Amanda Stanfield

The Effects on the Body

Gretchen Guelcher

RCP 210

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Drowning and near drowning are major causes of neurologic injury and can lead to death after a twenty-four-hour survival period. Near drowning is most often silent and usually occurs rapidly. The most common scenario of drowning is when an individual is floating in the water and quickly disappears underneath the surface. The body then begins to cut off oxygen supply to the brain, causing the body systems to shut down. Most people who experience near drowning are young children, however, drowning incidents can occur to all ages. In younger children, their body depletes in a matter of seconds, whereas adults take longer for their organs to deplete.

Near drowning is defined as survival after suffocation caused by submersion in a body of water or other fluid like substance. The lungs can immediately become damaged with lack of adequate oxygen within the tissues, even after the individual has been removed from the water and resuscitation has begun. In most cases, drowning occurs silently and motionless in cold and warm water. An individual can rapidly disappear beneath the surface without any thrash in the water. After an initial gasp of water encounters the larynx, there is an inspiratory hold followed by a spasm. The most common threat to drowning is the central nervous system and cardiac dysfunction. If mortality can be avoided, it is critical for the individual to blow off CO2 and not become acidotic or hypoxic. If the individual survives a near drowning episode, they may develop into a vegetative state due to the prolonged cerebral hypoxia.

The majority of near drowning cases occur by accidents near or in a body of fresh water than in salt water. According to the Centers for Disease Control and Prevention (CDC), "There were 2, 813,503 registered deaths in the United States in 2017. The age-adjusted death rate is 731.9 deaths per 100,000 people in the U.S., which is an increase of 0.4% over 2016's death rate." In cases of freshwater drowning, large amounts of river or pool water entering the lungs and stomach is more dangerous than swallowing large amounts of salt water. Ninety percent of

drowning cases occur in freshwaters, such as pools and rivers (2019). Swallowing freshwater into the lungs is considered hypotonic to the blood. The freshwater absorbs its way into the blood stream from the gastrointestinal tract due to a low osmotic pressure where it dilutes the plasma and electrolytes. The red blood cells then begin to swell up and eventually erupt in a short amount of time. The fluid within the person's lungs prevents the body to take in enough air resulting in the need for oxygen. The lack of oxygen will eventually lead to cardiac arrest and for an individual who is drowning, they will become unconscious before their heart stops. Drowning in saltwater, the lungs have an opposite effect and become hypertonic to the blood passing. There is equal amount of osmotic pressure in the blood, which increases chlorine and sodium levels slightly causing mild symptoms. The plasma in the bloodstream becomes sucked into the lungs and fill up, preventing for gas exchange to occur within the alveoli. Without gas exchange and oxygen to enter the bloodstream, our hearts will weaken and will eventually stop; causing the person to drown in their own fluids. It is recommended for swimmers that if large amounts of water is digested, they should try and remove it from their abdomen, even if they are healthy by seeking a near by hospital to control the electrolytes and blood levels, as the symptoms may worsen within the next twenty-four hours.

The most common causes of near drowning that are foreseen today include leaving children unattended near bodies of water, leaving infants unattended in the bath tub for a short period of time, panicking in the water, the inability to swim, falling through thin ice, hypothermia, cardiac arrythmias, head or spinal injuries, apnea, syncope, seizures, a suicide attempt, and an alcohol consumption while swimming or on a boat. Adults tend to drown in rivers, lakes, and in the ocean. In many adult cases of drowning, there may be an injury associated, such as scuba diving to max depths and getting decompression sickness, or diving in

shallow waters and hitting a rock. One of the more compelling claims regarding the issue of unsupervised children and infants indicates that inadequate supervision is the most common factor associated with submersion. Turning your attention away from a child or infant for just a moment can result in a drowning incident. According the Centers for Disease Control and Prevention, "Everyday, about ten people die from unintentional drowning and of these, two are aged fourteen or younger." Most infant deaths occur within five minutes of lapse in supervision. For example, answering the phone, stirring the spaghetti sauce on the stovetop, pouring a glass of tea, or a knock at the front door. Often the fence to the pool or gate is open and the child or infant jumps in. Complete and total surveillance with vigilant supervision is essential to avoid a drowning incident or near drowning occurrence.

An individual who is drowning or near drowning usually has a history of increased work of breathing after experiencing an inhalation of water into the lungs and submersion for an extended period. The individual may then experience shallow breathing or become apneic with respiratory distress. Acidosis and hypoxemia need to be corrected immediately if mortality is to be avoided. Their level of consciousness starts to alter having several coughing spells and feeling fatigued. The color of their skin may appear pale or cyanotic due to a lack of oxygen within the blood. Hypothermia is almost always a complication of immersion. When submerged into cold water, the body rapidly loses heat, with water conducting heat twenty times more efficiently than air. Oxygen consumption is reduced by fifty percent at a core temperature of thirty degrees Celsius. The first thing to remember is that hypothermia can make it difficult to find a pulse of a near drowning survivor. Basic life support and activation of the emergency medical services system should begin as soon as possible. The rescuer should carefully open the victim's airway and if there is no breathing, initially give two breaths. If the apneic victim cannot be rapidly

removed from the water, rescue breathing should be attempted in the water. Assessment for a heartbeat should be done when the victim is on a flotation device large enough for both the rescuer and the victim or brought to shore. Careful search for a pulse should be done carefully for at least a full minute to rule out bradycardia or a faint heartbeat before performing chest compressions. If the victim is breathing spontaneously, they should be placed and transported in the right lateral decubitus position with the head lower than the trunk to reduce the risk of aspiration. If rescue breaths are performed on the victim, it is vital to apply pressure on the cricoid to limit the risks of gastric aspiration. It is also vital to begin bringing the victim's body temperature to normal levels with the use of heaters, blankets, warmed intravenous fluids, hemodialysis or even hot packs and transport the victim to a medical center as soon as possible.

At the hospital, health care providers should prepare appropriate equipment in anticipation of the near drowning victim's arrival. The equipment for intubation needs to be present, including a laryngoscope, various tube sizes, Magill forceps, an assortment of blades, stylets, a cuff inflation, and syringe to check cuff patency, suctioning equipment, bag-valve-mask device, and tape to secure the endotracheal tube. Based on the treatment, the near drowning victim may need oxygen delivered via cannula or mask to maintain a PaO2 above 60 mmHg. An incentive spirometry device may also be helpful in preventing pneumonia. The healthcare provider may have additional test perform including an arterial blood gas (ABG), blood and urine tests, an electroencephalogram (EEG), a chest x-ray, and a CT scan to diagnose any near drowning injuries. If neurological deterioration occurs, it may be resulted from hypoxemia to worsening pulmonary condition an increase in intracranial pressure (ICP) caused by hypoxic injury, or drug ingestion before the event. According to Dipak, Chandy, M.D., "A 1978 study reported that giving barbiturate drugs and inducing controlled hypothermia lessened neurological

damage in unconscious, near-drowning victims." Health problems can also occur even after a near drowning injury, such as acute respiratory distress syndrome (ARDS), brain edema, chemical and fluid imbalances in the body, pneumonia, and permanent vegetative state.

Near drowning is possible anywhere and can occur in shallow as well as deep water. Huckabee, H., Craig, P., Williams, J., (p. 256-260).)., Gyori, E., (p. 237-239)

> A 31-year-old woman demonstrated intact neuropsychological functioning after being submerged for at least thirty minutes in icy cold water. After submersion, the patient received CPR for approximately one hour. Eight hours after submersion, the patient's temperature was thirty-one degrees Celsius. After the incident, she remained nonresponsive. Three months after the near drowning incident, extensive neuropsychological testing was performed. Further testing is needed for further application of induced hypothermia in the acute management of other types of cerebral incidents (Huckabee, H., Craig, P., Williams, J., p. 256-260).
>
> A 19-year-old healthy male fell into stagnant water of the intercostal waterway (salt water of South Florida), following a jet ski incident. He sustained minor superficial injuries, but engulfed significant quantities of water and sediment. Several days later, he experienced a severe headache, stiff neck, nausea and vomiting, and a fever of 102 degrees Fahrenheit. A CT scan without contrast resulted negative. He became lethargic and on the fifth day he developed a seizure. Despite antibiotics treatment, he had expired the next day. Autopsy of his brain revealed a massive leptomeningeal inflammatory infiltrate composed of neutrophils, lymphocytes, and numerous histiocyte like cells. The inflammatory infiltrate extended into the cerebral parenchyma exposure to stagnant water and the numerous histiocytic like cells, suspicion for an amebic etiology of the disease

process was raised. Infection by Naegleria Fowleri, a free-living ameba occurs after exposure to polluted water in manmade freshwater lakes, swimming pools, and ponds particularly during the warm weather months when the thermophilic ameba grows. The pathologic substrate of the infection is an acute hemorrhagic, necrotizing meninge encephalitis mainly at the base of the brain, cerebellum, and brainstem occurring in young, healthy individuals (Gyori, E., p. 237-239).

One of the most serious complications occurring in near drowning incidents are victims developing a lung infection. Freshwater and saltwater aspiration causes a difference in osmotic gradient. According to Dr. Jimili Saikia, "The osmotic gradient causes a disruption of the integrity of the alveolar capillary membrane with increased permeability, exacerbation of fluid and plasma and electrolyte to shift." The radiographic images may show a diagnostic challenge due to a presence of water in the lungs that can hinder the interpretation. In freshwater both bacteria and fungi and be reported as a pulmonary infection and can be most implicated as "aerobic gram-negative." A near drowning incident can be associated with pneumonia bacteremia caused by a coinfection with *Staphylococcis auresus* and *E. tarda*. Also harbors E. coli and bacteria in the Shigella family, which can cause an illness when ingested or spreads through pollution and through feces from swimmers. According to Lakshmi, "Naegleria fowleri can seep into the brain when entering the body through the nasal cavity." Some swimmers are seen using a nose clip to prevent an infection. According to the CDC, "Untreated recreational waters were connected to 140 disease outbreaks around 5,000 illnesses between 2000 and 2014. While oceans were included, 84% of the outbreaks stemmed from reservoirs, lakes, and ponds." The risk of infection can vary according the degree of water contamination and temperature, as well as gastric aspiration. According to John Rumpler, "People are becoming ill due to two main

pollutions on the beaches from runoff pollution and sewage overflow." Rain can cause sewage systems to overflow, carrying pollutants into the ocean and other bodies of water. A set of blood cultures will need to be performed prior to the use of antibiotics to allow detection of waterborne bacteria, which can be fatal infections.

The main treatments for neurological effects of near-drowning include, elevation of the head of the bed, as long as there is no neck injury, maintenance of proper blood sugar levels and normal body temperature, mild hyperventilation, and aggressive control of seizure activity. The body's immune system declines by the fact that cold suppresses and a risk in using hypothermia therapy risks for an internal infection, called "sepsis." Physiological changes can occur in near drowning that are complex. The pulmonary changes include, shunting, edema, and alterations in surfactant properties causing disturbances in oxygenation and chemical balance in a victim who experienced a near drowning incident and if no treatment is seek immediately it can have a negative outcome (1975). Most near drowning victims are hospitalized and monitored closely, however, if pulmonary deterioration has occurred within twelve to twenty-four hours and there is no neurological and the patient is stable, then the patient may be discharged and followed-up within two to three days after discharged. According to Dipak, Chandy, M.D., "About seventy-five percent of near drowning victims who receive medical treatment survive and approximately six percent will be left with long-term neurological problems." The risks of drowning can occur in as little as 2 feet of water and can be life threatening due to the ingestion of large amounts of water.

Near drowning and drowning are almost always preventable. Thousands of people drown in the United States each year and usually occur within seconds. It is important to educate adults and children about water safety. Children and infants need to have adult supervision near water

even for a short period of time. Leaving children and infants unattended around bathtubs, swimming pools, or a body of water are at great risk to experience a near drowning incident. Adults and young children need to wear an approved life preserver on a boat, tubing, skiing, or swimming if they are unable to swim on their own. Swimmers entering the beach should check their daily bacterial conditions and avoid entering the water if the levels exceed their recommendations. If there are any wounds, scrapes, or cuts it is also recommended to avoid the ocean to keep out bacteria. Swimming pools need to have a fence with a locked gate at least five feet tall. All teens and adults need to be taught CPR and should avoid swimming alone. Adults and teens should be educated on the importance of consumed alcohol and illicit drug use while in or around a body of water and how it can increase the chances of a drowning accident.

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The Effects Of Near Drowning on the Body

Informed Consent

Near Drowning

Dear Search and Rescue:

I am conducting a study to gather information on near drowning incidents and how it has affected the lungs. This study is being conducted by Amanda Stanfield a student in Respiratory Therapy from Southwestern Community College. In this study, you will be asked 15 questions. Your participation should take about 10-20 minutes.

The purpose of this study is to gather research on how many incidents search and rescue services has responded to a near drowning incident in the United States and how they occurred. I will ask two members from two different search and rescue services if they would participate in my survey. This research is important because there have been a lot of drowning and near drowning incidents that occur each year in our rural area. This research will inform the general public on the effects of near drowning incidents.

There are no risks to you.

All information will be handled in a strictly confidential manner, so that no one will be able to identify you when the results are recorded/reported.

Your participation in this study is totally voluntary and you may withdraw at any time without penalty. You are free to decline to answer any questions you do not wish to answer for any reason.

Please feel free to contact Gretchen Guelcher at (828)339-4472 ext. 4472 if you have any question about the study. Or, contact Amanda Stanfield by email ajenk4965@student.southwesterncc.edu.

By completing this survey and returning it you are also confirming that you are 18 years of age or older. I understand the study described above and agree to participate.

Signature of Participant _____ Date _____

Survey Questions

1. Are you 18 years old or older? If not, please do not continue.
2. In the SAR's services, how many incidents have you responded to in the United States within the last two years and where did it occur? 58/ Northeast Georgia
3. What was the geographic location of the incident and did the incident occur in freshwater or saltwater? Freshwater and saltwater
   - State (U.S) Georgia, Florida, South Carolina
   - County Stephens/Gwinnett/ Indian River/ Oconee
   - City Toccoa/Gainesville/Vero Beach and Seneca and Salem
4. What is the most common cause of injury in a near drowning incident? Unsupervised and not wearing a life jacket
5. In your opinion, how harmful is a near drowning incident to the lungs? Very Harmful, We have to be able to breathe in order to survive in this world. When experiencing a near drowning incident, the water fills up the lungs making it difficult for one to breathe. The fluid within the lungs can become difficult to remove without seeking proper treatment.
6. What types of treatments are available for a near drowning incident in freshwater? Specific antibiotics and medication to prevent or treat an infection within the lungs and 24 hour observation in a hospital setting.
7. What types of treatments are available for a near drowning incident in saltwater? Specific antibiotics to prevent or treat an infection within the lungs and 24 hour observation in a hospital setting.
8. What types of safety equipment were in place? Lifeguard and fenced yard
   - Fenced yard
   - Door alarms

- AED
- Life jackets
- Lifeguard

9. How long, approximately, was the victim in the water?

- 1-3 minutes
- 4-10 minutes
- 11-15 minutes
- 16-30 minutes
- 30-60 minutes
- 60 + minutes

10. Which season did the near drowning incident occur in? All of these incidents have occurred during each of these seasons

- Winter
- Spring
- Summer
- Fall

11. What types of rescue techniques were performed immediately upon the victim being recovered? All of the these

- Chest compressions
- CPR with rescue breaths
- AED
- CPR with medical oxygen
- Other

12. What types of illnesses did the near drowning victim develop? Vomiting, fatigue, increased work of breathing, coughing and an infection.

13. What was the outcome of the drowning? Some incidents resulted in injuries; however, they have improved in health. On the other hand some were fatal.

- Nonfatal
- Nonfatal- short term morbidity
- Nonfatal- long term morbidity
- Fatal- within 24 hours
- Fatal- within 48 hours
- Fatal- within 72 hours?

14. In your opinion, what types of prevention or safety precautions should be in placed for the public? Everyone should wear life jackets and learn to swim as soon as possible. No one should be left unattended near a body of water even if they know how to swim; they should always use what you call the buddy system. All fences should be locked and if there is a lifeguard present, they should play close attention for an incident to occur. It only takes a couple of seconds for an incident to occur. No one should attempt to swim in colder temperature due to hypothermia even if it's a challenge with your friends. Most people know the term "Polar plunge." It is also important for everyone to learn for to perform CPR and act quickly and calmly when an incident occurs.
15. Do you feel there should be more education provided to the community about the harmful effects of near drowning and why? Yes, education should be provided throughout the the community educating the importance of wearing a life jacket near a body of water and never being left alone. Education can be provided by the use of pamphlets, billboards, bulletin boards, and classes to prevent a near drowning incident or know what to do when an incident does occur.

Survey Questions

1. Are you 18 years old or older? If not, please do not continue.
2. In the SAR's services, how many incidents have you responded to in the United States within the last two years and where did it occur? 60/ Northeast Georgia
3. What was the geographic location of the incident and did the incident occur in freshwater or saltwater? Freshwater
   - State (U.S) Georgia/South Carolina
   - County Stephens/Gwinnett/Oconee
   - City Toccoa/Gainesville/Seneca
4. What is the most common cause of injury in a near drowning incident? Not wearing a life jacket
5. In your opinion, how harmful is a near drowning incident to the lungs? Very harmful, depending on the water conditions plays a role in developing an infection and fluid within the lungs can make it difficult for someone to breath.
6. What types of treatments are available for a near drowning incident in freshwater? Hospitalization and medication
7. What types of treatments are available for a near drowning incident in saltwater? Hospitalization and medication
8. What types of safety equipment were in place? None
   - Fenced yard
   - Door alarms
   - AED
   - Life jackets
   - Lifeguard
9. How long, approximately, was the victim in the water?

- AED
- Life jackets
- Lifeguard

9. How long, approximately, was the victim in the water?

- 1-3 minutes
- 4-10 minutes
- 11-15 minutes
- 16-30 minutes
- 30-60 minutes
- 60 + minutes

10. Which season did the near drowning incident occur in? All of these incidents have occurred during each of these seasons

- Winter
- Spring
- Summer
- Fall

11. What types of rescue techniques were performed immediately upon the victim being recovered? All of the these

- Chest compressions
- CPR with rescue breaths
- AED
- CPR with medical oxygen
- Other

12. What types of illnesses did the near drowning victim develop? Vomiting, fatigue, increased work of breathing, and infection.

13. What was the outcome of the drowning? Some incidents resulted in injuries; however, they have improved in health. On the other hand some were fatal.

- Nonfatal
- Nonfatal- short term morbidity
- Nonfatal- long term morbidity
- Fatal- within 24 hours
- Fatal- within 48 hours
- Fatal- within 72 hours?

Survey Questions

1. Are you 18 years old or older? If not, please do not continue.
2. In the SAR's services, how many incidents have you responded to in the United States within the last two years and where did it occur? 40/ Northeast Georgia
3. What was the geographic location of the incident and did the incident occur in freshwater or saltwater? Freshwater
   - State (U.S) Georgia
   - County Stephens/Gwinnett/White
   - City Toccoa/Gainesville/Cleveland and Helen
4. What is the most common cause of injury in a near drowning incident? Unsupervised and not wearing a life jacket
5. In your opinion, how harmful is a near drowning incident to the lungs? Harmful, the ability to breathe is vital to survive. When fluid is built up in one's lungs from a near drowning incident, it becomes difficult to breathe and can be life threatening if the fluid doesn't come out. The fluid within the lungs can also cause an infection and without the proper treatment it can become fatal.
6. What types of treatments are available for a near drowning incident in freshwater? Vigorous antibiotics to prevent or treat an infection and possible hospitalization for observation.
7. What types of treatments are available for a near drowning incident in saltwater? Vigorous antibiotics, medication, and possible hospitalization for observation.
8. What types of safety equipment were in place? Lifeguard and fenced yard
   - Fenced yard
   - Door alarms

- 1-3 minutes
- 4-10 minutes
- 11-15 minutes
- 16-30 minutes
- 30-60 minutes
- 60 + minutes

10. Which season did the near drowning incident occur in? All of these incidents have occurred during each of these seasons

- Winter
- Spring
- Summer
- Fall

11. What types of rescue techniques were performed immediately upon the victim being recovered? All of the these

- Chest compressions
- CPR with rescue breaths
- AED
- CPR with medical oxygen
- Other

12. What types of illnesses did the near drowning victim develop? Unsure

13. What was the outcome of the drowning? Some incidents resulted in injuries, however, they have improved in health. On the other hand some were fatal.

- Nonfatal
- Nonfatal- short term morbidity
- Nonfatal- long term morbidity
- Fatal- within 24 hours
- Fatal- within 48 hours
- Fatal- within 72 hours?

14. In your opinion, what types of prevention or safety precautions should be in placed for the public? Everyone should wear life jackets and learn to swim at an early age as a toddler.
15. Do you feel there should be more education provided to the community about the harmful effects of near drowning and why? Yes, education should be provided more often to help reduce poor decisions making that result in injuries or death.

14. In your opinion, what types of prevention or safety precautions should be in placed for the public? Everyone should wear life jackets and learn to swim as soon as possible. No one should be left alone in the water even if they know how to swim; they should use the buddy system. All fences should be locked and if there is a lifeguard present, they should play close attention for an incident to occur. It is also important for everyone to learn for to perform CPR and act quickly and calmly when an incident occurs.
15. Do you feel there should be more education provided to the community about the harmful effects of near drowning and why? Yes, education should be provided throughout the year with pamphlets, billboards, bulletin boards, and classes to prevent a near drowning incident or know what to do when an incident does occur.

The survey was conducted from October through November 2020. A combination of forced choice and open ended questions was used to assess near drowning-related knowledge, attitudes, and prevention behaviors, as well as the incidence of and the circumstances surrounding drowning and near-drowning among children and adults. The results showed that although most caregivers had some knowledge of drowning and near-drowning incidents among children, lack of knowledge in the importance of adult supervision and the recommended age at which to begin children's swimming instruction. Results showed a need for isolation fencing, that which separates a swimming pool from a house and yard. Most respondents reported that most people did not know how to perform cardiopulmonary resuscitation (CPR) on an infant, child, or adult. However, the respondents did describe water-related immersions that involved children who experienced difficulty in the water, but recovered by themselves or with the aid of a nearby person. In some instances the child's breathing pattern was altered. Recommendations are provided for programs for prevention of childhood drowning.

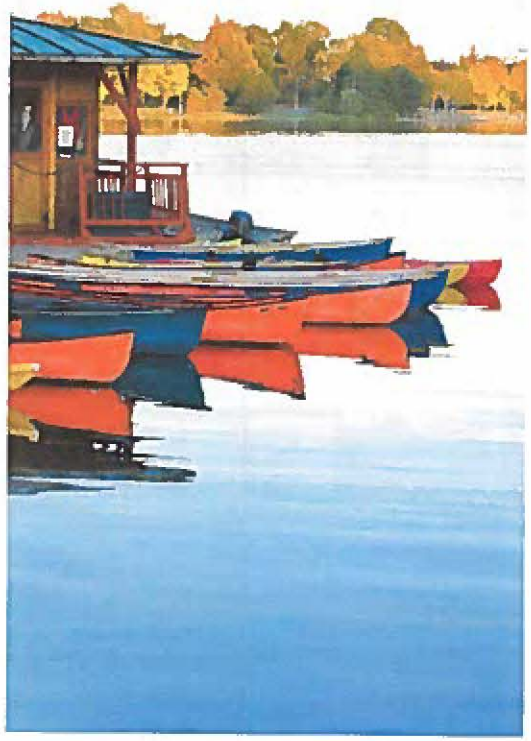
"There is no big splash scene like in the movies!"

- Drowning takes the lives of 3 children in the United States every day.
- Another 5 children will receive ER care due to non-fatal drowning accidents.
- Rapid response of CPR with rescue breaths could make a difference between life and death.

Make it a Habit

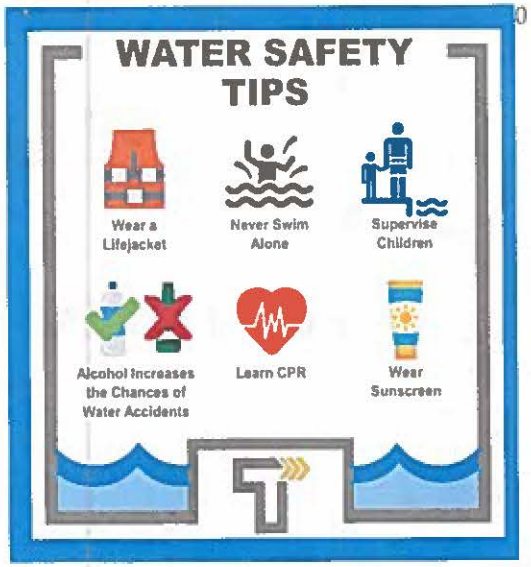
- Make safety part of your routine. Check the pool and surrounding area after every use and each night.

Near Drowning



Near Drowning

"Educate yourself and share the knowledge!"



Our Goal:

Is to ensure that parents and caregivers know that drowning is the leading cause of accidental death in children under the age of four and near drowning episodes is preventable.

This is an underserved very important topic dear to our hearts. We want to inform and educate as many parents as possible and caregivers so no one else experiences this tragedy.

Why is Water Safety so Important?

- Drowning is the leading cause of accidental death for infants and children age 1-4.
- Children, who suffer near drowning, may experience brain damage.
- A child can drown in a small amount of water. It just takes enough to cover their nose and mouth
- Drowning can be prevented

Water Safety in the Home

- Never leave your child alone near water. This includes
  - Bathtubs
  - Pools
  - Lakes
  - Water buckets
  - Rivers
- Remember that is only takes a small amount of water to cause your child to experience a near drowning episode.
- Take a CPR course, which can potentially save your child's life.

Pool Safety

- Pools can be a great place to cool off and have fun, but they can also be dangerous.
- Install a fence or gate around the pool and ensure that its locked
- Enroll your child in swimming lessons.

"Supervision is your first priority!"