

Environment High Risk Factors with Drowning among Elementary School-aged Children Before and During COVID 19

Sakchai Kaeomanee¹, Wuttiiphong Phakdeekul^{1*}, Warinmad Kedthongma^{1*}

¹Faculty of Public Health, Kasetsart University Chalermphrakiat Sakon Nakhon Province Campus, Thailand *

* Corresponding author, E-mail addresses: wuttiiphong.p@ku.th, warinmad.k@ku.th

Abstracts: In Thailand, drowning among school-age children is an urgent health problem. Every student of school age should practice safe drowning avoidance techniques. Sakon Nakhon Province's Mueang District, 16 drowning deaths were identified by the retrospective study from the previous five years (2018-2022). In addition, a cross-sectional analytic study was also conducted to explore the characteristics and risk factors associated with drowning. The sample included 531 children under the age of 15 according to the survey. Multiple logistic regression and descriptive statistics were used for analyzing all the data. The results were summarized as follows: With an average age of 7 years and a smallest age of 3 years, the death rate for children under 15 who drowned between 2018 and 2022 was 50.0 % in 2018. They were predominately male (68.8%), and 45.1% of them worked during the week. 68.8% in the farm's pool The incident involved 43.8% of the residents of 4, of which 43.75% were family members and 31.0% were friends. Natural water sources have certain physical features like slick ground and sloping pool margins. Furthermore, the proportion stayed at 75.0%, more factors than other types of fatalities were linked to the severity of drowning, including swimming activities, having completed primary school, and a lack of parental care, which was statistically significant at the 0.05 level.

Keywords: Drowning, Risk factor, School-aged Children, Environment.

1. INTRODUCTION

Only 16.3% of Thai children under 15 who responded to the survey claimed to have gone swimming over the summer and school breaks. Holidays in October fall on Saturdays and Sundays from 12 to 17:59, rendering March and May the busiest period. There are 875 deaths on average per year, or two per day, and the mortality rate per 100,000 people (2010-2019) ranges from 6.1 to 9.4. The case fatality rate from drowning is 37.2 per year, with a national average of 5.7 per 100,000 people [1]. According to the 2017 report on critical issues for child drowning prevention campaigns by the Non-Communicable Diseases, Department of Disease Control, and Ministry of Public Health, children between the ages of 10 and 14 are the most at-risk group, and the number of drowning deaths increased 14.5% from the previous year. Boys drowned 2.6 times more than girls, accounting for 17.5% of children who drowned while swimming [2]. Furthermore, the relationship between swimming ability and the danger of drowning was looked into, however there is no conclusive evidence that the rate of drownings is increasing. More water sports are played by better swimmers, and they feel more at ease participating in high-risk activities like swimming in unprotected waters [3]. The highest rate of drowning deaths occurred in Thailand's northeast, where children under the age of 15 perished at a rate of 7.2 per 100,000 inhabitants, according to data from 2020[4]. This made Sakon Nakhon Province the first highest in the nation [5]. A mortality rate of 6.0 per 100,000 people was achieved by 18 drowning deaths among children under the age of 15. There are 4.5 drowning deaths per 100,000 people in the Mueang Sakon Nakhon District, or two drowning deaths of children under the age of 15 years. The Ministry of Public Health's basic indications were exceeded by the majority of them, who died in agriculturally used water[6]. Wherein the aforementioned deaths have adverse impacts on people individually, within families, within communities, and within society [7]. In the ensuing ten years, 16,696 children are expected to drown if nothing is done.[8] In order to reduce unnecessary losses, a range of drowning prevention techniques are needed. There are certain water safety measures in place, and it is the community's duty to follow them [9].

We can grasp the regional environment by looking at school-aged children's drowning prevention behaviors. The planning of how to encourage drowning prevention among school-aged children will be 2000

greatly aided by the information provided to families, schools, communities, and affiliated organizations[10]. So This study aims to provide an understanding of the problem situation, and risk factors for drowning in children.

2. Materials and Method

2.1. Study Design

This study was retrospective and cross-sectional analysis research. Data were collected from the investigation form for patients who drowned and treated at Sakon Nakhon Hospital, throughout the previous five years (2018–2022).

2.2. Participants

Sakon Nakhon Province has 531 elementary school students. That took part in the survey, quantitative questionnaires to assess knowledge, social support, and preventive behavior. These questions were developed by reviewing and evaluating relevant research studies. Data from a report and the hospital management system program for the last five years (2018–2022), at Sakon Nakhon Hospital on the drowning investigations.

2.3. Data Analysis

All data were analyzed by descriptive statistics: Nominal variables were presented as numbers and/or percentages. Continuous variables were presented as means \pm standard deviations (SD), with the personal characteristics such as sex, age, education, swimming experience, and swimming skill. Inferential statistic: evaluate the severity of the risk factors for drowning among school-age children using the variables odds ratio, 95% confidence interval, and multiple logistic regression.

2.4 Ethics Approval of Research

This research was considered research ethics in humans by the Human Research Ethics Committee of Sakon Nakhon Provincial Public Health Office, Thailand, number of SKN REC 023/2565 dated 19/01/2023.

3.RESULTS

3.1 General Data

The most of samples were male (68.8%), with a average of age 7 years (SD = 3.674) minimum age 3 years, lower secondary school level (42.77%), inability to swim (68.75%), normal brain development (81.25%), and congenital disease (25.0%).

3.2 Information of Drowning

According to data on drowning incidents among children under the age of 15, the year with the greatest proportion of drownings was 2018 of 50.0%, and the distance between the accident site and the home was 0.5 km. and 2 kms. (18.8%) (M = 10.581, SD = 23.939), as shown in table 1.

| Table 1: Situation of drowning deaths among elementary school students during the year of 2018-2022 | | |
|---|-----------|------------|
| (n = 16) | | |
| general data | frequency | percentage |
| 1. Years | | |
| 2018 | 8 | 50.0 |
| 2019 | 1 | 6.3 |
| 2020 | 2 | 12.5 |
| 2021 | 2 | 12.5 |
| 2022 | 3 | 18.8 |
| 2. The distance between the scene and the house | | |
| ≤ 1 kilometer | 9 | 56.25 |
| >1 kilometer | 7 | 43.75 |
| Mean = 10.581 , SD. = 23.9396 , Min = 0, Max = 90 | | |

According to the findings of a three-year retrospective study, the majority of the drowning victims, 68.80%, were male and frequently passed away between the hours of 13:00 and 15:00 in the previous 16 incidents with a high mortality rate of 50.0% in 2018. 56.25% perished on designated days, 68.80% frequently passed away at the farm's well, as a result of hazardous environmental conditions linked to drowning (81.30%), as shown in Figure 1, 2.

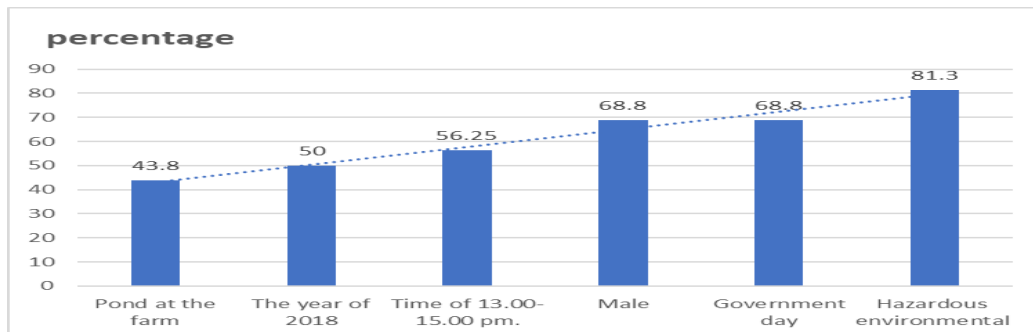


Figure 1: Presents data on children under 15 who drowned and died

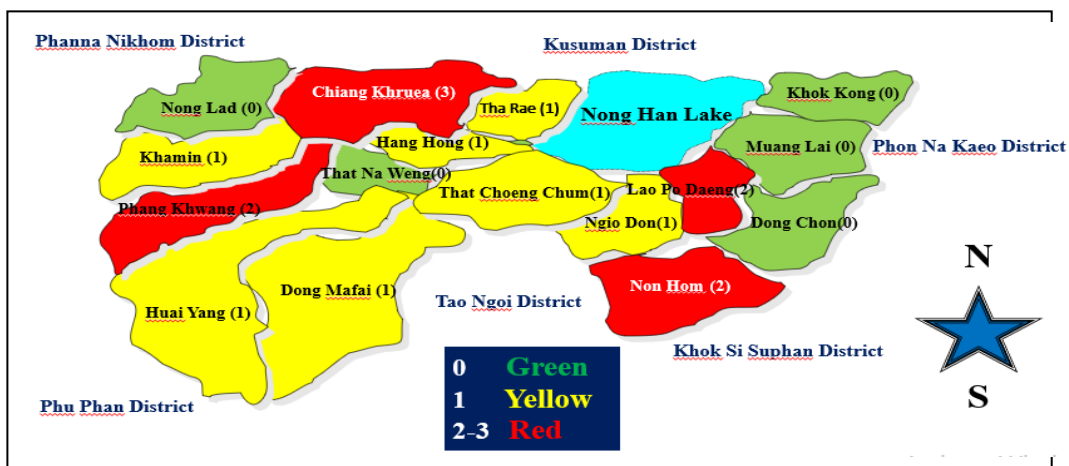


Figure 2: The map showing problematic data on drowning deaths in area of Sakon Nakhon Province, 2018–2022

3.3 Factors related to the severity of drowning

Factors related to the severity of drowning included playing in the water, being at the pond in the fields, being at a primary school, and non-caretaker while entering the water, as in Table 2.

| Table 2. factors related to the level of severity drowning | | | | |
|--|--------------|--------------|-----------------|---------|
| (n=16) | | | | |
| factors | dead | survive | chi square test | P-value |
| | (percentage) | (percentage) | | |
| 1. Activity | | | | |
| Accident | 4 (100) | 0(0) | 12.718 | 0.026* |
| Help drowning | 1 (100) | 0(0) | | |
| Play in the water | 7 (100) | 0(0) | | |
| Catch fish | 1 (100) | 1(50.0) | | |
| Walk the dog | 0 (0) | 1(100) | | |
| Shower | 0 (0) | 1(100) | | |
| 2. Place | | | | |
| Pond in school | 2 (100) | 0 (0) | 8.342 | 0.038* |
| Pond in the field | 7 (100) | 0 (0) | | |
| Water park | 1 (50) | 1 (50.0) | | |
| Phung River | 2(66.7) | 1 (33.3) | | |
| Swimming pool | 1 (100) | 0 (0) | | |
| In the house | 0 (0) | 1(100) | | |
| 3.status education | | | | |
| Lower than primary school | 5 (62.5) | 3(37.5) | 3.692 | 0.45 |
| Primary school | 8 (100) | 0 (0) | | |
| 4. Caretaker | | | | |
| Not caretaker | 4 (100) | 0 (0) | 7.467 | 0.028* |
| Sister | 1 (100) | 0 (0) | | |
| Grandparent | 1 (100) | 0 (0) | | |
| Uncle | 2 (100) | 0 (0) | | |
| Friends | 4 (80.0) | 1 (20.0) | | |
| Parent | 1 (50.0) | 1 (50.0) | | |
| Aunt | 0 (0) | 1(100) | | |

Note: * $p < 0.05$

3.4 Risk factors for drowning in children

The risk factors for drowning of school-aged children was an age, the 12-year-old group had drowned 51.1%, and had a risk of drowning 1.42 times (95%CI = 1.00 – 2.022, $p = 0.050$).

The group that went to swim more than 4 days per week had drowned 70.0% and had a risk of drowning 2.77 times (95%CI = 1.051 – 7.351, $p = 0.032$).

People who were not trained in survival skills from drowning. 61.5% had drowned, and 2.05 times the risk of drowning (95%CI = 1.139-3.687, $p = 0.015$).

People who had not been informed about drowning prevention 50.0% had ever drowned, and had a risk of drowning 1.49 times (95%CI = 1.054-2.105, $p = 0.024$).

People who had never received drowning protection 55.1% had drowned, and had a risk of drowning 1.635 times (95%CI = 1.083-2.468, $p = 0.019$) as shown in Table 3.

| Table 3: Risk factors for drowning in children (n = 531) | | | | | | |
|---|---------------------|-----------------|----------|-----------|-------------|-----------|
| variables | Drowning experience | | crude OR | Adjust OR | 95%CI | (p-value) |
| | never amount (%) | ever amount (%) | | | | |
| Age | | | | | | |
| -10-11 ȳ | 190 (57.8) | 139 (42.2) | 1.022 | 1.422 | 1.00-2.022 | 0.050* |
| -12 ȳ | 99 (49.0) | 103 (51.0) | | | | |
| Frequency of swimming per week | | | | | | |
| Amount 1-3 days | 268 (54.4) | 225 (45.6) | 2.519 | 2.779 | 1.051-7.351 | 0.032* |
| ≥ 4 days | 6 (30.0) | 14 (70.0) | | | | |
| Has received training in drowning survival skills training | | | | | | |
| Ever | 20 (38.5) | 32 (61.5) | 2.012 | 2.152 | 1.139-3.687 | 0.015* |
| Never | 269 (56.2) | 210 (43.8) | | | | |
| Obtaining information | | | | | | |
| Ever | 146 (50.0) | 146 (50.0) | 1.19 | 1.49 | 1.054-2.105 | 0.024* |
| Never | 143 (59.8) | 196 (40.2) | | | | |
| Playing in the water while having a fever | | | | | | |
| Ever | 252 (56.6) | 193 (43.4) | 3.158 | 3.578 | 1.363-6.922 | 0.020* |
| Never | 37 (43.0) | 49 (57.0) | | | | |
| Acquiring swimming aids | | | | | | |
| Ever | 236 (57.1) | 177(42.9) | 1.125 | 1.635 | 1.083-2.468 | 0.019* |
| Never | 53 (44.9) | 65 (55.1) | | | | |

Note: * $p < 0.05$

4. Discussion

Children who drowned in the research area were mostly male, according to the drowning's characteristics. There was twice as many men as women [11]. It was shown that men perished from drowning incidents at a higher rate than women who attended pre-primary school and were between the ages of 4-6 years. The most typical discovery [12]. Who researched the epidemiology of drowning among children at Sultan Qaboos University Hospital discovered 74 cases of drowning, 73% of which were male, and 59% of them were under the age of six. This is because young children are naturally curious at this age and lack the intellectual capacity to recognize the dangers. Most of them lacked swimming ability [13]. investigation of the reasons why children drown and how to prevent it. It was discovered that just 4.4% of children under 15 years old swam to survive, whereas 23.7% of them. Their brain development was normal, they have no medical conditions, the majority of drowning occurrences happened in 2018, and it takes an average of 10 kilometers to travel from the scene of the accident to your home. A pond in a farmland was 2004

identified as a factor in the Mueang Sakon Nakhon District drowning deaths of school-age children [14,15,16]. who researched how problems with child drowning are seen in Thailand. In the event, elementary school children were left unattended and alone near water sources including ponds and digging ponds [17]. who investigated the prevalence of pediatric drowning at Sultan Qaboos University Hospital. At the time of the occurrence, 52.7% of drownings occurred in unsupervised swimming pools as a result of being left unattended [18].

The findings of this study emphasize the significance of primary and secondary prevention in lowering drowning injury mortality and severe outcomes. Particularly, all of the fatal drownings in our cohort involved youngsters who were not being watched. Our results are in line with earlier research showing that injury downtime of N5 min or longer was linked to a higher risk of mortality [19]. Young infants should never be left unattended near water, especially bathtubs, for any length of time since they are more likely to drown and die [20-21]. The necessity of ongoing adult supervision was underlined in the American Academy of Pediatrics' study on drowning prevention [22]. Unsurprisingly, it has been demonstrated that prompt action after detection considerably lowers the likelihood of a negative outcome. This is in line with the CDC's recommendations and the results of research looking at how bystander CPR affects drowning outcomes [23–24]. Everyone in the community must work together to prevent drowning, and must take the issue of drowning in the community seriously. Encourage collaboration in the creation of plans for social and physical development by highlighting increased involvement from all sectors to ensure the sustainability of the development of drowning prevention, operations are planned for acquiring funds, acquiring equipment, and changing the environment, which is a source of danger for drowning. There is information available on how to prevent drowning, teach children how to swim, correctly rescue drowning victims, and perform cardiopulmonary resuscitation (CPR) on kids. The use of a playpen, indoor water supplies, school water supplies, and farm water sources should all be managed with equipment at hand [25–26]. In addition, a study on drowning and accident situation during the COVID-19 Outbreak, found that the majority of patients were elderly, women, and adolescent patients. That needs to be taken into account in terms of rules, preventative actions, and the creation of a service unit quality system. For helping with this issue [27–28].

Acknowledgments

The researcher is really appreciative to Sakon Nakhon Hospital, the disease prevention and epidemiology unit, and the primary school for supporting the data in this study.

Conflict of Interest

The authors declare no conflict of interest and report no financial or other relationship relevant to the subject of this article. In addition, the funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

REFERENCES

- [1] Ministry of Public Health Injury Prevention Division Department of Disease Control. Situation of drowning in children in Thailand 2009-2018. Nonthaburi: Rum Thai Press Co., Ltd.; 2020.
- [2] Division Non communication Diseases of Disease Control, Ministry of Public Health. Health Report. Nonthaburi: Ministry of Public Health; 2019.
- [3] Brenner RA, Saluja G, Smith GS. (2003). Swimming Lessons, Swimming Ability, and the Risk of drowning. *Injury Control and Safety Promotion*. 2003; 10(4): 211-5.
- [4] Ministry of Health Injury Prevention Division, Department of Disease Control. Health Report. Nonthaburi: Ministry of Public Health; 2020.
- [5] Strategy and Planning Division, Ministry of Public Health. (2019). Guidelines for Drowning Prevention. Nonthaburi: Ministry of Public Health; 2019.
- [6] Non Communicable Disease Control Division, Sakon Nakhon Provincial Public Health Office. Health Report. Sakon Nakhon: Sakon

- Nakhon Provincial Public Health Office; 2020.
- [7] Kedthongma, W, Phakdeekul, W. Oral Health and Well-being of Elderly During and Post COVID-19 Outbreak. *J Int Dent Med Res.* 2022; 15(4): 1672-7.
- [8] Ministry of Health Injury Prevention Division, Department of Disease Control. Health Report. Nonthaburi: Ministry of Public Health; 2021.
- [9] Kedthongma W, Phakdeekul W. The intellectually developed model for community participatory management of child care centers during the COVID-19 Outbreak. *European journal of contemporary education.* 2022; 11(1):81-8.
- [10] Ministry of Public Health Department of Disease Control. Health Report. Nonthaburi: Ministry of Public Health; 2020.
- [11] Ministry of Health Non-communicable Disease Division, Department of Disease Control. Health Report. Nonthaburi: Ministry of Public Health; 2017.
- [12] Girela-López, E., Beltran-Aroca, C. M., Dye, A., & Gill, J. R. Epidemiology and Autopsy Findings of 500 Drowning Deaths. *Forensic Science International.* 2021; 330: 111137.
- [13] Jeswani NL, Khilji MF, Rizvi S, Al Reesi A. Epidemiology of Drowning Incidents among Children at Sultan Qaboos University Hospital Oman. *Oman Med J.* 2021; 36(6): e320.
- [14] Bunnag P. Drowning in Children. *Thammasat Medical Journal.* 2020; 17(1): 109-114.
- [15] Jongsukklai K. Awareness of Child Drowning Problems in Thailand. *Journal of Public Administration and Politics.* 2019; 8(2): 48-68.
- [16] Phakdeekul W, Thongkrajai T., Eiamprapai P, Kanato, M. Risk Factors to Alcohol Law Violations in the Community: Quasi-experimental study. *American Journal of Applied Sciences.* 2011; 8(12): 1343.
- [17] Loux T, Mansuri F, Brooks SE, Slye N, Lewis B, Lu Y, Chen H, Kip KE. 2021. Factors Associated with Pediatric Drowning Admissions and Outcomes at a Trauma Center, 2010–2017. *The American Journal of Emergency Medicine.* 2021; 39: 86-91.
- [18] Cohen RH, Matter KC, Sinclair SA, Smith GA, Xiang H. Unintentional Pediatric Submersion-injury-related Hospitalizations in the United States, 2003. *Inj Prev* 2008;14:131–5.
- [19] Claesson A, Lindqvist J, Herlitz J. Cardiac Arrest Due to Drowning Changes over Time and Factors of Importance for Survival. *Resuscitation.* 2014; 85: 644–8.
- [20] Quan L, Bierens JJLM, Lis R, Rowhani-Rahbar A, Morley P, Perkins GD. Predicting outcome of drowning at the scene: a systematic review and meta-analyses. *Resuscitation* 2016;104:63–75. <https://doi.org/10.1016/j.resuscitation.2016.04.006>.
- [21] Centers for Disease Control and Prevention (CDC). Vital signs: Unintentional injury deaths among persons aged 0-19 years-United States, 2000-2009. *MMWR. Morbidity and mortality weekly report.* 2012; 61: 270-6.
- [22] Ministry of Health Injury Prevention Division, Department of Disease Control. Health Report. Nonthaburi: Ministry of Public Health; 2017.
- [23] Nuanchum K, Phakdeekul W, Kedthongma W. Factors Related to Preventive Behavior towards Covid-19 among People in Rural Area of Thailand. *Neuroquantology.* 2023;21(5):216-25.
- [24] Seesanor T, Phakdeekul W, Kedthongma W. Factors Related to Hemoglobin Levels among Infants Aged 6-12 Months after the COVID-19 Outbreak. *International Journal.* 2023; 10(2): 968-76.
- [25] Sangsuwun S, Phakdeekul W, Kedthongma W, Jukpim C. In-patient costs of coronavirus disease 2019 with financial regulations and health economy. *Russian Law Journal.* 2023; 11(6s): 192-200.
- [26] Wongta P, Kedthongma W, Phakdeekul W, Jukpim C. Factors Related to Hospital Accreditation of Community Hospital during COVID-19 Outbreak, Thailand. *Russian Law Journal.* 2023; 11(6s): 217-24.
- [27] Kedthongma W, Phakdeekul W. The Intellectually Developed Model for Community Participatory Management of Child Care Centers During the COVID-19 Outbreak. *European journal of contemporary education.* 2022;11(1):81-8.
- [28] Chuayrukha N, Phakdeekul W, Kedthongma W. Oral Rinse, Nasal Irrigation, and Risk Factor of COVID-19 Screening. *J Int Dent Med Res.* 2022; 16(3):1227-33.

DOI: <https://doi.org/10.15379/ijmst.v10i4.2354>

This is an open access article licensed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>), which permits unrestricted, non-commercial use, distribution and reproduction in any medium, provided the work is properly cited.