster format to fellow graduate students, faculty, and other peers attending the scholarly poster forum and the Sigma Theta Tau Research conference. Education will focus on three areas: making people aware of the hazard, encouraging them to gain knowledge of the safety measures at the pools children will be using, and assessing the knowledge of the pool staff or pool owners (Dellinger, 2001).

Conceptual/Theoretical Framework

Orem's self-care deficit theory, a grand theory will be used as a framework for this project. The *Theory of Self-Care Deficit* describes the grounds for patients'

requirements for nursing care. These requirements are related to inabilities or deficits in meeting self-care requisites or needs (Moore & Beckwitt, 2006). The self-care deficit theory of nursing is divided into three specific entities. They include a theory of self-care, a theory of self-care deficit, and a theory of nursing system. For the purpose of this project the self-care deficit theory will be explained. The main idea of self-care deficit is that people can benefit from nursing care because they are prone to health-related or health-derived limitations that make them incapable of continuous self-care or dependent care. "Self-care is the action of mature and maturing persons who have the powers and who have developed or are developing capabilities to use appropriate, reliable, and valid measures to regulate their own functioning and development in stable or changing environments" (Orem, 2001, p.43). Self-care is described by Orem (2001) as understood as a learned activity, learned through interpersonal relations and communications. Dependent care is defined by Orem as "Activity (to regulate factors that affect development and functioning in the interests of life, health, or well-being) performed by responsible adults for socially dependent individuals" (Orem, 2001, p. 491). It could also mean ineffective or incomplete care provided by the dependent care provider (Orem, 1980). For the purpose of this paper dependent care providers can and will include caregivers such as parents and grandparents and daycare providers.

There are multiple propositions to Orem's theory. According to Orem (2001, p. 147):

1. Persons who take action to provide their own self-care or care for dependents have specialized capabilities for action.

2. Individuals' abilities to engage in self-care or dependent-care are conditioned by age, developmental state, life experience, sociocultural orientation, health, and available resources.
3. Relationship of individuals' abilities for self-care or dependent-care to the qualitative and quantitative self-care or dependent-care demand can be determined when the value of each is known.
4. The relationship between care abilities and care demand can be defined in terms of equal to, less than, and more than.
5. Nursing is a legitimate service when (a) care abilities are less than those required for meeting a known self-care demand (a deficit relationship) and (b) self-care or dependent-care abilities exceed or are equal to those required for meeting the current self-care demand, but a future deficit relationship can be foreseen because of predictable decreases in care abilities, qualitative or quantitative increases in the care demand, or both.
6. Persons with existing or projected care deficits are in, or can expect to be in, states of social dependency that legitimate a nursing relationship.
7. A self-care deficit may be relatively permanent, or it may be transitory.
8. A self-care or dependent-care deficit may be wholly or partially eliminated or overcome when persons with deficits have the necessary human capabilities, dispositions, and willingness.
9. Self-care deficits, when expressed in terms of persons' limitations for engagement in the estimative (intentional) or production operations of self-care, provide

guides for selection of methods of helping and understanding patient roles in self-care.

Orem defines self-care as, "Care that is performed by oneself for oneself when one has reached a state of maturity that enables him or her to take consistent, controlled, effective, and purposeful action" (Orem, 2001 p. 32). The unborn, newborn, infants, children, mentally handicapped, and those who are ill cannot meet the above requirements for self-care. The majority of this project focuses on the child that has an abundance of self-care needs and is dependent on his/her parents or caregivers to meet the bulk of his/her needs. Thus, according to Orem children are unable to meet their own self care needs, resulting in a self-care deficit. The parents play the role of the dependent care provider in this situation. In the context of pool and spa entrapment, it will be imperative for the health care provider to educate parents and caregivers on suction entrapment and drowning.

Definitions

A spa or hot tub is defined as a warm water reservoir, manufactured from prefabricated materials at a factory with hydromassage jets. All the control, water heating, water circulating equipment are contained within the unit (CPSC, 2005). The term public pool and sp refers to facilities intended for use by the public in such areas as parks, hotel/motel facilities, institutions, multiple family dwellings, resorts, and other areas of public use (CPSC, 2005). The term residential pool and or spa refers to a pool or spa located within the constraints of a residential property and intended for the private use of the owner and or the home's occupants (CPSC, 2005).

In this project the term entrapment, otherwise known as suction entrapment will be defined as when a part of a child's body, hair, or piece of clothing becomes attached to a drain due to the high-powered suction of a pool or spa's filtration system. More specifically, there are five types of entrapment that will be described. First, there is body entrapment, in which a part of the torso becomes entrapped. Next, there is limb entrapment, in which an extremity is stuck in an open drain pipe. Hair entrapment or entanglement occurs when the hair is sucked in the grate of the drain cover and wrapped around it. Mechanical entrapment involves jewelry or a piece of the swimmer's clothing getting stuck in the drain or grate. Entrapment occurs because of the tangling, and not necessarily because of the strong suction forces, although the suction is what initially draws the hair into the drain cover (CPSC, 2005). Finally, evisceration can occur if the victim's buttocks come into contact with the pool suction outlet and he or she can have rectal lacerations and partial or nearly complete eviscerations or disembowelment (CPSC, 2005).

Drowning is defined as death occurring as a result of suffocation (lack of oxygen) within 24 hours of submersion in water (Brenner, 2003. Near-drowning is initial survival after submersion for at least 24 hours (Brenner, 2003). There are also two types of drownings: dry drownings and wet drownings. "About 10% of drownings are dry drownings: in which the person does not take water into their lungs. The larynx, or voice box, spasms and closes off the airway. The person cannot cry out in dry drownings because the larynx is in severe spasm" (Harvard Health Letter, 2000, p.6).

Wet drownings occur when "Water in the lungs interferes with the normal carbon dioxide-oxygen exchange in the alveoli, which are tiny sac-like structures of the lungs. The body's oxygen stores are depleted and suffocation occurs" (Harvard Health Letter, 2000, p.6).

Significance of the Project

Drowning and near-drowning are major causes of morbidity and mortality related to unintentional injury of children. From 1990 to 2000, drowning was the second leading cause of unintentional injury death among U.S. children between the ages of 1 and 19(Centers for Disease Control and Prevention (CDC), 2003). Among toddlers 12 to 23 months of age, it was the leading cause of injury or death and the second leading cause of death overall (Brenner, 2003). Even though the statistics elude that drownings (4,000) aren't huge in numbers compared to the number of people who die in car accidents (40,000) or from falls (about 16,000) each year in the U.S., the significance of the problem lies in a couple areas. Many of these drowning are preventable and 25% of those 4,000 people were children under the age of fourteen (Harvard Health Letter, 2000).

The public, which includes parents and caregivers, may not fully realize how powerful the suction is in a hot tub or spa. For example, if a person held a 40 lb ball to the bottom near a suction outlet, it would take at least 400 pounds of lifting pressure to remove the ball (Dworkin, 1998). This is a staggering piece of information, in that there may not be enough people around to break the powerful suction. Or, there may not be people strong enough to remove the force of the suction.

Nurse practitioners and other healthcare personnel may benefit from the results of this project by being able to provide education and guidance to parents of young children

and caregivers. The project may also raise awareness over a topic that has not yet received the attention it deserves. Awareness over this safety topic could potentially save lives and prevent severe health consequences such as disembowelment, permanent disabilities from a near-drowning, or injury to a limb from entrapment.

Assumptions/Limitations

An assumption for this project is that parents and caregivers want to be educated on suction entrapment for pools and spas due to the significant adverse health outcomes. It is also assumed that dependent care agents will value the concept of prevention in terms of their children. Another assumption is that the general public lacks knowledge on the topic, and this information will be well received.

Limitations of this study include first that there is underreporting of pool and spa entrapment. Next, there is minimal literature available to compare and contrast research studies on the safety concerns addressed above.

Summary

It would be any parents worst fear to find their child trapped against a drain in a pool or spa or to learn their child has drowned. That was the case with Nancy Baker, as introduced earlier in this chapter. The magnitude of this problem has been explained and the theory that guided this project has been explored. The expectation is that after one reads through the above information it will become quite clear what the problem is and the purpose of this project.

CHAPTER II

Introduction

Pools and spas can provide many hours of entertainment and fun, but there are also hidden dangers for children and adults. Drowning continues to be a safety problem among children. And, as stated earlier, there are discrepancies on accidental drownings and suction entrapment. Many of the reported accidental drownings may have actually been from suction entrapment. Suction entrapment and drowning will be explained in further detail with the focus on specific studies and their implications, and the scope of the problem will also be more thoroughly examined.

Review and Critique of Related Studies

Entrapment

A study conducted by Davison and Puntis (2003) examined travel agents' level of understanding related to suction injuries in the United Kingdom (UK). The researchers interviewed 42 travel agents by telephone and email with a structured questionnaire about their familiarity with suction/entrapment injuries. They enquired about any safety checks being implemented, and if there were lifeguards present in the facilities they were recommending to their customers. One out of four of the 42 travel agencies declined to comment or was unable to comment on any of the issues addressed, and an additional 16% of the respondents did not sell vacations that had access to a swimming pool. Twenty-four companies, who had access to a swimming pool, did provide a response to the questionnaire. One third of the employees interviewed reported they were somewhat

familiar with suction injuries, and this sometimes meant only hearing of the problem which meant only hearing of the problem. None of the companies reported that it was their practice to give information to their clients warning them about suction injuries or cautioned them before entering a pool to look for uncovered drains. Roughly two thirds of the travel companies did not perform safety checks, and considered it the hotel owners' responsibility. Seven of the 24 companies reported they carried out their own safety checks. Only 1 in 6 companies reported that they used lifeguards at their facilities and two stated that if the pool was not attended by lifeguards, children were not allowed to be in the pool area. This study had a small sample size and the response rate was not 100%. This concludes they state that this study illustrates there is a relatively low awareness of the issues involved among the holiday resorts who were prepared to discuss customer safety with only a small minority setting a high standard for prevention. The need for education on pool safety and also raises concerns in the UK about injury prevention education (Davison & Puntis, 2003).

According to a study by Quraishi, et.al. (2006) 66% of parents with children age 14 or under are not or only slightly familiar with drain entrapment and entanglement. One out of two parents surveyed in the United States self-reported that they had a pool or spa in their home. This included inflatable pools (22%), in ground pools (15%), above ground pools (13%), and spas (8%). Also, interestingly, "among the parents surveyed only 15 percent of pool and spa owners had anti-vortex drain covers and, only 12 percent had safety vacuum release systems in place. And, from the parents surveyed from above only 28 percent of pool/spa owners had isolation fencing; 50 percent had perimeter fencing; and 34 percent had self-closing, self-latching gates" (Quraishi, et.al., 2006). These

findings prove that although there are safety devices available to prevent entrapment and entanglement, parents who own a pool or a spa are not likely to have them installed. Parents who own a pool or spa are moderately likely to have barriers such as fencing and self-closing, self-latching gates.

The newspaper article from Mogharabi (2006) discussed Nancy Baker's tragic loss in further detail. The article reports how Nancy is working with Safe Kids Worldwide and with Florida's U.S. democratic representative Debbie Wasserman Schultz to help the public become aware of suction entrapment and to avoid putting other parents through this same heartache. Wasserman Schultz is presently sponsoring a bill that would provide monetary incentives to states that enact safety precautions for pools that are more rigid with their guidelines. As a part of this legislation, there would be three safety measures mandated a) a physical barrier such as a fence, b) anti-vortex drain covers, and c) safety vacuum release devices in all pools and spas (Mogharabi, 2006).

According to Brenner (2003), installing 4-sided fencing that separates the swimming pool from the house and the yard decreases the number of pool immersion injuries by more than 50% among young children. Because children are able to climb, fencing should be at least four feet high, there should not be an opening under the fence, and there should be no more than four inch spans between uprights. Gates should be self-latching and self-closing, and should be meticulously inspected often to ensure they are working well (Brenner, 2003).

Safety Devices

The Star 100 and Anti-Hair Snare Plus are two types of anti-vortex drain covers designed to meet the performance requirements for preventing entrapment within the

water safety community (Safe Kids, 2006a). They each work in unique ways to prevent body and/or limb entrapment, disembowelment, or hair entanglement induced by powerful suction. They are each made with a UV inhibitor to prevent the cover from breaking down due to exposure from the sunlight. There is a higher risk of entrapment if the cover is broke because the suction force becomes greater. This is the primary reason that a pool or spa should not be used if the drain cover is missing or broke (Safe Kids, 2006a).

The Star 100 functions by having water flow underneath the cover through scalloped edges, which ensures the strongest suction is not pulling straight downward. It has a 13" diameter along with the innovative scalloped edges, which prevents the suction from making a complete seal and powerfully holding the person's body against the drain. The water flow through the rectangular holes in the cover has minimal suction so it is not strong enough to trap hair in the cover or below it. The Star 100 is contraindicated for use in a spa or hot tub, however, because larger pumps with higher flow rates are used in these instances. The Star 100 uses a low flow rate for an anti-entrapment cover (Safe Kids Grand Forks, 2006a).

The Anti-Hair Snare Plus drain cover has a dome shape with wedges positioned at different heights. It prevents the suction from making a complete seal and holding the person's body against the drain. The wedges also prevent hair entanglement because the hair flows naturally to the center of the cover and it can be pulled out easily (Safe Kids Grand Forks, 2006a).

A safety vacuum release system (SVRS) is available and works as an automatic suction release system. When a drain becomes blocked, the SVRS quickly provides a

vacuum release. It works with or without a drain cover and does not cause interference with the swimming pool pump function. There is a spring loaded piston in the SVRS unit which forms a seal to stop air from entering the suction system under normal operation. With an entrapment event a sudden rise in the vacuum occurs, which in turn forces the piston open and the air seal is broken, thus releasing the vacuum and suction. Once the SVRS unit is installed by a pool professional it requires little to no maintenance (Safe Kids Grand Forks, 2006b).

Even though entrapment is a relatively unknown concept, it is something that can cause serious injury and even death. Increased awareness about entrapment issues is imperative among parents and caregivers. Pool and spa entrapment can be prevented with education and the above mentioned safety features. The intense force that is generated to produce entrapment within pools and spas is sometimes as great as 500 pounds. The magnitude of this problem is serious causing a potential for a great number of injuries and deaths.

Drowning

Residential swimming pools are the most common place for immersion injuries, especially with preschool children. The annual financial losses due to swimming pool drownings and near drownings of young children in the United States are estimated to be between $450 and $650 million (Al-Mofadda, Nassar, Turki & Al-Sallounm, 2001). Typical medical costs for a near-drowning victim can range from $75,000 for initial treatment to $118,000 a year for long-term care. This large number is due to the fact that as many as 20% of near-drowning survivors suffer severe, permanent neurological disability. The total cost of a single near-drowning that results in brain injury can be more

than $4.5 million (Centers for Disease Control and Prevention, 2002). These financial figures include money spent on hospital and nursing home care, physician services, medications, appliances, and rehabilitation as well as for nonmedical care directly related to the injury.

The study by Al-Mofadda et al. (2001) was performed at King Khalid University Hospital, in Riyadh, Saudi Arabia. This was a retrospective case review study that looked at twenty-eight cases of pediatric near drowning over a 10-year period. The medical records of all these cases were gathered and data regarding age, sex, nationality, season of near drowning, type of drowning, duration of water submersion, duration of transport to the hospital, initial vital signs, initial Glasgow Coma Scale, initial temperature, initial blood gas, pH and the initial blood sugar levels, was obtained and the patient's outcome was analyzed. Results of this study showed that only one of the 21 private swimming pools was up to date on safety regulations. Eleven patients died in the pediatric intensive care unit and 17 were discharged alive (Al-Mofadda, et al., 2001). Submersion time of >5 minutes and the emergency room documentation of absence of vital signs, Glasgow Coma scale of <4, arterial pH of <7.0 and blood sugar of >10mmol/L all predicted bad outcomes, with a statistical significance ($P<0.05$) (Al-mofadda, et al., 2001). Of the 28 near-drowning subjects who met the admission criteria, 12 recovered fully, 11 were diagnosed to have brain death and 5 were discharged from the Pediatric intensive care unit (PICU) with severe neurological injury (totally dependent on others) (Al-Mofadda, et al., 2001).

One key element of the study by Al-Mofadda et al. (2001) on pediatric near drowning in Saudi Arabia was that none of the patients' families were trained in

cardiopulmonary resuscitation (CPR). When a person is submerged under water for less than a minute, chances for a full recovery are good (Harvard Health Letter, 2000). After about three minutes without oxygen, a person will lose consciousness and stop breathing. Quick implementation of CPR can save a person's life. After three minutes, people can still be revived, but the chance of permanent brain damage increases. After roughly 10 minutes, the heart stops and chances of recovery are slim (Harvard Health Letter, 2000). Time has also been shown to be critical with preventing children from drowning. The Consumer Product Safety Commission (CPSC) (2006) reports that three-quarters of victims of drownings that were children were missing for five minutes or less. Medical costs associated with a submersion-related injury are extremely high. The CPSC estimates that an injury that results in brain damage can cost $160,000 for the initial hospitalization. And, some injuries that result in an extended hospital stay exceed $300,000 (CPSC, 2006).

Saluja, Brenner, Trumble, Smith, Schroeder, and Cox (2006) conducted a study that looked at U.S. residents aged 5-24 to examine why black males and other ethnic groups have a higher rate of drowning. They obtained their data from death certificates, medical examiner reports, and newspaper clippings from the U.S. Consumer Product Safety Commission for the years 1995-1998. During this timeframe, they found that 678 residents aged 5-24 drowned in pools; 75% were male, 47% were Black, 33% were White, and 12% were Hispanic. The largest number of Black victims (51%) drowned in public pools, and most of the white victims (55%) drowned in neighborhood pools. One limitation to this study is minimal information was cited on how much time children in different ethnic groups spends around pools. The study also did not take into account

individual incomes. Therefore, socioeconomic status might have been a significant factor for the association between race and drowning (Saluja, et al., 2006).

Another study, conducted by Browne, Lewis-Michl, and Stark (2003), produced similar findings to the Saluja, et al. (2006) study. This study looked at 883 non-bathtub drownings among New York State residents from 1988-1994. They observed differences in drowning rates by age, gender, and race. Similar results were found in that males, children ages 0-4 years, and African American males ages 5-14 experienced the highest rate of drowning. Drowning rates are usually higher for African Americans as compared to Caucasians, with the exception of children between the ages of 1 and 4. The differences are risk by gender may be associated with increased time spent in water-related activities and risky behavior among males (Howland, et al., 1996). However, the differences among races are not as clear. Some explanations from this study are lack of early exposure to recreational swimming and acquiring swimming skills (Browne, et al., 2003).

A twenty year review of autopsied cases of pediatric drownings conducted by Somers, Chiasson, and Smith (2006) found that drowning is a major cause of pediatric death in the developed world. The annual number of deaths among all ages of children ranged from 1.5 to 4.4 per 100,000. The most common places where the drownings occurred were pools and freshwater, which include lakes, rivers, and streams. The incidents usually involved preschoolers who were old enough to walk and older children. Drownings that occur in the home most often involve bathtubs, with infants and preambulatory children predominantly at the highest risk. During this 20-year study

period, 18 cases of pediatric bathtub drownings were found. Of these, all but two were in children aged 16 months and younger (Somers, et al., 2006).

There were significant age differences when the site of drowning was considered over the 20-year period (Somers, et al., 2006). Victims of bathtub drownings were younger compared to victims of open water and pool drownings (open water, 6 years 6 months, $P < 0.0001$; pools, 4 years 6 months, $P=0.0002$). There was not a significant difference ($P= 0.6374$) in gender for the bathtub drownings. But, bathtub drownings did have a significantly ($P= 01889$) higher number of drownings in females than in males, with most males drowning in an open body of water (Somers, et al., 2006).

In the study discussed earlier by Browne, et al. (2003), 883 non-bathtub drownings among New York State residents were investigated from the years 1988 to 1994. Browne, et al. accessed medical examiner, coroner, police, hospital records, and death certificate data. It was found that more than 79% of the drownings happened in a natural body of water - 532 in freshwater bodies such as lakes, ponds, rivers, and streams, and 171 in the ocean or other saltwater body of water. Residential swimming pools accounted for 123 drownings (13.9%), and nonresidential pools and spas consisted of 33 drownings (3.7%). In this study it was also found that 109 drownings occurred among children ages 0-4 years and, 77 (70.6%) occurred in residential swimming pools (Browne, et al., 2003). In children older than five years of age, the most frequent site of drowning was a natural body of water, which most often is unfamiliar to the child (Browne, et al., 2003).

The studies discussed above entail the major sites of drownings among children and the risk factors associated with these drownings. The studies stress the magnitude of bathtub drowning involving infants and swimming pool drownings with preschool children and older. Drowning related to unintentional injury continues to be a significant cause of childhood death in the United States.

Summary

Drownings are often considered a silent killer. Most children who drown are not heard, even as they fall into the water. And, as discussed previously, swimming pools are often the site of these drownings a majority of the time. Suction entrapment is gaining more attention in the political world. It also should be stressed that entrapment has the capability of afflicting adults as well as children. The force generated by suction outlets has the capacity of producing many pounds of pressure, thus creating a very difficult scenario for releasing an entrapped person. As literature becomes available the problem will become more familiar to the public and ultimately reduce the likelihood of occurrence.

CHAPTER III

Introduction

As stated, suction entrapment and drowning among children in pools and spas is beginning to emerge as a major cause of morbidity and mortality in our society. The problem with this issue seems to be the lack of education that parents, caregivers, and healthcare providers possess in regards to this issue, and especially to suction entrapment. I will explain in this chapter how this project has evolved and what I hope transpires from my research and review of the literature.

Target Audience

The audience for this project included faculty and fellow graduate students at a university in a Midwestern community. The research I obtained on suction entrapment and drowning among children was presented at the 2007 Sigma Theta Tau International Research Conference at the University of North Dakota in Grand Forks. The focus of the 2007 conference was Nursing Science: Advancing the Care of Patients. The participants of this conference were all in the field of nursing, and nursing research.

The summary of the review of literature was also presented in poster format at the Graduate School 2008 Scholarly Forum at UND. The participants at this forum included other graduate students, faculty, and professionals from the community. At the scholarly forum venue questions presented to me were answered and statistics were explained. I will give the poster I created to the local Safe Kids Coalition Coordinator, Carma Hanson. This person is in an ideal position to distribute this information on a wide scale.

Procedures

I met with the local Coordinator of Safe Kids in Grand Forks, North Dakota, Carma Hanson, MS, RN. We discussed and established there was a need for the project. Carma and I realized there was a huge gap of information, and thus necessary to provide education on the safety concern of suction entrapment and drowning among children. The scope of the project was agreed upon by myself, the Safe Kids coordinator, and my nursing graduate school advisor, Dr. Julie Anderson, PhD, RN, CCRC.

Next, an extensive literature review was performed on the topic of suction entrapment and drowning among children. Scholarly research articles were sought using Medline, PubMed, Cumulative Index for Nursing and Allied Health Literature (CINAHL), and SCOPUS database. Practice Guidelines from National Guideline Clearinghouse was also queried without any hits from this search. Public information was sought using the GOOGLE search engine. Nursing texts were also utilized when researching the theory that guided this project. Throughout the literature review various key words were utilized including a combination of the following: pools, spas, suction, entrapment, entanglement, drowning, children, drain, safety devices, Safe Kids, Orem, nursing, education, research, policy, practice. Reference lists in scholarly articles often offered insight into additional relevant literature. As articles were reviewed, highly published or referenced content experts became evident in the field became evident.

Finally, I developed my poster depicting the review of the literature and recommendations for nursing practice. I chose to use hues of blues to represent water in my poster for the purpose of impact on the audience. I also chose to use colorful pictures of children in and around water to gain the attention of the reader. My poster was

evaluated by my advisor, other students in the Family Nurse Practitioner Program (FNP) at UND, and a practicing FNP. Feedback was provided on the graphics and content and was incorporated into the final poster document.

Evaluation Plan for the Project

An evaluation of the project and presentation utilizing power point and poster format revealed that participants at both venues were drawn in by the creative use of color and illustrations depicted in both presentations. I also accessed Carma Hanson throughout my project for information, advice, and constructive criticism on the progress of the project.

CHAPTER IV

Introduction

This chapter will address the overall results of this project and provide an explanation of the project in terms of the theory that guided the work. Additionally recommendations for nursing practice, research, policy, and education will be addressed.

Expected Results of the Project

Orem's theory guided this project. According to Orem it is the parent or dependent care agent's responsibility to protect the child. By educating people at the Graduate Scholarly Forum who were perhaps both parents and presenters, the goal of disseminating the research was achieved. Additionally the poster will be given to the Safe Kids director, who will be able to educate more parents and healthcare professionals on this especially important safety topic.

Implications for Nursing: Practice

The statistic involved with suction entrapment may be reported too low because emergency workers usually report injuries such as entrapment as accidental drownings. This means the magnitude of the problem is significantly underestimated. I hope to reach a large number of healthcare professionals who treat children or the parents of these children. I then hope that these professionals will educate their staff further, such as the nurses, occupational therapists, physical therapists, etc. Then, asking patients that come to be seen in the healthcare setting will be asked about pool or spa use and specific safety questions. This will become a standard part of prevention education and screening that

can be added to well-child exams as anticipatory guidance. Pool safety must include anti-entrapment drain covers (Star 100 and Anti-hair snare plus), fencing, shut-off valves, and inspection of the pool or hot tub by an Association of Pool and Spa Professionals member.

Research

Further research on pool safety including drowning and entrapment to determine the effectiveness of the new devices and measures must occur. More funding needs to be obtained to determine if these accidental drownings that are occurring are indeed an accident or rather a suction entrapment injury or death as a result of a faulty device or a missing safety mechanism. It should become a requirement of public pools and spas to have all of their drains, pumps, and safety devices inspected by either an Association of Pool and Spa Professionals member or a member of the Safe Kids Coalition. It is in the best interest of these accessible public places to take into consideration their most vulnerable population, young children.

Education

Multi-media educational efforts by pool manufacturers, health care professionals, and recreational experts regarding pool safety needs to target parents and children. Education should be geared at all schools with these children on pool safety and the implications of owning or being around a pool. It should also be geared at hotel owners to educate them on the importance of having a lifeguard in place or at least having shut-off valves readily available and easy for a bystander to operate. The main purpose of education provided by the health care professional should be aimed at prevention. This is achieved by ensuring proper awareness and education of the patients, families, and

communities. Children should be enrolled in swimming lessons between the ages of 4-8. Parents and care providers should learn infant and child CPR. Children should be educated at length about the rules of water safety.

Policy

New policies need to be put in place requiring public pools to have all necessary safety equipment in operation to avoid entrapment and drowning accidents. Some of these safety devices include and are not limited to installing a SVRS that will automatically shut off a pump if a blockage is detected. Drain covers should be dome – shaped, instead of the past flat drain covers. There are also anti-entrapment drain covers, called the Star 100 and the Anti-Hair Snare Plus which will help eliminate the incidence of body/limb entrapment, disembowelment, or hair entanglement. Personal pool and spa owners should also have fencing that completely surrounds the pool and does not allow direct access from the house. All pool owners and operators should be required to know how to utilize these safety devices and will need to attend a class to learn how to use them. Ms Baker, introduced in Chapter one now directs her attention to educating other parents and health care providers on the magnitude of the problem. On October 9, 2007 the House of Representatives passed the Virginia Graeme Baker Pool and Spa Safety Act, H.R. 1721. This bill protects children from drowning by requiring the use of proper anti-entrapment drain covers in pools and spas and by creating a swimming pool safety grant program to encourage states to adopt comprehensive safety laws. The bill was introduced by Representative Debbie Wasserman Schultz.

Summary

The implications for nursing as stated above for suction entrapment and drowning among children are a work in progress with the ultimate goal of educating the appropriate people on this devastating issue. As people become more aware, these preventable accidents will hopefully decrease, and ultimately cease from occurring. Children's youth and innocence can be preserved and the idea of being disemboweled sitting on a pool drain will never occur. This project informed me of all the potential dangers that exist when children are around pools or spas. The personal gain I achieved was getting rid of an above ground pool we had in our own yard. I have small children, and the risks associated with being a pool owner far outweighed the benefits.

References

Al-Mofadda, S. M., Nassar, A., Al-Turki, A., & Al-Sallounm, A. A. (2001). Pediatric near drowning: The experience of King Khalid University Hospital. *Annals of Saudi Medicine, 21*(5-6), 300-303. Retrieved March 25, 2007, from Scopus database.

Brenner, R.A., & The Committee on Injury, Violence, and Poison Prevention. (2003). Prevention of drowning in infants, children, and adolescents. *American Academy Of Pediatrics,* 112(2), 440-445.

Browne, M.L., Lewis-Michl, E.L., & Stark, A.D. (2003). Unintentional drownings among New York State residents, 1988-1994. *Public Health Reports,* 118, 448-458.

Centers for Disease Control and Prevention. Drownings in recreational water settings. MMWR (2006);55:566.

Centers for Disease Control and Prevention. (2003). Web-based injury statistics query and reporting system. Retrieved March 23, 2007 from http://www.cdc.gov/ncipc/wisqars.

Davison, A., & Puntis, J.W.L. (2003). Awareness of swimming pool suction injury Among tour operators. *Archives of Disease in Childhood,* 88, 584-586.

Dellinger, K. (2001). Suction injuries: Education is the key to prevention. *Journal of Pediatric Nursing,* 16(3), 147-148.

Dworkin, G.M. (1998). Pool and spa entrapment. *Lifesaving Resources Inc.* Retrieved March 23, 2007, from http://www.lifesaving.com/issues/articles/17pool_spa_entrapment.html

Harvard Health Letter. (2000). Recreation: Keeping safe around the water. Harvard Health Publications. Aug., 6-7.

Howland, J., Hingson, R., Mangione, T.W., Bell, N., & Bak, S. (1996). Why are most drowning victims men? Sex differences in aquatic skills and behaviors. *American Journal of Public Health,* 86:93-96.

Lee, L. K., & Thompson, K. M. (2007). Parental survey of beliefs and practices about bathing and water safety and their children: Guidance for drowning prevention. *Accident Analysis and Prevention, 39*(1), 58-62. Retrieved March 25, 2007, from Scopus database.

Mogharabi, S. (2006). Season of change:Nancy Baker lost her 7-year-old daughter to suction entrapment. Now an advocate, she is forcing the pool and spa industry to do more to address this deadly hazard. *Pool & Spa News.* Retrieved March 20, 2007 from http://www.highbeam.com/doc/1G1-144201995.html

Moore, J.B., & Beckwitt, A.E. (2006). Self-care operations and nursing interventions for children with cancer and their parents. *Nursing Science Quarterly,* 19:2, 147-156.

Orem, D.E. (1980). *Nursing: Concepts of practice.* 2nd ed.). New York: McGraw-Hill Book Company.

Orem, D.E. (2001). *Nursing concepts of practice.* (6th ed.). St. Louis: Mosby.

Quraishi, A.Y., Morton, S., Cody, B.E., & Wilcox, R. (2006). Pool and spa drowning: A National study of drain entrapment and pool safety measures. Safe Kids Worldwide. Washinton D.C.

Safe Kids Grand Forks. (2006a). Anti-entrapment drain covers. Retrieved April 15, 2007 From http://www.usa.safekids.org/water/documents/DrainCoverExplanation Consumerpdf

Safe Kids Grand Forks. (2006b). Install a SVRS in your pool or spa for safety. Retrieved April 15, 2007 from http://www.usa.safekids.org/water/documents/SVRS.pdf

Safe Kids North Central Florida. (2006). New research shows parents not adequately aware of the risk of drain entrapment and drowning. Retrieved March 26, 2007, from http://www.shandssafekids.org/

Saluja, G., Brenner, R. A., Trumble, A. C., Smith, G. S., Schroeder, T., & Cox, C. (2006). Swimming pool drownings among US residents aged 5-24 years: Understanding racial/ethnic disparities. *American Journal of Public Health, 96*(4), 728-733. Retrieved March 25, 2007, from Scopus database.

Somers, G.R., Chiasson, D.A., & Smith, C.R. (2006). Pediatric drowning: A 20-year review of autopsied cases: I. Demographic features. *The American Journal of Forensic Medicine and Pathology, 26*(4), 316-319.

Somers, G.R., Chiasson, D.A., & Smith, C.R. (2006). Pediatric drowning: A 20-year review of autopsied cases: III. Bathtub drownings. *The American Journal of Forensic Medicine and Pathology, 27*(2), 113-116.

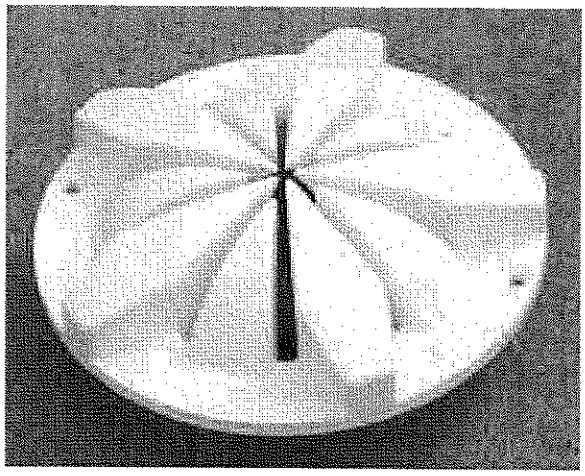
Thompson, D.C., & Rivara, R.P. (1998). Pool fencing for preventing drowning in children. Cochrane Database Syst Rev (1):CD001047.

Traugott, R. (2007). Protect little children with pool alarms. Retrieved March 20, 2007 from http://EzineArticles.com/?expert=Rob_T.

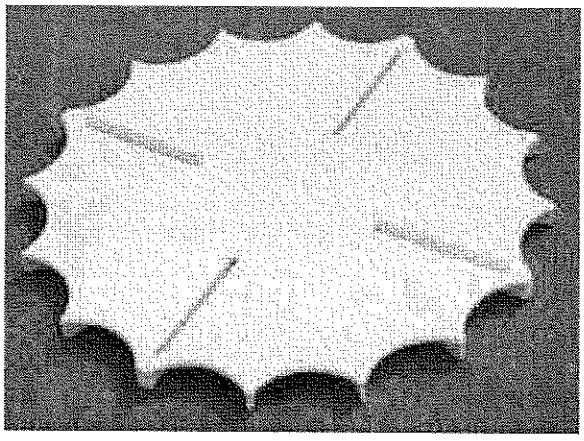
United States Consumer Product Safety Commission (2005). Guidelines for entrapment hazards: Making pools and spas safe. Washington, D.C.

United States Consumer Product Safety Commission (2006). How to plan for the unexpected: Preventing child drownings. Washington, D.C.

APPENDIX



Anti-Hair Snare Plus



Star 100 Entrapment Cover