ISSN: 2710-0723

# Analysis and Practical Research on Drowning Prevention in Natural Open Waters in China

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## Abstract

**This paper mainly focuses on various drowning accidents occurring in natural waters in China. According to the types of drowning incidents, it analyzes the causes and preventive measures. Using the survey analysis method, expert interview method, and case analysis method as the main research methods, it investigates the current situation of drowning accidents in natural waters in China, understands the real causes of these accidents, and summarizes them. The study finds that the causes of drowning are multi-faceted, including the complex water conditions in natural waters, insufficient swimming skills and lack of corresponding self-rescue abilities, insufficient awareness of drowning prevention safety, sudden physical conditions or potential physical diseases, and improper rescue in case of accidental falling into the water. In response to these issues, the following preventive measures are proposed: improving drowning prevention safety education, carrying out a series of water safety education activities, promoting the learning and popularization of swimming skills, learning basic rescue methods, and establishing drowning prevention safeguard measures.**

## Keywords

**Natural Open Waters; Drowning Prevention; Security Factors.**

## 1. Introduction

In China, natural open waters are widely distributed, such as the ocean, rivers, lakes, reservoirs, ponds, etc., which provide convenience for people's production, life, and recreational activities. These waters are characterized by openness and complex water conditions, making them high-risk areas for drowning accidents. Drowning accidents can occur throughout the year. Especially during the hot summer when students are on vacation, the probability of drowning accidents is the highest. There are also drowning accidents in winter. For example, in winter 2015, there was an incident of people falling into the water while ice fishing in Yutian County, Tangshan City, Hebei Province. This not only brings great pain and losses to the families of the victims but also attracts extensive attention from all sectors of society. Therefore, in-depth research on the prevention of drowning in natural open waters in China is of extremely important practical significance and urgency. Through the analysis of the current situation and causes of drowning accidents, as well as the study of existing prevention and control measures, it can provide a basis for formulating more effective drowning prevention strategies, thereby reducing the occurrence of drowning accidents and protecting people's lives.

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# 2. Research Objects and Methods

## 2.1. Research Objects

The research objects are the drowning prevention mechanisms and systems. It studies the causes of drowning accidents in different scenarios, the existing operation mechanisms for drowning prevention, and the existing drowning prevention systems.

## 2.2. Research Methods

1.Expert Interview Method: It is planned to conduct interviews with the responsible persons of the education department and relevant experts and scholars. The interviewees include the responsible persons for formulating school safety and drowning prevention systems; the responsible persons of the Drowning Prevention Working Group of the Ministry of Education, the National Swimming Administrative Center, and relevant experts from the lifeguard associations at all levels. The interviews mainly focus on the investigation of drowning accidents, policy systems, and the problems existing in actual operation.

2.Investigation Method: It includes on-site observation, investigation, interview, and case investigation. It is planned to conduct sample on-site investigations in several provinces and cities with relatively developed water areas across the country, obtain the real data of drowning accidents from the health commissions of provinces and cities, count the number of accidents, and investigate the causes of the accidents.

# 3. Research Results and Analysis

## 3.1. Analysis of the Scenarios, Prone Groups, and Causes of Drowning Accidents in Natural Open Waters

### 3.1.1. Main Scenarios of Drowning Accidents

According to the investigation, the probability of drowning accidents occurring in places such as rivers, lakes, seas, reservoirs, ponds, and abandoned construction site ponds is very high. Most of the drowning accidents of adults and teenagers occur in the above-mentioned places. The high-risk periods for drowning accidents are generally during the hot summer days, weekends during holidays, and rest periods of major holidays. According to the investigation, the middle and afternoon of summer vacation are the high-incidence periods for drowning accidents, and weekends during hot weather are also relatively high-risk. The occurrence of drowning accidents is relatively low in spring, autumn, and winter, but there are still drowning accidents in low-temperature seasons. Different drowning scenarios have varying degrees of influence on different groups. The following will conduct a detailed analysis of the groups prone to drowning accidents in natural open waters.

### 3.1.2. Prone Groups of Drowning Accidents

The groups prone to drowning accidents in natural open waters can be divided into three categories according to age:

1) Teenagers and Children Group: Their physical and mental development is not yet mature, they have a poor understanding of swimming, a serious lack of danger awareness, and weak strength and endurance. They often fail to realize the potential risks in natural waters. They are curious and like to explore the unknown, and they are full of curiosity about natural waters. They are likely to go swimming or playing in natural waters without the company of adults or safety guarantees. And they may engage in some dangerous behaviors under the encouragement of their peers, such as competing in swimming distance or challenging the deep water area. During the summer vacation or holidays, due to the lack of effective supervision, they like to go to natural waters to play in groups. They usually do not have sufficient swimming

ISSN: 2710-0723

skills and self-rescue abilities. Once an accident occurs, it is difficult for them to carry out effective self-rescue in the first place, and the probability of collective drowning during mutual rescue is very high.

2) Young and Middle-Aged Group: Some young and middle-aged men think they have good swimming skills and strong water adaptability, and they ignore the complexity and danger of natural waters. They rashly enter the water without making full preparations. When they encounter unexpected situations such as sudden changes in water temperature, abnormal water currents, underwater reefs, or whirlpools, they exceed their ability to cope, resulting in drowning. Young people are energetic and impulsive, and they like to make bets, show off their abilities, be competitive, and can't resist provocation. They may engage in some risky behaviors when swimming in natural waters. Some young and middle-aged people participating in water activities such as rowing and kayaking are also likely to have drowning accidents if they do not wear life-saving equipment or operate improperly or encounter bad weather during the activities. In addition, some young and middle-aged people may accidentally fall into the water while fishing, working, etc. Or swimming in the water after drinking alcohol will lead to slow physical reactions and decreased balance ability, increasing the risk of drowning.

3) Elderly Group: Their physical coordination, flexibility, and reaction ability have all declined. When they are near natural waters, such as by the river or pond, they are likely to slip and fall into the water due to reasons such as wet ground and poor eyesight. Some elderly people suffer from diseases such as Alzheimer's disease and Parkinson's disease, and they may experience cognitive impairment, mobility difficulties, and other situations, unable to accurately judge the dangers of the surrounding environment, and are prone to accidental falls into the water. Some elderly people have relatively weak safety awareness and insufficient understanding of the dangers of natural waters. They may approach the waters without the company of others or engage in some dangerous activities by the water, such as washing clothes or vegetables, thus increasing the possibility of drowning.

### 3.1.3. Causes of Drowning Accidents in Natural Open Waters

The causes of drowning in natural open waters can be mainly divided into three categories:

1) Environmental Factors: Natural waters such as rivers, lakes, and seas are deep, and there are undercurrents, whirlpools, and water flows of different speeds. The depth of the water is the main cause of drowning accidents. Once a person who cannot swim falls into the deep water area and loses balance and is unable to catch their breath, a drowning accident will occur in a very short time. And the speed of turbulent currents, undercurrents, whirlpools, and water flows of different speeds mainly affect those who have a certain swimming foundation but not very good swimming skills. Undercurrents may flow quietly under the water surface and are difficult to detect. Once a swimmer enters the undercurrent area, they will be quickly carried away from their original position, leading to exhaustion and drowning. Whirlpools will generate a strong suction force, drawing in surrounding objects and people. Even people with relatively strong swimming abilities find it difficult to break free. Secondly, when swimming in natural waters, the weather changes are unpredictable. Sudden heavy rain, strong winds, and other bad weather will generate large waves on the water surface, making it difficult for people to maintain their balance in the water. Moreover, a sudden drop in temperature may cause the human body to cramp and other conditions, increasing the risk of drowning. Lightning weather is extremely dangerous. People in the water become prominent conductors and are extremely likely to be struck by lightning, which can also lead to drowning accidents.

2) Personal Factors: Insufficient swimming ability. Many people do not have an accurate understanding of swimming. They think that as long as they can swim, they can keep swimming and overestimate their swimming ability. They enter natural waters without sufficient swimming skills and physical reserves. When they encounter slightly complex water conditions,

ISSN: 2710-0723

such as stronger water currents or larger waves, they cannot effectively control their bodies, resulting in drowning. Weak safety awareness. Some people do not pay attention to safety when swimming in natural waters and do not take necessary safety measures, such as not carrying life-saving equipment. Some people also swim in the water after drinking alcohol. Alcohol will affect people's judgment and physical coordination, making them more likely to encounter danger in the water. Sudden physical conditions. During the swimming process, the body may experience some sudden conditions, such as cramps. Low water temperature, insufficient warm-up before exercise, etc. may all lead to cramps. Once cramps occur in the water, the muscles will suddenly contract violently, making the limbs unable to move normally, resulting in drowning. In addition, people with underlying diseases such as heart disease and epilepsy may lose their mobility due to the onset of the disease in the water, leading to drowning. This situation occasionally occurs in some open water competitions, and there is even a probability of drowning accidents among professional athletes.

3) Difficulty in Rescue Factors: Natural open waters are large in area and wide in range. Once someone drowns, it is difficult to be discovered in a timely manner. Even if someone discovers the drowning person, due to the complex water environment, it is difficult for rescue personnel to reach the drowning person quickly. Moreover, during the rescue process, various difficulties may also be encountered, such as turbulent water currents and many underwater obstacles, increasing the difficulty and time of rescue. Lack of professional rescue facilities and personnel. Many natural open waters are not equipped with complete rescue facilities, such as life rings, life ropes, etc., and there are no professional lifeguards on patrol and duty. When a drowning incident occurs, effective rescue cannot be carried out in a timely manner, resulting in the drowning person missing the best rescue opportunity.

## 3.2. Preventive Measures for Drowning Prevention in Natural Open Waters

### 3.2.1. Policy Level

First, set up warning signs. Set up clear and eye-catching drowning prevention warning signs at obvious positions around natural open waters, such as "Dangerous water depth, swimming is prohibited", "It is strictly prohibited to enter the water, and you will bear the consequences yourself" and other words to remind people to pay attention to safety. The content of the signs should be concise, clear, and easy to understand, and ensure that the number of signs is sufficient and the distribution is reasonable to ensure that they can be clearly seen from different angles and positions. Second, improve protection facilities. Set up protective fences, isolation belts, and other facilities in areas where people may enter the water to prevent people from entering dangerous waters at will. Repair and maintain the roads, steps, etc. around the waters to ensure safe passage and prevent accidental falls into the water due to wet and damaged roads. Equip necessary rescue equipment, such as life poles, life rings, ropes, etc., and regularly check and maintain them to ensure that the equipment is in good condition so that it can be used in a timely manner in case of an emergency.

Secondly, establish a sound AI (Artificial Intelligence) protection and monitoring system and incorporate key areas, key locations, and potential dangerous areas into supervision. For example, existing AI drowning prevention systems such as the Wuyou Shuibian AI Drowning Prevention System, the Intelligent Drowning Prevention Monitoring and Robot Autonomous Rescue System, the AI Intelligent Drowning Prevention System of Nantong Branch of China Telecom, the Drowning Prevention Early Warning and Monitoring System in Fudao, Tangyin County, and the AI Intelligent Drowning Prevention Early Warning System of Hubei Branch of China Mobile, etc. In this way, it is possible to monitor the activities of people around the waters in real-time. Once it is found that someone enters a dangerous area or shows signs of drowning, an alarm can be immediately issued. This system has the advantages of a wide monitoring range and high recognition accuracy. To achieve the networked and unified management of AI

ISSN: 2710-0723

systems across the country, a central data processing platform can be established. Local systems will upload the monitoring data to this platform in real-time, and the corresponding functional departments will conduct unified scheduling and analysis to timely grasp the safety dynamics of natural open waters across the country.

### 3.2.2. Safety Management Level

Strengthen patrol and supervision. Arrange professional patrol personnel to regularly patrol around the waters. Especially during holidays, high-temperature weather, and other high-risk periods for drowning accidents, increase the frequency of patrols and the number of personnel. Patrol personnel should be familiar with the water conditions, have basic rescue skills, and stop dangerous behaviors in a timely manner. Establish an emergency rescue mechanism. Formulate a complete emergency rescue plan, clarify the rescue process and the responsibilities of various departments and personnel in case of a drowning accident. Establish an emergency rescue team and organize regular drills to improve the emergency response ability and rescue level of rescue personnel. Ensure that after receiving the alarm, they can quickly reach the scene for rescue. The water management department should establish a close cooperation mechanism with local public security, fire protection, medical and other departments to achieve information sharing. Once a drowning accident occurs, it can quickly coordinate and carry out rescue work to improve the rescue efficiency.

### 3.2.3. Publicity and Education Level

Carry out publicity activities. Through various channels, such as community publicity, school lectures, media reports, etc., widely carry out drowning prevention safety knowledge publicity activities. Popularize knowledge about the hazards of drowning, prevention methods, self-rescue and rescue techniques, etc. to the public, and improve people's safety awareness and self-protection ability.

Set up publicity boards. Set up drowning prevention publicity boards in places with high traffic flow such as around the waters, in communities, and in schools. The content of the publicity boards can include real cases, safety knowledge in pictures and texts, and demonstrations of rescue methods to convey drowning prevention information to people in an intuitive way.

Conduct safety education and training. Organize professional personnel to conduct drowning prevention safety education and training for residents, students, tourists, etc. around the waters. Through on-site demonstrations, simulation drills, and other methods, let people experience and master the correct swimming methods, self-rescue, and rescue skills in person.

## 4. Conclusion and Suggestions

The study believes that the main causes of drowning in natural open waters include the complex water conditions of rivers, lakes, and seas, the insufficient swimming skills of the drowning victims, the lack of corresponding self-rescue and first aid abilities, insufficient awareness of drowning prevention safety, negligence, imperfect drowning prevention education for teenagers and children, and the lack of a scientific prevention and rescue system.

The following preventive measures are proposed: improve the construction of the drowning prevention system for open waters, introduce corresponding laws and regulations to effectively protect people's lives and health; improve the drowning prevention education system, incorporate drowning prevention education into the classroom, and carry out a series of water safety education activities; establish a sound joint mechanism among society, schools, and families, combining both prevention and control, and continuously improve preventive measures. Establish a sound AI drowning prevention system, achieve the networked and unified management of AI systems across the country, establish a central data processing platform, and local systems will upload the monitoring data to this platform in real-time, and

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the corresponding functional departments will conduct unified scheduling and analysis to timely grasp the safety dynamics of natural open waters across the country.

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