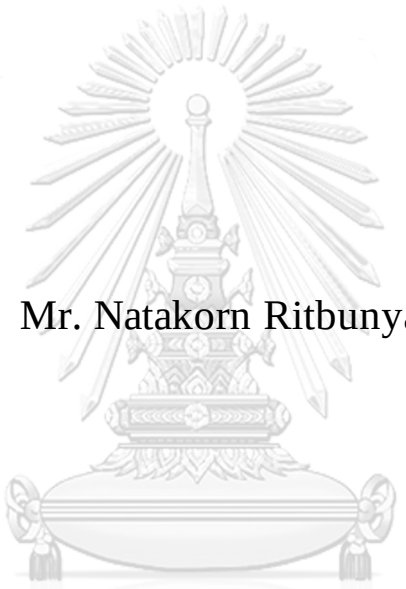
COMPARISON BETWEEN THE PREVALENCE OF PROBABLE POST-TRAUMATIC STRESS DISORDER AMONG DIFFERENT FLOOD TYPES IN THAILAND

Mr. Natakorn Ritbunyakorn



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Thesis Title	COMPARISON BETWEEN THE PREVALENCE OF PROBABLE POST-TRAUMATIC STRESS DISORDER AMONG DIFFERENT FLOOD TYPES IN THAILAND
By	Mr. Natakorn Ritbunyakorn
Field of Study	Public Health
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ณฐกร ฤทธิ์บุญญากร : การเปรียบเทียบความชุกและโอกาสเกิดภาวะป่วยทางจิตจากเหตุการณ์รุนแรงของน้ำท่วมประเภทต่างๆ ในประเทศไทย. (COMPARISON BETWEEN THE PREVALENCE OF PROBABLE POST-TRAUMATIC STRESS DISORDER AMONG DIFFERENT FLOOD TYPES IN THAILAND) อ.ที่ปรึกษาหลัก : ดร.วันดี ศิริโชคชัชวาล

น้ำท่วมเป็นหนึ่งในภัยธรรมชาติที่เกิดขึ้นบ่อยครั้งในประเทศไทย น้ำท่วมสามารถส่งผลกระทบทางจิตใจในระยะยาวกับผู้รอดชีวิต ซึ่งมักตรวจพบภาวะป่วยทางจิตจากเหตุการณ์สะเทือนขวัญ (PTSD) ในผู้ประสบภัยน้ำท่วม อย่างไรก็ตาม การศึกษาเกี่ยวกับ PTSD จากน้ำท่วมชนิดต่างๆมีอยู่จำกัด ดังนั้นวิจัยนี้มีจุดประสงค์เพื่อศึกษาความชุกของ PTSD และปัจจัยที่สัมพันธ์กับการเกิด PTSD ในประเภทน้ำท่วมที่แตกต่างกันในประเทศไทย การศึกษานี้วิเคราะห์ข้อมูลทุติยภูมิ โดยใช้ข้อมูลจากการศึกษาแบบภาคตัดขวางในปี 2562 ถึง 2563 ในจังหวัดที่มีพื้นที่น้ำท่วมซ้ำซากมากที่สุด ได้แก่ นครสวรรค์และนครศรีธรรมราช ทั้งสองจังหวัด ถูกเลือกโดยคณะผู้เชี่ยวชาญด้านน้ำท่วม ข้อมูลทุติยภูมิที่สมบูรณ์จะได้รับการคัดเข้ามาวิเคราะห์ การวิเคราะห์ข้อมูลทำในตัวอย่างจำนวน 376 คนในน้ำท่วมแต่ละประเภท คือ น้ำท่วมขังและน้ำท่วมฉับพลัน วิจัยนี้ใช้แบบคัดกรอง PTSD สำหรับการดูแลแบบปฐมภูมิ (PC – PTSD-5) เพื่อคัดกรอง PTSD วิเคราะห์ข้อมูลด้วยการทดสอบไคสแควร์และการวิเคราะห์ถดถอยพหุคูณ เพื่อหาปัจจัยที่เกี่ยวข้องและปัจจัยเสี่ยงระหว่างตัวแปรต้น และแนวโน้มการเป็น PTSD โดยพบว่าความชุกของแนวโน้มเป็น PTSD ในตัวอย่างทั้งหมดโดยไม่แบ่งชนิดน้ำท่วมเท่ากับ 12.6% ในพื้นที่น้ำท่วมขังเท่ากับ 20.2% และ 5.1% ในพื้นที่น้ำท่วมฉับพลัน ปัจจัยที่เกี่ยวข้องกับการเกิด PTSD ในพื้นที่น้ำท่วมขังได้แก่ รายได้ การเจ็บป่วยที่ไม่ได้รักษา และความกังวลต่อน้ำท่วม ส่วนปัจจัยในพื้นที่น้ำท่วมฉับพลันได้แก่ อายุ การศึกษา รายได้ โรคประจำตัว ปีที่อาศัยในพื้นที่ การอพยพ และการเจ็บป่วยที่ไม่ได้รักษา ตัวแปรที่สามารถทำนายแนวโน้มการเกิด PTSD ในพื้นที่น้ำท่วมฉับพลัน ได้แก่ การอพยพ (AOR: 6.06; 95% CI: 1.85 - 19.88) และการเจ็บป่วยโดยไม่ต้องได้รับการรักษา (AOR: 5.08; 95% CI:1.68 - 15.38) ส่วนในพื้นที่น้ำท่วมขังไม่พบตัวแปรที่สามารถทำนายแนวโน้มการเกิด PTSD แต่พบตัวแปรที่จะลดแนวโน้มการเกิด PTSD ได้แก่ รายได้ในครัวเรือนเท่ากับหรือมากกว่า 6,001 บาท (AOR: 0.57; 95% CI: 0.33 - 0.99) และการเจ็บป่วยโดยไม่ต้องได้รับการรักษา (AOR: 0.12; 95% CI: 0.02 - 0.93) จากการศึกษาสามารถสรุปได้ว่า ภาวะป่วยทางจิตจากเหตุการณ์สะเทือนขวัญสามารถพบได้ในเหตุการณ์น้ำท่วมประเภทต่างๆ ดังนั้นเจ้าหน้าที่ทุกภาคส่วนควรให้ความสำคัญกับปัญหาสุขภาพจิตในเหตุการณ์ภัยพิบัติ

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต .....
ปีการศึกษา 2564 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

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KEYWORD: flood, post-traumatic stress disorder, disaster, Thailand, PTSD, flood-prone

Natakorn Ritbunyakorn : COMPARISON BETWEEN THE PREVALENCE OF PROBABLE POST-TRAUMATIC STRESS DISORDER AMONG DIFFERENT FLOOD TYPES IN THAILAND. Advisor: Wandee Sirichokchatchawan, Ph.D.

Floods are one of the most common natural disasters in Thailand. Floods may have a long-term psychological impact on survivals. Post-traumatic stress disorder (PTSD) usually diagnosed among flood victims. However, there is limited information on PTSD from different flooding events in Thailand. This study aimed to determine the prevalence and associated factors of having probable PTSD among different flood types in Thailand. A secondary data analysis was performed using a dataset from previous cross-sectional survey conducted from 2019 to 2020 in Nakhon Sawan and Nakhon Si Thammarat provinces selected from the expert reviews' discussion. The analysis was performed on 376 respondents experienced river flood, and 376 respondents experienced flash flood. Primary Care PTSD 5 (PC-PTSD-5) was used to detect probable PTSD. Chi-square and multiple logistic regression were used for determining the differences and associated factors among the two flood types. The prevalence of probable PTSD was 12.6% in total sample, 20.2% for river flood, and 5.1% for flash flood. The associated factors with probable PTSD in river-flooded areas are income, sickness (no treatment needed), and level of flood concern. While age, education, income, underlying disease, years of living in areas, migration, and sickness (treatment needed) were associated with flash flood. The associated risk factors in flash flood were migration (AOR: 6.06; 95% CI: 1.85 - 19.88), sickness (no treatment needed) (AOR: 5.08; 95% CI:1.68 - 15.38). While in river flood, monthly household income more than or equal to 6,001 Baht (AOR: 0.57; 95% CI: 0.33 - 0.99) and sicked (no treatment needed) (AOR: 0.12; 95% CI: 0.02 - 0.93) which showed 43% reduction in having probable PTSD, and 2) sicked (no treatment needed) reduced the chance of having probable PTSD. In conclusion, PTSD was detected in both flood types in Thailand. Therefore, public health authorities should not only focus on physical injuries or damages after flood events but also must address mental health issues. In addition, more attention and support are needed in areas affected by river floods compared to those affected by flash floods.

Field of Study:	Public Health	Student's Signature .....
Academic Year:	2021	Advisor's Signature .....

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CHAPTER I
INTRODUCTION

1.1 Background and Rationale

Climate change has been linked to the increase of numerous weather-related natural disasters, including extreme weather events such as floods, hail, and dush storms. Floods happen when the water rises and overflows, which submerges the land (World Health Organization, n.d.). Flash floods and river floods are the two basic types of flooding events. Flash floods occur when heavy or excessive rainfall causes a rapid rise of water height in a short time. Flash floods usually happen within minutes or a few hours after the rainfall, and they are going to sweep everything before them.

In contrast, river floods caused by excessive runoff from longer-lasting rainstorms lead to a slower water-level rise over a larger area (The United States Geological Survey, n.d.). Nevertheless, heavy rainfall, storms, or ruptured dams are common causes of floods. Most flooding events are a natural phenomenon and have a possibility of turning into a disaster, causing a direct impact on human lives. Widespread damage to infrastructure and health problems in physical and psychological issues or even death can be observed after the events (Du et al., 2010). Mental health problems after experiencing floods are considered a direct impact of psychological trauma from climate-related disasters. These problems have become a global public health concern (Paranjothy et al., 2011; Liu et al., 2006). Many large epidemiological studies have observed a high prevalence and major burden to individuals, families, and greater societies from mental health disorders (Kessler et al., 2007). Previous studies have demonstrated the impacts of natural disasters on the mental health of the community such as people who experienced probable acute stress disorder were significantly more likely to develop posttraumatic stress disorder (PTSD) eight months after the typhoon, or there were two times higher risks of developing mental disorders in people who had direct exposure to a tsunami than those without direct exposure (Staab et al., 1996; Kristensen et al., 2009). In addition, middle-aged people or older adults are more susceptible to developing mental health problems such as depression and anxiety if experiencing a disaster than younger people (Rafiey et al., 2016).

Thailand has been facing many challenges from flooding events annually. The cumulative flooding events happen mainly in Thailand's Central and Southern parts. (Geo-Informatics and Space Technology Development Agency (Public Organization):GISTDA, 2022). For example, in 2011, Thailand experienced one of the worst flooding events that affected over nine million Thais and caused 400 deaths.

Nakhon Sawan and Nakhon Si Thammarat provinces are among the flood-prone provinces in Thailand. Nakhon Sawan province is considered an entryway between the Central and Northern parts of Thailand, while Nakhon Si Thammarat province is located in the Southern part of Thailand. Nonetheless, these two provinces both frequently face floods. The topography of Nakhon Sawan province is one of the reasons that contributed to floods. The province is primarily flat, with two large rivers (Ping and Nan) flowing into the province. Therefore, a large amount of water usually flows into several areas of the province during heavy rain. (Witthayamet et al., 2016).

Moreover, continuous rainfall and inadequate water drainage are factors of repeated flooding in Nakhon Sawan province. (Anucharn & Thongjit, 2020) Nakhon Si Thammarat province is also facing recurrent flooding events. The causes of floods are heavy rainfalls, deforestation, expanded cultivated area, and mountain erosion. Moreover, the road is paved throughout the community, perpendicular to the water line, making water hard to drain. (Khaenamkhaew et al., 2021)

The consequences and impacts of floods in Nakhon Sawan and Nakhon Si Thammarat provinces are also similar to those experience worldwide. Floods have both physical and mental impacts on the population in both provinces. The physical impacts range from minor injuries such as small cuts and falls, drowning, water-borne infectious diseases, displacement and destroyed personal assets, and even death of family members or loved ones. Since post-traumatic stress disorder (PTSD) is usually observed post-disaster (Neria et al., 2008), it is selected as a focus of mental health problems in this study. PTSD is a mental disorder associated with a direct or witnessed traumatic event. The traumatic events are natural disasters, war, and sexual assault. The symptoms of PTSD can be intrusive symptoms like nightmares and flashbacks. (Sadock, 2019). The prevalence of PTSD from floods is up to 33% in the United Kingdom (Mulchandani et al., 2020) and 15.94% in China (Dai et al., 2016).

A previous study in the south of Thailand shows a 44.8% prevalence of PTSD among the population after floods (Sonpaveerawong et al., 2017). Therefore, the prevalence of PTSD from floodings varies from 14.94% to 44.48%, according to the study area and population. The factors associated with PTSD after floods are physical injury, lack of social support, underlying diseases before a flood event, financial difficulty, and displacement (Sonpaveerawong et al., 2017) (Tempest et al., 2017) (Cruz et al., 2020). In Thailand, after the flooding, the mental health of an affected population is examined by Mental Health Crisis Assessment and Treatment Team (MCATT). The MCATT team includes the multidisciplinary team and village health volunteers. The roles of MCATT teams are mental health problems screening and psychological first aid (PFA) to the victims. The mental health screening tools used in a crisis are 2Q, 9Q, 2P, PICES-10, and a visual analogue scale. The MCATT team used these tools for accessing mental health two weeks after the disaster. (Bureau of mental health service administration, 2018). Nevertheless, in many countries, primary care PTSD 5 (PC – PTSD-5) has been used to screen for PTSD in the community setting after natural disasters or war. Previous studies demonstrated the excellent diagnostic accuracy of PC-PTSD-5, along with good acceptance of the tool by the providers (Prins et al., 2016; Bovin et al., 2021; Silwal et al., 2021).

Nevertheless, there is a limited study on the prevalence and associated factors of probable PTSD among flood-prone communities in Thailand. PC-PTSD-5 consists of a few numbers of questions and a higher rate of detection of PTSD. This screening tool has high clinical diagnostic accuracy, detecting more PTSD patients. The higher numbers of detection increase accessibility to care and reduce the cost of undetected PTSD patients. (Bovin et al., 2021). Therefore, this study aimed to use PC-PTSD-5 as a screening tool to examine the prevalence of probable PTSD and to compare the difference in the prevalence of people identified as having probable PTSD among different flood types in Thailand. In addition, associated factors of probable PTSD were also determined in this secondary data analysis.

1.2 Research Questions

- What is the prevalence of probable PTSD among different flood types in Thailand?
- Is there any difference in the prevalence of people identified as having probable PTSD among different flood types in Thailand?
- Is there any difference in general characteristics, history of flooding experiences, the impact of flooding, and level of flood concern of the studied population among different flood types in Thailand?
- Are there any associations between selected independent variables (general characteristics, history of flooding experiences, impact of flooding, flood types, and level of flood concern) with probable PTSD among different flood types in Thailand?

1.3 Research Objectives

General Objective

1. To determine the prevalence of probable PTSD among different flood types in Thailand.
2. To compare the prevalence of probable PTSD among different flood types in Thailand

Specific Objectives

1. To examine general characteristics, history of flooding experiences, the impact of flooding, and level of flood concern among different flood types in Thailand.
2. To compare general characteristics, history of flooding experiences, the impact of flooding, and level of flood concern of the studied population among different flood types in Thailand.
3. To determine the association between selected independent variables (general characteristics, history of flooding experiences, impact of flooding, flood types, and level of flood concern) with probable PTSD among different flood types in Thailand.

1.4 Research Hypotheses

1. Null Hypothesis:

   There is no difference between the prevalence of people identified as having probable PTSD between different flood types in Thailand.

   Alternate hypothesis:

   There is a difference in the prevalence of people identified as having probable PTSD between different flood types in Thailand.

1. Null Hypothesis:

   There is no association between general characteristics, history of flooding experiences, the impact of flooding, flood types, level of flood concern, and probable PTSD.

   Alternate hypothesis:

   There is an association between general characteristics, history of flooding experiences, the impact of flooding, flood types, level of flood concern, and probable PTSD.

1.5 Conceptual framework

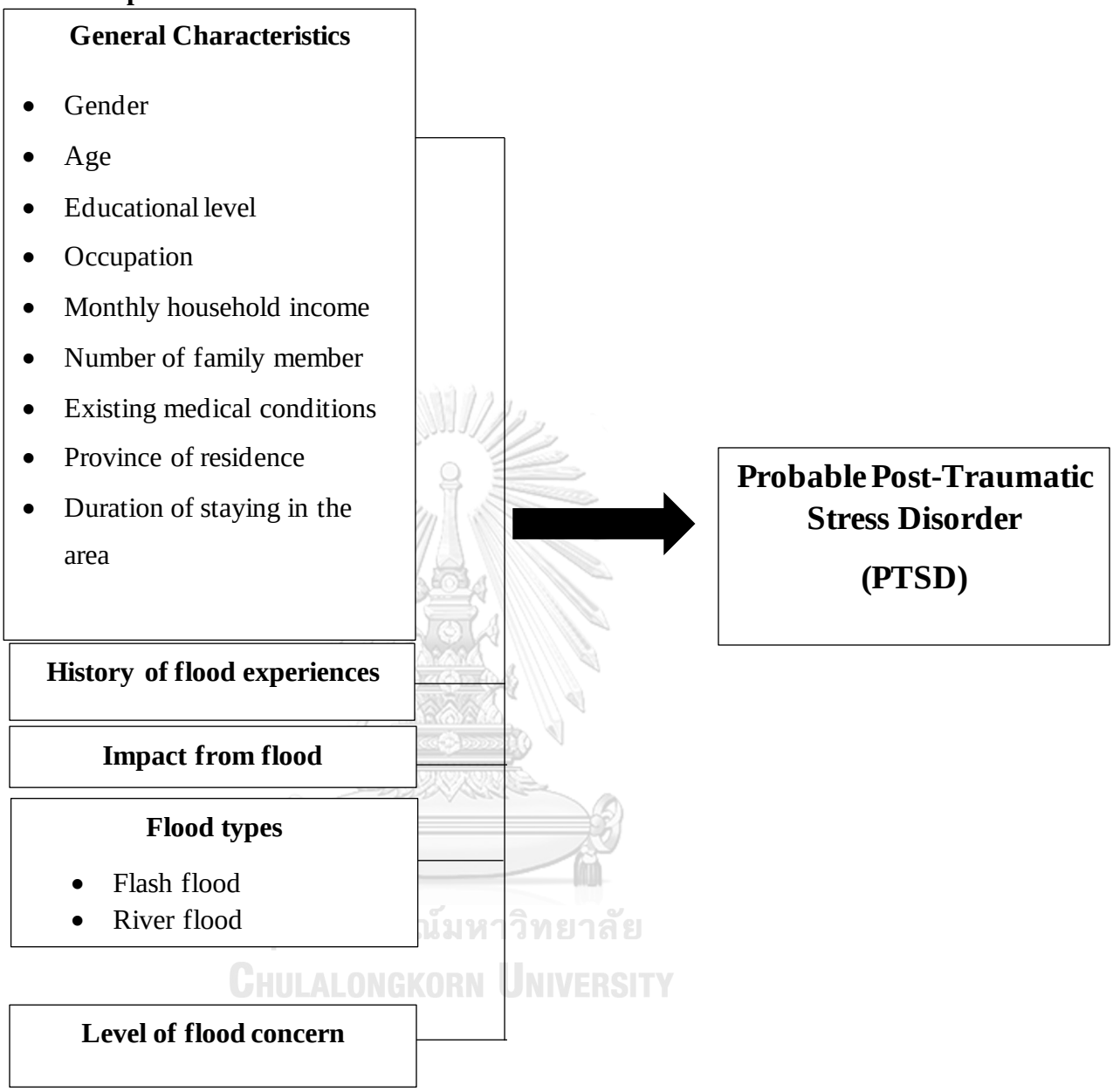

Figure 1 Conceptual framework

This conceptual framework shows the association among variables generated from research questions. The independent variables are general characteristics, history of flooding experiences, the impact of flooding, flood types, and level of flood concern.

1.6 Operational definitions

1. Gender refers to the gender of the respondent as male or female

2. Age refers to the respondent's age at the time of the interview.

3. Educational level refers to the highest educational level of the respondent at the time of the interview and is categorized into “Below primary education”, “Primary education”, “Secondary education”, “Vocational education”, and “Undergraduate and above”.

4. Occupation refers to the respondent's occupation at the time of the interview

5. Monthly household income refers to the monthly total gross income before taxes of all family members of the respondent’s household at the time of the interview.

6. Number of family members refers to the number of family members living together with the respondent at the time of the interview.

7. Existing medical conditions refer to the respondent's medical or health conditions at the time of the interview.

8. Housing ownership status refers to the ownership status of the house that the respondent lives in at the time of the interview, categorized into “Renting/Tenant”, “Owner”, or “others; please specify.”

9. The period of staying in the area refers to the years respondents lived in the study province at the time of the interview.

10. History of flood experiences refers to the frequency of flooding events the respondent had ever experienced in the past 10 years in the study province at the time of the interview.

11. Flood types are separated into two types in this study: flash floods and river flooding.

- Flash flood is a rapid rise of water height in a short time, normally from heavy or excessive rainfall.

- River floods caused by excessive runoff from longer-lasting rainstorms lead to a slower water-level rise over a larger area.
- Flood-prone provinces refer to Nakhon Sawan province and Nakhon Si Thammarat province, which are prone to floods. The two provinces have experienced numerous flooding events.
- Nakhon Sawan province is selected as a representative of "river flooding."
- Nakhon Si Thammarat province is selected as a representative of "flash flood."

13. Flood concern refers to the level of concern over flooding events, categorized into five levels "Extremely concerned", "Moderately concerned", "Somewhat concerned", "Slightly concerned", and "Not at all concerned."

14. Impact from flooding refers to the impact of flooding events that the respondent had ever experienced, both health and economic impacts from no impact to evacuation, loss of income, loss/impair of personal belongings, sickness, and death of family members.

15. Probable post-traumatic stress disorder (Probable PTSD) refers to the probability of the respondent having PTSD, which is screened by a set of five questions called "Primary Care PTSD (PC-PTSD-5)". Three "yes" answer or more is categorized as positive for probable PTSD.

CHAPTER II
LITERATURE REVIEW

Contents

- Flood definition and situation
- Study area
- Flood and health problems
- PTSD definition
- Prevalence of PTSD and factors in a flood situation.
- PTSD screening tools

2.1 Flood definition

A flood is a natural disaster from rising and overflowing large amounts of water coming to the area of dry low land. Flood-prone or floodplain area is land susceptible to inundation or submerging from any water source (Merriam-Webster, 2022). Thailand has had flood events annually. The source of flood can be heavy rainfalls, storms, or artificial water control structures. The cumulative flood events happen mainly in the central and the south. The total repeatedly flooded area is 26.7 million rai (42,800 km²). The most repeatedly flooded area is up to 8 – 10 times per 10 years. (Geo-Informatics and Space Technology Development Agency (Public Organization):GISTDA, 2022)

The flooding causes in Thailand are heavy rainfalls, low-pressure areas, storms, and monsoons. There are various characteristics of floods that are related to their environment. Flash flood is caused by continuous heavy rainfall in lowland near a mountain. The water erupts from the top of the mountain to the lowland nearby. The impact of flash floods can destroy the household or cause death. Drainage floods gradually increased flood levels from high to low places. The causes of drainage flood are blockage of water drainage. The impacts of drainage floods destroy agriculture and living areas. The fluvial or river flood happens when the stream level increases and

overflows into the shore or lower living area. The impact of a fluvial flood can be as exact as a drainage flood. (Meteorological Department)

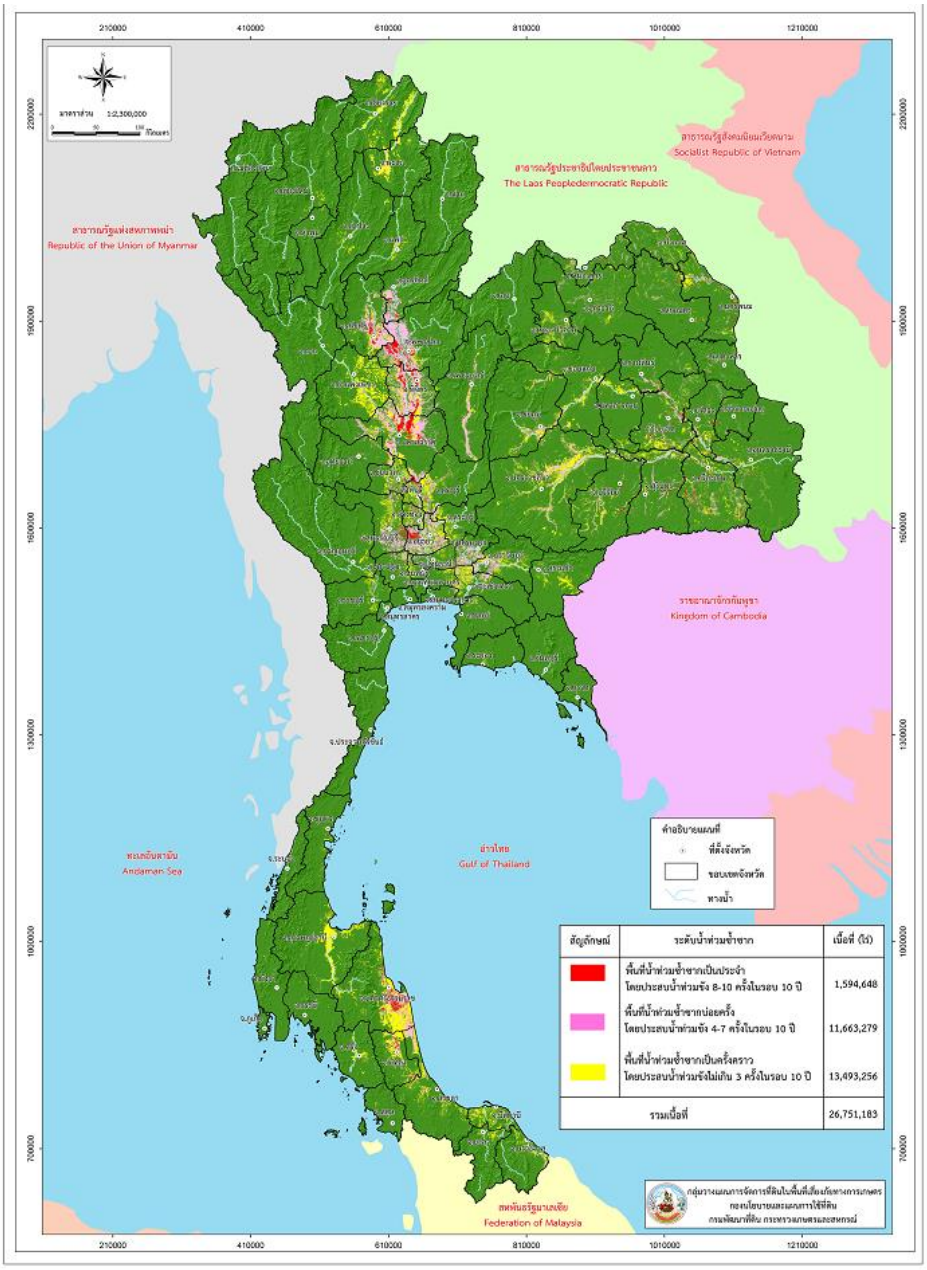

Figure 2 the repeatedly flooded areas in Thailand.

The red legend is the repeatedly flooded areas 8-10 times/10 years. The pink legend repeatedly flooded areas 4-7 times/10 years. The yellow legend is repeatedly flooded areas less than 3 times/10 years. translated from (Office of Natural Calamity and Agricultural Risk Prevention)

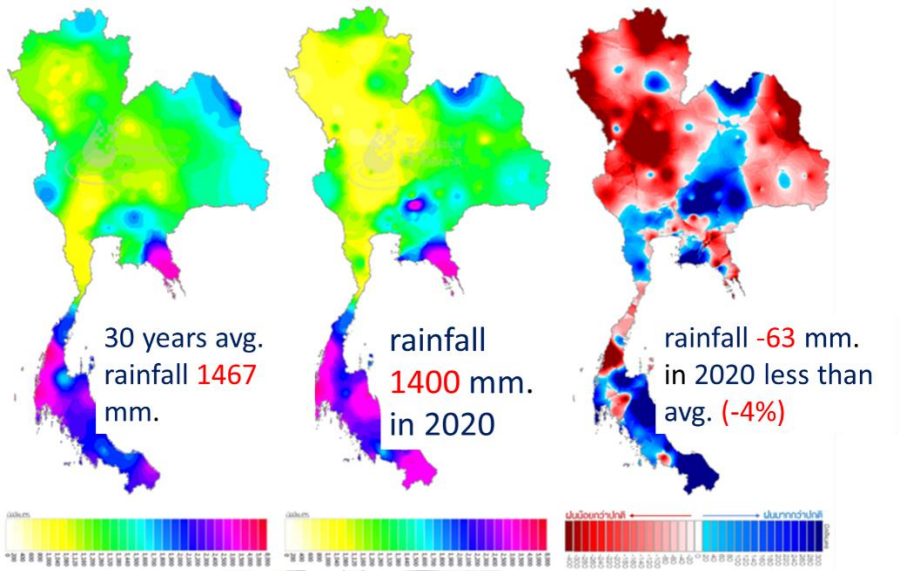

Figure 3 The level of rainfall distribution in Thailand
(National Hydroinformatics Institute, 2021)

From figure 3, the repeatedly flooded areas are in the lower north, central, the south of Thailand. There are heavy rainfalls in the south and the east of Thailand.

2.2 Study Area

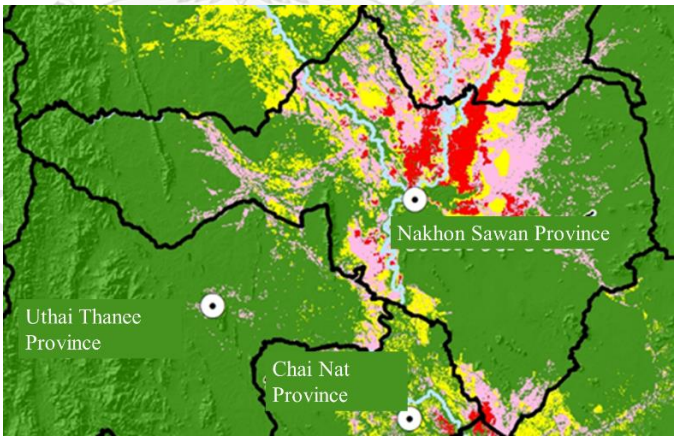

Figure 4 geographical and repeatedly flood areas of Nakhon Sawan Province.
(Office of Natural Calamity and Agricultural Risk Prevention)

Nakhon Sawan is the most repeated flood area in the north of Thailand. The area of the province is 9,597 km². Nakhon Sawan has three rivers flowing through it. Ping, Yom, and Nan Rivers originated from the Chao Phra Ya

River. The monsoon always starts raining from May to October. The cumulative rain over the years is 1,200mm. Nakhon Sawan province has 15 districts. The Mueng Nakhon Sawan, Chum Saeng, and Lat Yao are the most repeated flood districts. (Office of Natural Calamity and Agricultural Risk Prevention) Lat Yao and Chum Saeng districts are flooded susceptibility areas because the Lat Yao district is near to Ping River and Chum Saeng has Yom and Nan Rivers flowing through it. The areas in Chum Saeng district are 77.6% repeatedly flooded. The total repeatedly flooded area is 275,540 rai (440 km²). The area of repeated floods more than 8-10 times in 10 years is 61,042 rai (97.6 km²). The total flooded area for the Lat Yao district is 210,804 rai (337 km²). The area of repeated floods more than 8-10 times in 10 years is 5,948 rai (9.5 km²). The causes of repeated floods are low wet land, Pak Nam Pho peninsula, and drainage problems. So, the characteristics of a flood are fluvial and drainage floods.

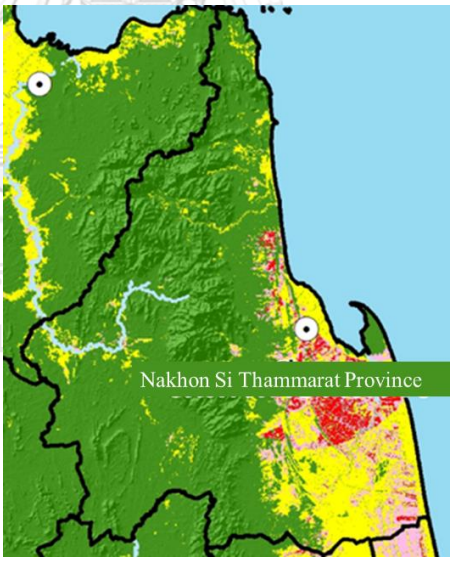

Figure 5 geographical and repeatedly flood areas of Nakhon Si Thammarat province

(Office of Natural Calamity and Agricultural Risk Prevention)

Nakhon Si Thammarat province is in the Southern part of Thailand and is frequently affected by many natural disasters, including floods. Therefore, the province is considered one of the flood-prone provinces in Thailand.

Nakhon Si Thammarat province has a total of 23 districts with differ in geographical characteristics. Nevertheless, two districts, namely Chian Yai district and Pak Phanang district, have always experienced and are prone to floods. Chian Yai district and Pak Phanang district are near the Pak Phanang river's catchment area and are prone to flooding during the monsoon (Wipulanusat et al., 2009). Once flood, the water level is around 30 to 40 centimetres high. Chian Yai district has a total area of 258 km². Pak Phanang district is considered among the top districts with the highest population, with about 32,173 registered households. (Pak Phanang Fangtawanok Sub District Administration Organization) The elongated peninsula, or "Talumphuk", an essential landmark of Nakhon Si Thammarat province, is also situated in this district. (Nakhonsithammarat Provincial office, 2552)For Chian Yai, the Total of repeatedly flooded areas is 190,884 rai (440 km²). The area of repeated floods more than 8-10 times in 10 years is 29,199 rai (97.6 km²). In comparison, Pak Phanang district has a total area of 459 km2 . The total repeatedly flooded area is 265,023 rai (440 km²). The area of repeated floods more than 8-10 times in 10 years is 80,805 rai (97.6 km²). (Office of Natural Calamity and Agricultural Risk Prevention)Therefore, data collected from three flood-prone communities in Chian Yai district and Pak Phanang district, Nakhon Si Thammarat province will be selected and used for the analysis in this study.

There are different types of floods between the two provinces: flash and fluvial floods. The cause of flash floods in Nakhon Sri Thammarat is heavy rainfalls, deforestation, expanded cultivated area, and mountain erosion. Moreover, the road is paved through the community, perpendicular to the waterline, making water hard to drain. (Khaenamkhaew et al., 2021) Lowland, heavy rainfall and inadequate water drainage also be factors of fluvial floods in Nakhon Sawan. (Anucharn & Thongjit, 2020)

2.3 Flood and health problems

The health problems from a flood are physical and mental effects. The physical effects are drowning and physical injury in the acute phase. Due to the loss of medication, people with chronic diseases can poorly control their symptoms. The disease can be exacerbated in this situation. Because of poor self-care and broken health infrastructure, the infections from the contaminated flood water are skin and gastrointestinal tract infections. The zoonoses from a flood are leptospirosis and dengue fever. The chances of diarrhoea, leptospirosis and dengue fever are higher in a flood situation. The other physical effects are infrastructure damage and asset loss. (Paterson et al., 2018)

The mental effects of the flood are stress, anxiety, depression, and posttraumatic stress disorder (PTSD). The chances of stress, anxiety, depression, and PTSD are increased in flood events compared to non-affected populations. (Fernandez et al., 2015) Stress is a human response that is helpful in fight-or-flight survival situations but may harm mental health in a flood situation. Flood velocity and high levels of water can be significant stressors. Providing accurate information, combining flood risk awareness and flood protection and preventive behaviour, establishing the ability to protect against harm, and learning from prior experiences are all important. (Foudi et al., 2017) Anxiety is related to increased levels of stress, sleep problems, trouble concentrating on daily tasks, nightmares, and mood changes.

Moreover, anxiety can increase alcohol use or sleep medication. (Cruz et al., 2020) People with flood experiences have a greater concern for future floods. People who lived in the riskiest areas or had a lower level of trust in local authorities also had higher risk awareness. (Scolobig et al., 2012)Depression is a mood of sadness. It can become a mental disorder if it persists all day and night for more than two weeks. The victims who have relationship problems with death, displacement, and the low socioeconomic group will have a chance of depression. (Cruz et al., 2020) There is no consensus on suicidal evidence from flood events, but suicidal screening

should be done routinely. (Fernandez et al., 2015) PTSD is directly related to a natural disaster. The chance of PTSD may be higher in a flood event. So, PTSD is interested in this study.

2.4 PTSD definition

The definition of PTSD comes from the Diagnostic and Statistical Manual of Mental Disorders (Fifth Edition) (DSM-5). Posttraumatic stress disorder (PTSD) is a mental disorder that occurs after experiencing or witnessing a traumatic event. PTSD is diagnosed following these criteria for more than 1 month. (Sadock, 2019)

A. Expose to a traumatic event directly or witness the traumatic event which happened to others. Learning that the traumatic event happened to others. The traumatic event must be violent or accident that causes actual or threatened death. Repeated exposure to aversive details of the traumatic event. These events cannot apply to media, medical conditions, or substance use.
B. Have at least one of the intrusion symptoms following the traumatic event. The intrusive symptoms are flashbacks, distressing dreams. dissociative symptoms, psychologic, or physiological reactions.
C. Have at least one avoidance of thought, people, places, activities, objects, and situations that remind distressing memories.
D. Have at least two negative moods or cognition after the traumatic event. distort memories, emotional blunting, anhedonia, detachment.
E. At least two arousal and reactivity changes are associated with the traumatic event like irritable behavior, hypervigilance, startle reaction, concentration problems, insomnia.

Although the diagnostic criteria are used for the clinical diagnosis of mental health disorders, the 4Ps and biopsychosocial models have been used to approach individual problems. The 4Ps are predisposing, precipitating, perpetuating, and protective factors. Predisposing factors are determinants that increase the risk of developing a presenting problem. These may include

genetics, life events, or temperament. Precipitating factors are specific events or triggers to the current symptoms' onset. e.g., relationship problems. Perpetuating factors are those that maintain the problem. e.g., financial problems, low education, or unemployment. Last, protective factors are strengths or skills that reduce the severity of problems and promote healthy and adaptive functioning. e.g., coping skills, social support, or good compliance with treatment. Engel first proposes the biopsychosocial model. The biological factors are genetics, medications, substance, and environment. Psychological factors are coping skills, personality traits, self-esteem, individual thoughts, feelings, and behaviour. Social factors are socioeconomic status, relationships, and spirituality. (Psychiatry DataBase, 2022)

PTSD symptoms can change over time and may be more severe during stress. If no therapy is given, the patient has a 30% chance of recovering. Furthermore, 40% still have mild symptoms, 20% have moderate symptoms, and 10% have severe symptoms. After a year, almost half of the patients will have recovered. (Sadock, 2019)

The predisposing factors of PTSD are childhood trauma, personality disorder, female, genetic, perception of being external control than can control themselves, and first-degree relatives with a history of depression. The precipitating factors are stressful events, severity, duration, and actual life-threatening trauma. The perpetuating factors are inadequate social support, low socioeconomic level, living alone, and too much alcohol drinking. The protective factors are rapid onset of the symptoms and short duration of the symptoms, which are less than 6 months. Moreover, good premorbid functioning, social support, and absence of prior psychiatric, medical, or substance-related disorders. (Sadock, 2019)

Treatments of PTSD are medical treatment, psychotherapy, and psychosocial support. Psychotherapies are crisis intervention, individual psychodynamic psychotherapy, or trauma-focus cognitive behavioural therapy may be helpful. (Sadock, 2019)

PTSD patients always have comorbidities. The common comorbidities in PTSD are anxiety, bipolar, depression, or substance use disorder. These comorbidities should be screened in all PTSD patients. Primary care's role in screening and referring patients to mental health treatment care. The mental health screening tools in primary care in Thailand are depression (2Q, 9Q) and stress (ST-5). (Department of Mental Health, 2020) There have no PTSD screening used in primary care. The mental health issue was accessed by Mental Health Crisis Assessment and Treatment Team (MCATT) when the situation was resolved. The MCATT team includes the multidisciplinary team and village health volunteers. The multidisciplinary team includes psychiatrists, doctors, psychologists, social workers, and psychologic post-graduated nurses.

The roles of MCATT teams are mental health problems screening and psychological first aid (PFA) to the victims. The mental health screening tools used in a crisis are 2Q, 9Q, 2P, PICES-10, and the visual analogue scale. The victims will be quickly evaluated with a visual analogue scale, 2Q, and number 9 question of 9Q. If they have stress, a sign of depression, or suicidal ideas, the victims will be evaluated with 9Q Next, and they will be evaluated with 2P for PTSD. If the result is positive, they will be evaluated with PICES-10. Last, the victims will be sent to the counsellor for psychological first aid. (Bureau of mental health service administration, 2018)

1. No stress 2. Mild 3. Moderate 4. High 5. Highest
if a score ≥ 4 means a high-risk group

Figure 6 example of visual analogue scale
(Bureau of mental health service administration, 2018)

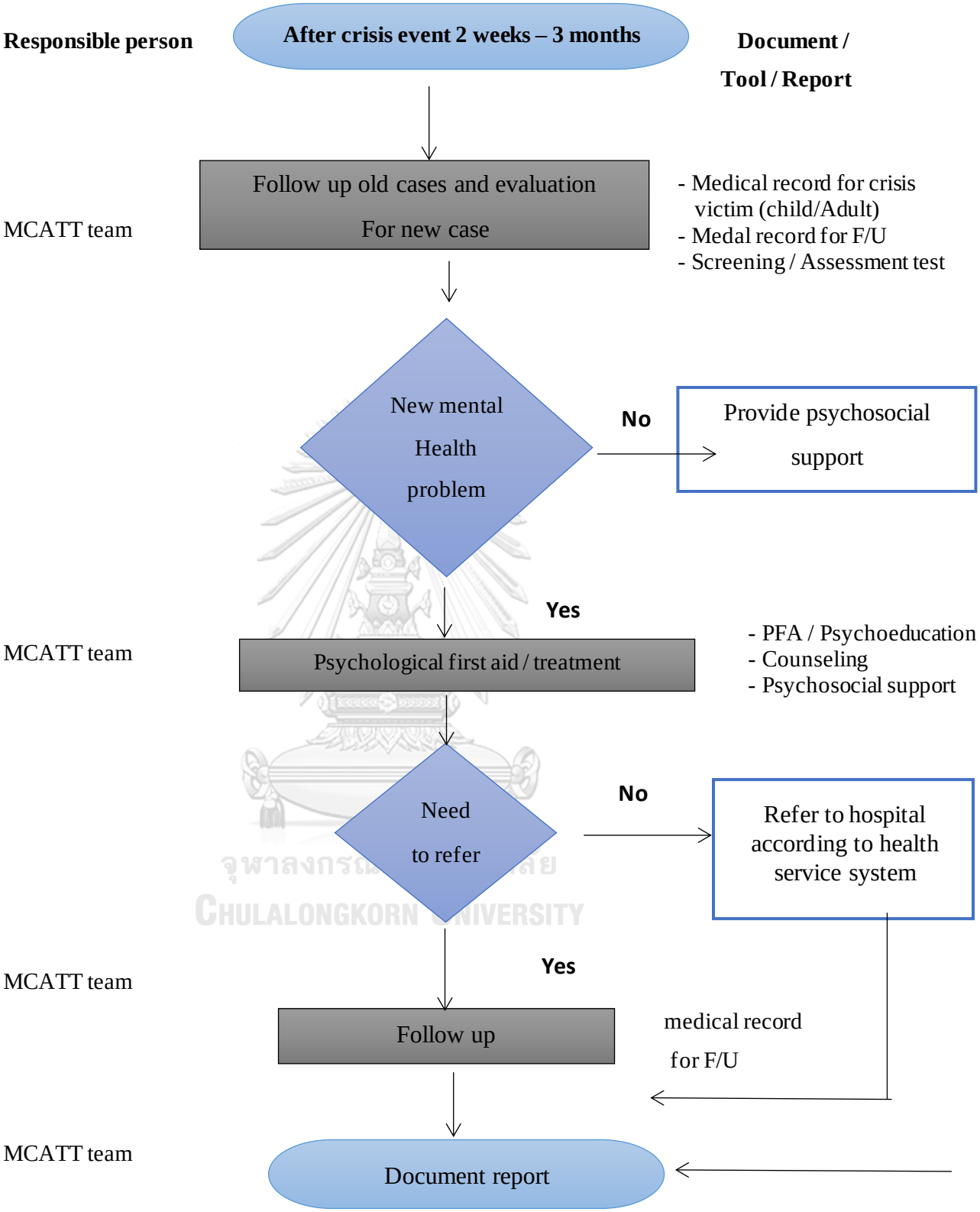

Figure 7 flow chart for MCATT team operations 2 weeks after the crisis.
translated from (Bureau of mental health service administration, 2018)

2.5 Prevalence of PTSD from flood and associated factors.

The lifetime prevalence of PTSD is 6.8%, 9.7 % in women and 3.6 % in men. (Sadock, 2019) There are studies of flood situations in the UK and China. These countries had experienced large flood events. (Dai et al., 2017) (Mulchandani et al., 2020) From meta-analysis, the incidence of PTSD was 15.74%. The incidence of PTSD was higher at moderate to severe flood levels. The incidence of PTSD was lower after 6 months. (Chen & Liu, 2015) Since the Dongting lake flood in China in 2003, the prevalence of PTSD after 13-14 years is 19.4%. The associated factors are lost relatives, physical injury, lower level of social support, or negative coping style. (Dai et al., 2016) The prevalence of mental health problems in the study from India is PTSD 26.9%, anxiety 27.4%, and depression 45.29%. In 2015, the UK experienced heavy rainfalls that made many areas flood. The study of mental health problems and quality of life post-6-month flood impacted the quality of life and mental health. The 6-month prevalence of anxiety, depression, and PTSD are 4.16%, 7.7%, and 14.41%. (French et al., 2019) The cohort study had a 3-year follow-up in 2015. In the flooded group, we observed a significant reduction in prevalence across all three probable mental health outcomes: depression (year one 20.8%, year two 11.2%, year three 7.8%, $p = 0.0014$), anxiety (year one 27.6%, year two 12.3%, year three 11.8%, $p < 0.001$) and PTSD (year one 33.2%, year two 24.9%, year three 17.1%, $p = 0.001$). (Mulchandani et al., 2019) From systematic reviews of the flood situation in the UK, the point prevalence was 19.8% for anxiety, 21.35% for depression, and 30.36% for PTSD. In 2011, Thailand faced severe floods in many regions. The study was done in Nakhon Si Thammarat, which affected a large flood area in the south of Thailand. The prevalence of PTSD from the flood is 44.48 %, using GHQ-12 plus R. The probable depression and psychological distress prevalence is 31.29% and 29.45%. (Sonpaveerawong et al., 2017)

The factors that affected mental ill-health in people exposed to flooding were female, water depth, low income, minor ethnicity, lack of post-flood support, displacement, and absence of flood warnings. (Cruz et al., 2020) while the secondary stressor of mental health problems is the loss of sentimental items and concern about health problems. (Tempest et al., 2017) The elderly have more chance of PTSD and

anxiety than other age groups. The people exposed to flash floods have more chance of having PTSD than those who experienced fluvial floods. Depression was found more in low socio-economic groups but did not find any increased chance of suicidal ideation. (Bandla et al., 2019)

There is no consensus on age and gender associated with PTSD. Loss of jobs or income might be increased mental health problems (Fernandez et al., 2015). Compared to individuals who live in rented housing, homeownership as an indication of income was associated with lower levels of poor mental health. Those with lower income levels, who were jobless or economically inactive, and those with past medical issues were more likely to have their psychological health deteriorate after being exposed to floods. (Cruz et al., 2020) The associated factors are age, lack of social support, physical health problems, and injuries from the flood event in Nakhon Si Thammarat. Protective factors are female, fewer health problems, and more social support (Sonpaveerawong et al., 2017)

The flood prevention plans are city planning, mapping NCD patients, stocking more medical suppliers at hospitals and evacuation centres, and creating an information network among stakeholders. (Ayuwat et al., 2016) Moreover, creating leadership, practising evacuation plans, and creating hubs for treatment and evacuation should be included. Telemedicine and healthcare team visits can be beneficial during a flood situation. (Paterson et al., 2018) In Thailand, people who have experienced flood events are always used to nonstructural measures. The measures are planning and response measures. The planning measures are forecasting, control of floodplain development, and catchment management. The response measures include flood fighting training, warning, evacuation, emergency assistance, and relief. Due to the uncertainty of flood events, structural flood prevention maybe not be cost-effective for investment. The people in the flood-prone area are less likely to awareness of flood events. The flood prevention and response measures do not mention mental health assessment and first aid. Chronic illness patients in flood-prone areas are vulnerable to worsening disease or relapse due to the shortage of medical supplies and are unprepared to flood events. (Saneha et al., 2015)

2.6 PTSD screening tools

Table 1 screening tools for PTSD in Thailand and PC-PTSD - 5

Name	Number of items	Psychometric properties	Professional use
Primary Care PTSD Screen for DSM-5 (PC-PTSD-5)	5	sensitivity 78% specificity 91% (Bovin et al., 2021)	No
PTSD screening test (2P) Thai version	2	sensitivity 87.2% , specificity 89.1% , positive predictive valve (PPV) 44.2% , negative predictive value (NPV) 98.6% , positive likelihood ratio (LR+) 8.0, negative likelihood ratio (LR-) 0.14 (Bureau of mental health service administration, 2018)	Yes
The Psychological Impact Scale for Crisis Events – 10 (PISCES-10) Thai version	10	Cronbach's alpha 0.9 (Boonyamalik et al., 2009)	Yes
Posttraumatic stress disorder checklist (PCL) Thai version	17	IOC > 0.5 Cronbach's alpha 0.961 (Chawanakrasaesin et al., 2011)	Yes
Clinician-Administered PTSD Scale for DSM-5 (CAPS-5) Thai version	30	Cronbach's alpha 0.903 intraclass correlation coefficients 0.87 inter-item correlation 0.302 (Tantirangsi)	Yes

From table 1, most PTSD screening tools are used in professional fields. PC –PTSD 5 is the tool for PTSD screening in a community setting. The benefits of PC-PTSD 5 are low numbers of questionnaires and a higher rate of detection of PTSD.

In the past month, have you ...

1. had nightmares about the event(s) or thought about the event(s) when you did not want to?	YES	NO
2. tried hard not to think about the event(s) or went out of your way to avoid situations that reminded you of the event(s)?	YES	NO
3. been constantly on guard, watchful, or easily startled?	YES	NO
4. felt numb or detached from people, activities, or your surroundings?	YES	NO
5. felt guilty or unable to stop blaming yourself of others for the event(s) or any problems the events may have caused?	YES	NO
Total score is sum of "YES" responses in items 1-5.	**TOTAL SCORE**	

PC-PTSD-5 (2015) National Center for PTSD

Figure 8 example of the PC-PTSD-5 questionnaire.
("The Primary Care PTSD Screen for DSM-5 (PC-PTSD-5)," 2015)

2.7 Pro and Con of PC-PTSD-5 questionnaire

Pros of the PC-PTSD-5 questionnaire consist of a few numbers of questions and have a higher rate of detection of probable PTSD. Cons of PC-PTSD-5 require clinical diagnosis and might have recall bias from subjects.

In summary, a flood is a natural disaster from rising and overflowing large amounts of water to an area of dry low land. Flood-prone or floodplain area is land susceptible to inundation or submerging from any water source (Merriam-Webster, 2022). Thailand has had flood events annually. The cumulative flood events happen mainly in the central and the south. The total repeatedly flooded area is 26.7 million rai (42,800 km^2). The most repeatedly flooded area is up to 8 – 10 times per 10 years. (Geo-Informatics and Space Technology Development Agency (Public Organization):GISTDA, 2022) Nakhon Sawan and Nakhon Si Thammarat are the high susceptibilities to repeated flood areas. These provinces have different types of floods. PTSD is a mental disorder related to directed or witnessing traumatic events. The prevalence of posttraumatic stress disorder from experienced flood situations is varied from 14.94% to 44.48%. Associated factors are physical injury, lack of social support, underlying diseases before a flood event, financial problems, and displacement from own places. PTSD screening tools are primarily used in professional fields. PC –PTSD 5 is the tool for PTSD screening in a community

setting. This screening tool has high clinical diagnostic accuracy and good psychometric properties, which can detect more PTSD patients. The higher numbers of detection increase accessibility to care and reduce the cost of undetected PTSD patients. (Bovin et al., 2021).

CHAPTER III
METHODOLOGY

3.1 Research Design

This study was a secondary data analysis using primary data collected from a cross-sectional survey titled "AN ACTION PLAN FOR HEALTH RELIEF MEASURES FROM WATER UTILIZATION DURING FLOOD THROUGH A MULTIDISCIPLINARY APPROACH", which was carried out in 2019 among flood-prone provinces affected by different flood types in Thailand. In the original cross-sectional study, a face-to-face interview using a structured questionnaire was performed to collect the data. The interview was done from the health-promoting hospital by public health volunteers and/or trained research assistants.

In this study, two flood-prone provinces, Nakhon Sawan province and Nakhon Si Thammarat province, were selected from the original cross-sectional survey according to the nature of the flood type (river flood or flash flood) the province frequently experienced. The data extracted were general characteristics (such as gender, age, educational level, occupation, monthly household income, number of family members, underlying disease, and duration of staying in the area), history of flood experiences, level of flood concern, Impact from flooding, and probable PTSD.

For this study, the secondary data were cleaned and coded onto SPSS software to determine and compare the prevalence of probable PTSD among the two selected flood types (river flood or flash flood) in Thailand and the associated factors of having positive probable PTSD.

3.2 Study Area

The secondary data from the original cross-sectional survey were used in this study. All information was retrieved from two selected flood-prone provinces (Nakhon Sawan province and Nakhon Si Thammarat province) in Thailand to represent different flood types (Figure 9). Nakhon Sawan province was selected as a representative for "River flood". The province is in the upper central part of Thailand. The area of the province is 9,597 km2. Nakhon Sawan has three rivers flowing

through it. Ping, Yom, and Nan Rivers originated from the Chao Phra Ya River. Lat Yao and Chum Saeng districts are flooded susceptibility areas. The Lat Yao district is near the Ping River. Chum Saeng has Yom and Nan Rivers flowing through it. Chum Saeng district is a repeatedly flooded area. (Anucharn & Thongjit, 2020). For Nakhon Sawan province, the data collected from four flood-prone communities in Lat Yao District and Chum Saeng District were used for the secondary analysis in this study (Figure 9).

Nakhon Si Thammarat province was selected as a representative for "Flash flood", The province is in the Southern part of Thailand and is frequently affected by many natural disasters, including floods. Therefore, the province is considered one of the flood-prone provinces in Thailand. Nakhon Si Thammarat province has a total of 23 districts with significantly differ in geographical characteristics. Nevertheless, Chian Yai district and Pak Phanang district have always experienced and are prone to floods (Figure 9). Chian Yai district and Pak Phanang district are near the Pak Phanang river's catchment area and prone to flooding during the monsoon. (Wipulanusat et al., 2009) Once flood, the water level is around 30 to 40 centimetres high. Chian Yai district has a total area of 258 km², whereas Pak Phanang district has a total area of 459 km2. Pak Phanang district is considered among the top districts with the highest population, with about 32,173 registered households (Pak Phanang Fangtawanok Sub District Administration Organization). The elongated peninsula, or "Talumphuk", an essential landmark of Nakhon Si Thammarat province, is also situated in this district. (Nakhonsithammarat Provincial office, 2552). Therefore, data collected from three flood-prone communities in Chian Yai district and Pak Phanang district, Nakhon Si Thammarat province, were selected and used for the secondary analysis in this study.

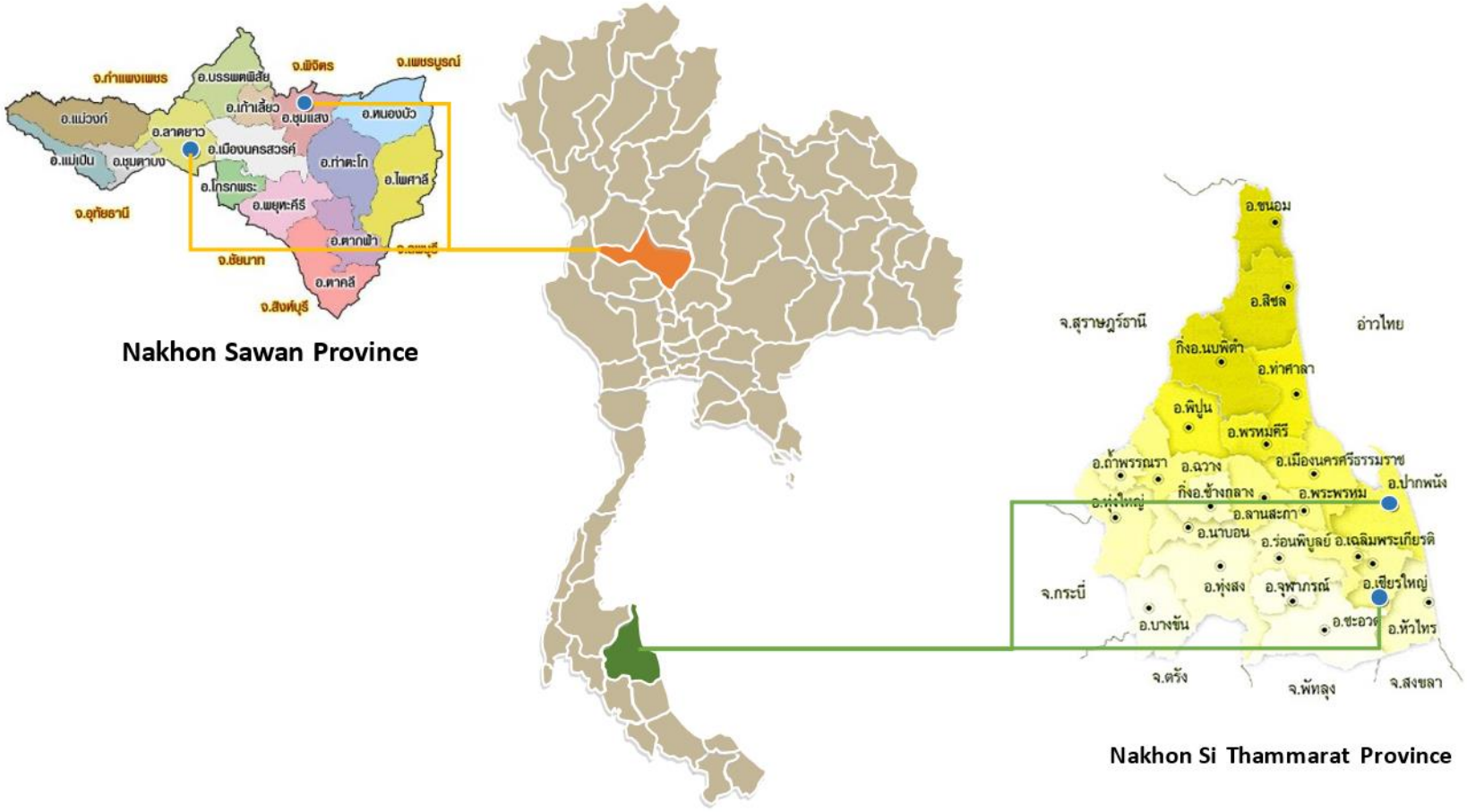

Figure 9 Study area

3.3 Study Population

The study population from the original cross-sectional survey was the households that had ever experienced floods, which were located in Chian Yai district and Pak Phanang district in Nakhon Si Thammarat province, and Lat Yao district and Chum Saeng district in Nakhon Sawan province. The questionnaire was administered to the head of the household. If the head of the household were not available for an interview, any volunteer member in the family would be asked to fill in the interview. The list below was the criteria for recruiting the study population in the original cross-sectional survey.

Selection criteria for the cross-sectional study:

Inclusion Criteria

- A household member who lived in Lat Yao district and Chum Saeng district in Nakhon Sawan province, Thailand, at the time of the interview during 2019-2020
- A household member who lived in Chian Yai district and Pak Phanang district in Nakhon Si Thammarat province, Thailand, at the time of the interview during 2019-2020
- Had previously experienced flooding in the mentioned area before the time of the interview during 2019-2020
- 18 years old and above at the time of the interview during 2019-2020
- Able to communicate in Thai

Exclusion criteria

- Not willing to participate in this study

For this secondary analysis, incomplete and/or missing data collected in the primary data were excluded from the secondary analysis.

3.4 Sample Size

For this secondary data analysis, all questionnaires were screened and checked for any incompleteness of the data required for analyses of this study. Only the participants with completed data from the survey were included in the analysis.

After screening for incompleteness, the subsample used in this secondary data analysis comprised 752 participants.

In detail, there were 376 participants with complete data from both flood types from each selected province.

Here we also provided the sample size obtained from ***the original cross-sectional study per one province***, which was calculated using the formula according to Taro Yamane (Yamane, 1967) with a 95% confidence level. The formula was presented as follows:

The estimated sample size was calculated from the following formula.

$n = Z^2_{\alpha/2} P(1-P)/d^2$

n= the estimated sample size

α= 0.05 (the level of statistical significance)

$Z^2_{\alpha/2}$= the value from normal distribution associated with confidence interval (1.96 with 95% confidence interval)

P = 0.44 (maximum number of prevalence is used in this study from (Sonpaveerawong et al., 2017)

d =0.05 (the value of maximum allowable error or desired precision)

$n = (1.96)^2 \times 0.44 \times (1-0.44)/(0.05)^2$

$= 378.62$

Therefore, the minimum sample size of **the original cross-sectional study** was about 379 respondents in a single province.

3.5 Sampling Technique

In the original cross-sectional study from provinces in Thailand, Nakhon Sawan province was selected as a representative of a flood-prone province in the Northern part of Thailand, while Nakhon Si Thammarat province was selected as a representative of the flood-prone province in the Southern part of Thailand. The two provinces were purposively selected through an expert meeting considering flood types, flooding frequency, and previous impacts from floods. Furthermore, purposive sampling and simple random sampling were used. The expert review was conducted among fifteen experts specialising in flooding events and the research team. Five flood-prone communities were further selected from each province. These communities have experienced flooding every year. Then two districts from each selected province were also purposively selected from the history of flooding events and how prone are the communities in the districts to floods. Lat Yao district and Chum Saeng district were selected for Nakhon Sawan province. Chain Yai district and Pak Phanang district were selected for Nakhon Si Thammarat province. Later, flood-prone communities from those districts were also selected. After, a convenience sampling or a random-walk sampling technique (Wei et al., 2004) was applied to the selected flood-prone communities. In this study, the health-promoting hospital or primary healthcare centre of sub-districts was selected as a place for an interview or the starting location for a random walk sampling. A survey director was determined by spinning a pen for a random-walk sampling. The direction with the pen cap pointing was the selected direction for the survey. The closest household to the primary healthcare centre in the survey direction was selected for the first interview. The head of the household, who fit the study criteria, was asked to consent to participate in the interview. If the head of the household were not available, any volunteer member in the family would be asked to fill in the interview. After the first household, the next household was selected for the second interview and the next nearest until the targeted sample size was reached.

For this secondary data analysis, the questionnaires were screened and only the complete data required for this study were chosen. Finally, it was found that 752

questionnaires (participants) were completed for secondary data analysis, 376 participants from each flood type (Figure 10).

3.6 Study Period

The secondary data analysis was conducted from June to July 2022.

3.7 Measurement Tools

3.7.1 Measurement tool

The question items were selected from the structured questionnaire used in the original cross-sectional study. There were five selected parts for this secondary data analysis listed below:

Part 1: General characteristics

There were 10 questions as follows:

1. Gender
2. Age
3. Educational level
4. Occupation
5. Household monthly income
6. Number of family members
7. Existing medical conditions
8. Housing ownership status
9. Province of residence (For an indication of different flood types; Nakhon Sawan province as River flood, and Nakhon Si Thammarat province as Flash flood)
10. Duration of staying in the area

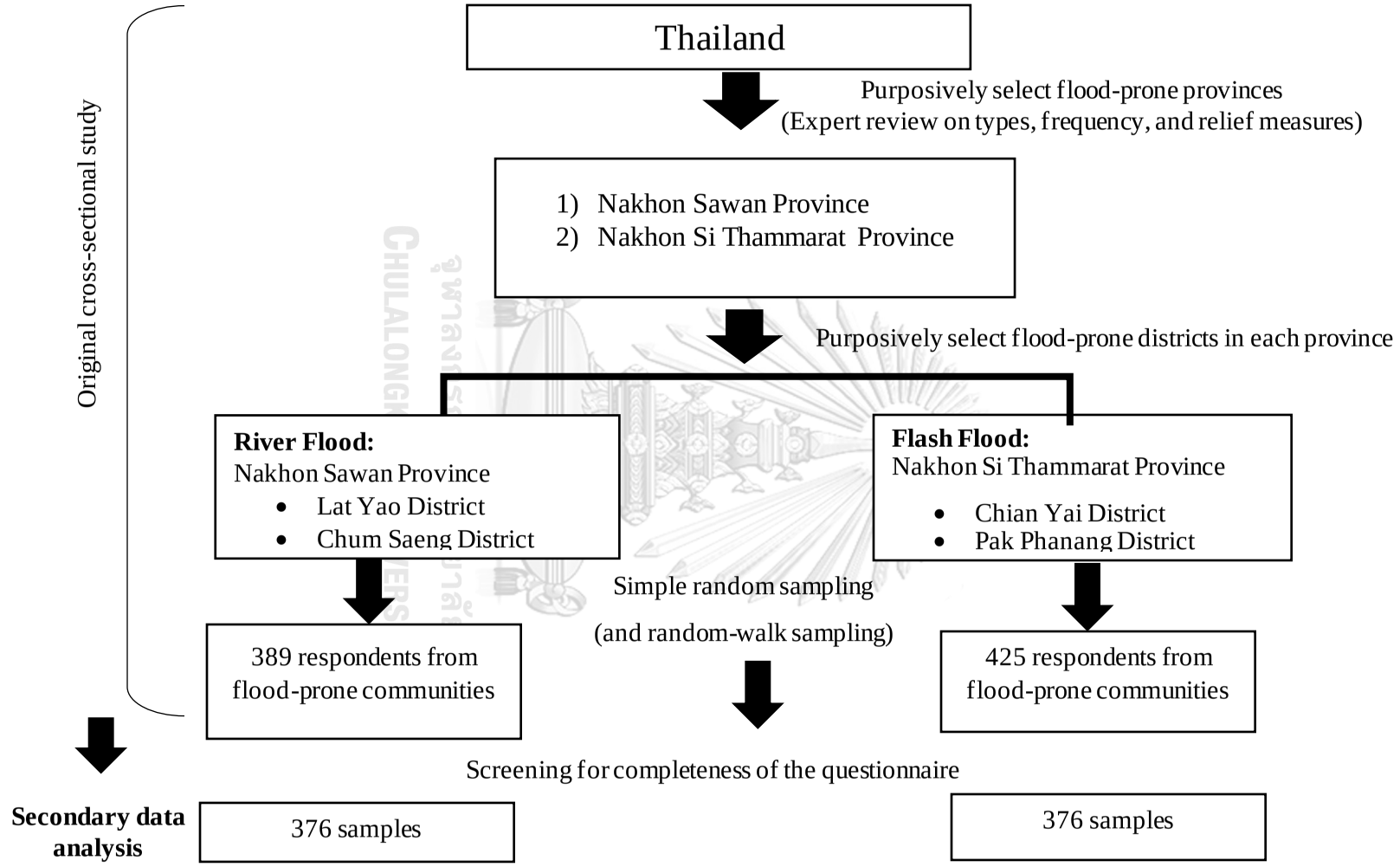

Figure 10 Sampling frame

Part 2: History of flooding experiences

There was a question on the number of times the respondent has experienced floods in the study area.

Part 3: Impact of flooding

There was a question on what kind of impact from floods the respondent experienced.

Part 4: Level of flood concern

There was a question on the level of flood concern indicated by five-level on the Likert scale as “Extremely concerned”, “Moderately concerned”, “Somewhat concerned”, “Slightly concerned”, and “Not at all concerned”.

Part 5: Flood types

The location of the respondents was screened to determine the type of flood they experienced. Nakhon Si Thammarat province respondents are categorized as experiencing “flash floods”. On the other hand, respondents from Nakhon Sawan province are selected to represent “river floods”. This part is determined from question 9 (Province of residence) in general characteristics.

Part 6: PC-PTSD-5

There was a set of five questions from a PC-PTSD-5. The score ranges from 0-5 points. The standard cut-off of the score equal to 3 or more is classified as a positive probable PTSD or implies that the respondent has a probable to have PTSD.

3.7.2 Validity and Reliability

Three experts were asked to evaluate the validity of the questionnaire. The Item Objective Congruence (IOC) Index was equal to or more than 0.7 for all items in the questionnaire. The pilot test of the questionnaire was done on 30 persons to test for reliability. The Cronbach’s alpha value of the questionnaire was 0.8.

3.8 Data collection

In the original cross-sectional study, data were collected through face-to-face interviews conducted by primary healthcare officers or trained researchers at the health-promoting hospitals/primary healthcare centres. In a secondary analysis, data were screened, cleaned, and coded using Excel and imported to IBM SPSS Statistics for Windows, version 28 (IBM Corp., Armonk, N.Y., USA) for further data analyses.

3.9 Data analysis

Statistical Analysis

After all, data were cleaned and coded. Analyses were conducted using IBM SPSS Statistics for Windows, version 28 (IBM Corp., Armonk, N.Y., USA).

For descriptive statistics, categorical data were presented as frequency and percentage.

A Chi-square test of homogeneity was performed to determine the difference in the probable PTSD (Yes/No) among two different flood types (flash and river floods) with an alpha level <0.05 considered as statistical significance. Fisher's exact test was used when more than 20% of cells have expected frequencies of less than 5.

A Chi-square test was performed to examine the association between general characteristics, history of flooding experiences, the impact of flooding, level of flood concern with "having probable PTSD" among all respondents, river flood, and flash flood. An alpha level <0.2 was considered statistically significant (Hosmer, 2013). Multiple logistic regression was conducted to determine associated risk factors of "having probable PTSD" in all respondents, in river floods and flash floods, with an alpha level <0.05 considered statistical significance. Adjusted odd ratios and 95% confidence intervals were reported.

3.10 Ethical consideration

Ethical approval had been approved for the cross-sectional study by the Ethics Review Committee of Chulalongkorn University (COA NO. 148/2563).

All participants were given an information sheet about the study, agreed to participate, and informed consent.

Before conducting the analyses, the secondary data analysis was approved for an ethical exemption from the Ethics Review Committee of Chulalongkorn University (COA. No.118/65). In addition, no personal information was included in the secondary data analysis to prevent the leaking of the participant's information. Therefore, the number code was assigned to each participant instead.

Chapter 4
Results

This study was a secondary data analysis using data collected from a cross-sectional study under the title "AN ACTION PLAN FOR HEALTH RELIEF MEASURES FROM WATER UTILIZATION DURING FLOOD THROUGH A MULTIDISCIPLINARY APPROACH", which was carried out in 2019 among flood-prone provinces affected by different flood types in Thailand. The main objectives of this study were 1) to examine the prevalence of probable PTSD using PC-PTSD-5 as a screening tool; 2) to compare the difference in the proportion of people who were identified as having probable PTSD among different flood types in Thailand, and 3) to find the associated factors of probable PTSD of different flood types.

The study population consisted of the representative households that had previously experienced different flood types represented by Nakhon Si Thammarat province (Flash flood) and Nakhon Sawan province (River flood) in Thailand.

This chapter consisted of the following results:

- **Part 1:** Comparison between general characteristics of the participants between flood types
- **Part 2:**
    - Prevalence of probable PTSD between different flood types (river flood and flash flood)
    - The impact of floods and level of flood concerns between flood types
- **Part 3:** Associated factors between the studied independent variables and probable PTSD (Yes/No) among different flood types
- **Part 4:** Associated risk factors of probable PTSD among different flood types.

4.1 Comparison between general characteristics of the participants between flood types

Table 2 shows the general characteristics of the participant from two flood types represented by two flood-prone provinces, namely Nakhon Si Thammarat for "Flash flood" and Nakhon Sawan province for "River flood". The age ranges of the participants were from 18 to 98 years old. The majority of participants were women aged more than 50 years with a primary school education level. Most participants have less than minimum wage (300 Thai Baht) daily. In addition, 40% of Nakhon Si Thammarat participants lived in the affected area for less than 30 years and faced more flood events than Nakhon Sawan samples. This analysis shows that Nakhon Si Thammarat province participants tend to have more family members than in Nakhon Sawan province.

A comparison of the general characteristics of the participants from two flood types shows that the participants were significant differences in their occupation (p-value <0.001), monthly income (p-value = 0.002), years of living in the affected area (p-value = 0.001), number of flood events experienced within 10 years (p-value <0.001), and number of the family member (p-value <0.001) (Table 2).

Table 2 Comparison of general characteristics of the participants between flood types in the study (n=752)

Characteristic	Flood type		P - value
	River flood n (%)	Flash flood n (%)	
Gender			
- Male	133 (35.4)	119 (31.6)	0.279
- Female	243 (64.6)	257 (68.4)	
Age (years)			
- ≤ 30	13 (3.46)	16 (4.26)	0.171
- 31 – 40	28 (7.45)	42 (11.17)	
- 41 – 50	63 (16.76)	76 (20.21)	
- 51 – 60	109 (28.99)	103 (27.39)	
- ≥ 61	163 (43.35)	139 (36.97)	
Education			
- Lower than primary school	28 (7.4)	37 (9.8)	0.66
- Primary school	237 (63.0)	249 (66.2)	
- High school	72 (19.1)	71 (18.9)	
- Vocational education	15 (4.0)	9 (2.4)	
- Bachelor's degree and above	24 (6.4)	10 (2.7)	
Occupation			
- Agriculture	147 (39.1)	76 (20.2)	<0.001*
- Merchant	48 (12.8)	57 (15.2)	
- Freelance	72 (19.1)	64 (17.0)	
- Housewife	52 (13.8)	58 (15.4)	
- NGO workers'	3 (0.8)	1 (0.3)	
- Government workers'	13 (3.5)	5 (1.3)	
- Unemployed	31 (8.2)	40 (10.6)	
- Others	10 (2.7)	75 (19.9)	
Monthly income			
- ≤3000	82 (21.8)	105 (27.9)	0.002*
- 3001 – 6000	105 (27.9)	130 (34.6)	
- 6001 – 9000	91 (24.2)	53 (14.1)	
- 9001 – 12000	49 (13.0)	40 (10.6)	
- ≥12001	49 (13.0)	48 (12.8)	
Underlying disease			
- Yes	183 (48.7)	175 (46.5)	0.609
- No	193 (51.3)	201 (53.5)	

*Statistically significant difference (p-value <0.05)

Table 2 Comparison of general characteristics of the participants between flood types in the study (n=752) (cont.)

Characteristic	Flood type		P - value
	River flood n (%)	Flash flood n (%)	
Years of living in affected area	118 (31.4)	151 (40.2)	0.001*
- ≤ 30	46 (12.2)	68 (18.1)	
- 31 – 40	63 (16.8)	55 (14.6)	
- 41 – 50	65 (17.3)	51 (13.6)	
- 51 – 60	84 (22.3)	51(13.6)	
- ≥ 61			
Number of flood events experienced within 10 years			
- 1 time	101 (26.9)	18 (4.8)	<0.001*
- 3 – 5 times	237 (63.0)	127 (33.8)	
- 5 – 10 times	28 (7.4)	211 (56.1)	
- 11- 15 times	10 (2.7)	19 (5.1)	
- > 15 times	0	1 (0.3)	
Number of family members			
- 1	51 (13.6)	26 (6.9)	<0.001*
- 2	99 (26.3)	61 (16.2)	
- 3	89 (23.7)	87 (23.1)	
- 4	81 (21.5)	83 (22.1)	
- ≥ 5	56 (14.9)	119 (31.6)	

*Statistically significant difference (p-value <0.05)

4.2 Comparison of the impact of floods, level of flood concern, and prevalence of probable PTSD between flood types

Table 3-5 presents the comparison results of the impact of floods, level of flood concern, and prevalence of probable PTSD between flood types.

Table 3 shows that some of the impacts from floods, namely financial impact, migration, destroyed personal assets, Sick with no treatment needed, deaths of family members and others, were significantly different among the participants from river flood province (Nakhon Sawan) and flash flood (Nakhon Si Thammarat) province. In addition, those who responded with no impact from flooding events were significantly different between the two flood types. Nevertheless, both flood types were dominated by financial impacts and destroyed personal assets.

The majority of participants who experienced **river floods had only somewhat concern** about flooding events, while the majority of participants who experienced **flash floods had moderately to extremely flood concerns** (Table 4). The comparison in Table 4 indicates a significant difference in the level of flood concerns between the respondents experiencing river floods and flash floods in this study.

From a total of 752 participants, who had experienced different flood types in from Nakhon Sawan and Nakhon Si Thammarat provinces, 95 participants (12.6 %) were screened positive for having probable PTSD. Among them, **19 participants were from Nakhon Si Thammarat province, which experienced a flash flood**. **In contrast, 76 participants were from Nakhon Sawan province, which experienced a river flood** (Table 5). Further comparison of the prevalence of probable PTSD between the two flood types revealed that river floods showed significantly higher

flood victims with probable PTSD than flash floods (Table 5). In addition, it was found that respondents who experienced river floods also had higher scores of PC-PTSD-5, as shown in Table 6.

Table 3 Comparison of the impact of floods between flood types

Impact	Flood types		P - value
	River flood n (%)	Flash flood n (%)	
Impact from floods			
- No impact			<0.001*
- Yes	51 (13.6)	11 (2.9)	
- No	325 (86.4)	365 (97.1)	
- Financial			<0.001*
- Yes	254 (67.6)	335 (89.1)	
- No	122 (32.4)	41 (10.9)	
- Migrate			<0.001*
- Yes	49 (13.0)	136 (36.2)	
- No	327 (87.0)	240 (63.8)	
- Destroy personal assets			<0.001*
- Yes	177 (47.1)	268 (71.3)	
- No	199 (42.9)	108 (28.7)	
- Sick (no treatment)			<0.001*
- Yes	29 (7.7)	69 (18.4)	
- No	347 (92.3)	307 (81.6)	
- Sick (treatment needed)			0.1668
- Yes	65 (17.3)	80 (21.3)	
- No	311 (82.7)	296 (78.6)	
- Death of family members			0.008*
- Yes	7 (1.9)	0 (0)	
- No	369 (98.1)	376 (100.0)	
- Others			0.004*
- Yes	8 (2.1)	0 (0)	
- No	368 (97.9)	376 (100.0)	

*Statistically significant difference (p-value <0.05)

Table 4 Comparison level of flood concerns between flood types

Impact	Flood types: River flood n (%)	Flash flood n (%)	P - value
Level of flood concern			<0.001*
- Not at all concerned	39 (10.4)	18 (4.8)	
- Slightly concerned	41 (10.9)	27 (7.2)	
- Somewhat concerned	183 (48.7)	99 (26.3)	
- Moderately concerned	76 (20.2)	117 (31.1)	
- Extremely concerned	37 (9.8)	115 (30.6)	

*Statistically significant difference (p-value <0.05)

Table 5 Comparison of the prevalence of probable PTSD between flood types

Impact	Flood types: River flood n (%)	Flash flood n (%)	P - value
Probable PTSD			<0.001*
- Positive (≥3)	76 (20.2)	19 (5.1)	
- Negative (<3)	300 (79.8)	357 (94.9)	

*Statistically significant difference (p-value <0.05)

Table 6 Scoring of PC-PTSD 5 between flood types

PC-PTSD 5	Flood types: River flood n (%)	Flash flood n (%)
Score		
0	227 (60.4)	232 (61.7)
1	48 (12.8)	93 (24.7)
2	25 (6.6)	32 (8.5)
3	44 (11.7)	13 (3.5)
4	12 (3.2)	2 (0.5)
5	20 (5.3)	4 (1.1)

4.3 Associated factors between the studied independent variables and probable PTSD

4.3.1 Associated factors between general characteristics and probable PTSD among different flood types

The analyses using the Chi-square test to find the associated factors of probable PTSD among river floods and flash floods are shown in Table 7.

Amongst the total population, without separating the types of floods, it was found that age group, educational level, monthly income, and the number of family members were the "independent variables" associated with "having probable PTSD". Additionally, having probable PTSD appeared to increase with age group gradually. Furthermore, most participants with a primary education level, had two or more family members, and experienced river floods were significantly associated with having probable PTSD. However, this study found that gender, occupation, underlying diseases, and the number of times participants experienced floods were not significantly associated with having probable PTSD (Table 7).

Once examining the associated factors of having probable PTSD belonging to river floods, **it was found that only monthly household income was significantly associated with having probable PTSD among those who experienced river floods** (Table 7). Whereas **age group, educational level, monthly household income, underlying diseases, and years of living in the affected area were those associated with probable PTSD among those who experienced flash floods** (Table 7). Interestingly, gender, occupation, number of flooding events experienced in the past 10 years, and number of family members were not associated with having probable PTSD in the respondents who either experienced river floods or flash floods.

Table 7 Associated factors and probable PTSD (n=752)

Characteristic	**Probable PTSD**							
	Total population		P-value	River flood		P-value	Flash flood		P-value
	Positive n (%)	Negative n (%)		Positive n (%)	Negative n (%)		Positive n (%)	Negative n (%)	
Gender			0.615						1.00
- Male	34 (35.8)	218 (33.2)		28 (36.8)	105 (35.0)	0.789	6 (31.6)	113 (31.7)	
- Female	61 (64.2)	439 (66.8)		48 (63.2)	195 (65.0)		13 (68.4)	244 (68.3)	
Age (years)									0.015*
- ≤ 30	3 (3.2)	26 (4.0)	0.16	3 (3.9)	10 (3.3)	0.248	0 (0)	16 (4.5)	
- 31 – 40	3 (3.2)	67 (10.2)		3 (3.9)	25 (8.3)		0 (0)	42 (11.8)	
- 41 – 50	10 (10.5)	129 (19.6)		8 (10.5)	55 (18.3)		2 (10.5)	74 (20.7)	
- 51 – 60	30 (31.6)	182 (27.7)		27 (24.8)	82 (27.3)		3 (15.8)	100 (28.0)	
- ≥61	49 (51.6)	253 (38.5)		35 (46.1)	128 (42.7)		14 (73.7)	125 (35.0)	
Education			0.155			0.733			0.145*
- lower than primary	5 (5.3)	60 (9.1)		4 (5.3)	24 (8.0)		1 (5.3)	36 (10.1)	
- primary	67 (70.5)	419 (63.8)		50 (65.8)	187 (62.3)		17 (89.5)	232 (65.0)	
- high school	12 (12.6)	131 (19.9)		12 (15.8)	60 (20.0)		0 (0)	71 (19.9)	
- vocational	4 (4.2)	20 (3.0)		4 (5.3)	11 (3.7)		0 (0)	9 (2.5)	
- bachelor's degree and above	7 (7.4)	27 (4.1)		6 (7.9)	18 (6.0)		1 (5.3)	9 (2.5)	

*Statistically significant difference (p-value <0.2)

Table 7 Associated factors and probable PTSD (n=752) (cont.)

Characteristic	**Probable PTSD**							
	Total population		P-value	River flood		P-value	Flash flood		P-value
	Positive n (%)	Negative n (%)		Positive n (%)	Negative n (%)		Positive n (%)	Negative n (%)	
Occupation						0.248			0.354
- Agriculture	28 (29.5)	195 (29.7)	0.518	27 (35.5)	120 (40.0)		1 (5.3)	75 (21.0)	
- Merchant	11 (11.6)	94 (14.3)		7 (9.2)	41 (13.7)		4 (21.1)	53 (14.8)	
- Freelance	17 (17.9)	119 (18.1)		15 (19.7)	57 (19.0)		2 (10.5)	62 (17.4)	
- Housewife	15 (15.8)	95 (14.5)		10 (13.2)	42 (14.0)		5 (26.3)	53 (14.8)	
- NGO workers'	0	4 (0.6)		0 (0)	3 (1.0)		0 (0)	1 (0.3)	
- Government workers'	5 (5.3)	13 (2.0)		4 (5.3)	9 (3.0)		1 (5.3)	4 (1.1)	
- Unemployed									
- Others	11 (11.6)	60 (9.1)		8 (10.5)	23 (7.7)		3 (15.8)	37 (10.4)	
	8 (8.4)	77 (11.7)		5 (6.6)	5 (1.7)		3 (15.8)	72 (20.2)	
Monthly household income			0.134			0.196*			0.049*
- ≤3000	23 (24.2)	164 (25.0)		16 (21.1)	66 (22.0)		7 (36.8)	98 (27.5)	
- 3001 – 6000	40 (42.1)	195 (29.7)		29 (38.2)	76 (25.3)		11 (57.9)	119 (33.3)	
- 6001 – 9000	13 (13.7)	131 (19.9)		13 (17.1)	78 (26.0)		0 (0)	53 (14.8)	
- 9001 – 12000	8 (8.4)	81 (12.3)		8 (10.5)	41 (13.7)		0 (0)	40 (11.2)	
- ≥12001	11 (11.6)	86 (13.1)		10 (13.2)	39 (13.0)		0 (0)	47 (13.2)	
Underlying disease						0.7			0.18*
- Yes	49 (51.6)	309 (47.0)	0.407	35 (46.1)	148 (49.3)		14 (73.7)	161 (45.1)	
- No	46 (48.4)	348 (53.0)		41 (53.9)	152 (50.7)		5 (26.3)	196 (54.9)	

*Statistically significant difference (p-value <0.2)

Table 7 Associated factors and probable PTSD (n=752) (cont.)

Characteristic	**Probable PTSD**							
	Total population		P - value	River flood		P - value	Flash flood		P - value
	Positive n (%)	Negative n (%)		Positive n (%)	Negative n (%)		Positive n (%)	Negative n (%)	
Years of living in the affected area									
- ≤30			0.341			0.206			0.017*
- 31 – 40	36 (37.9)	233 (35.5)		29 (38.2)	89 (29.7)		7 (36.8)	144 (40.3)	
- 41 – 50	15 (15.8)	99 (15.1)		8 (10.5)	38 (12.7)		7 (36.8)	61 (17.1)	
- 51 – 60	8 (8.4)	110 (16.7)		8 (10.5)	55 (18.3)		0 (0)	55 (15.4)	
- ≥61	17 (17.9)	99 (15.1)		17 (22.4)	48 (18.3)		0 (0)	51 (14.3)	
	19 (20.0)	116 (17.7)		14 (18.4)	70 (23.3)		5 (26.3)	46 (12.9)	
Number of flood events in 10 years			0.227			0.444			0.31
- 1 time	16 (16.8)	103 (15.7)		16 (21.1)	85 (28.3)		0 (0)	18 (5.0)	
- 3 – 5 times	55 (57.9)	309 (47.0)		52 (68.4)	185 (61.7)		3 (15.8)	124 (34.7)	
- 5 – 10 times	22 (23.2)	217 (33.0)		7 (9.2)	21 (7.0)		15 (78.9)	196 (54.9)	
- > 10 times	2 (2.1)	27 (4.1)		1 (1.3)	9 (3.0)		1 (5.3)	18 (5.0)	
- > 15 times	0 (0)	1 (0.2)		0 (0)	0 (0)		0 (0)	1 (0.3)	
Number of family members			0.106			0.831			0.218
- 1	10 (10.5)	67 (10.2)		9 (11.8)	42 (14.0)		1 (5.3)	25 (7.0)	
- 2	30 (31.6)	130 (19.8)		24 (31.6)	75 (25.0)		6 (31.6)	55 (15.4)	
- 3	21 (22.1)	155 (23.6)		17 (22.4)	72 (24.0)		4 (21.1)	83 (23.2)	
- 4	17 (17.9)	147 (22.4)		16 (21.1)	65 (21.7)		1 (5.3)	82 (23.0)	
- ≥5	17 (17.9)	158 (24.0)		10 (13.2)	46 (15.3)		7 (36.8)	112 (31.4)	

*Statistically significant difference (p-value <0.2)

4.3.2 Associated factors between impact from flood, level of flood concern, and probable PTSD among different flood types

Table 8 shows analyses of the associated factors between impact from flood, level of flood concern, and probable PTSD among different flood types.

Among river flood respondents, it was found that only the impact of being "sick" with no treatment needed was significantly associated with having probable PTSD (Table8). In addition, it was also found that level of flood concern was significantly associated with having probable PTSD in those who experienced river floods (Table 8).

For flash flood respondents, the results show that "migrate" and "sick" with no treatment were the two impacts that were significantly associated with having probable PTSD (Table 8). However, the level of flood concern was not significantly associated with probable PTSD in those who experienced flash floods (Table 8).

In this study, the impact of floods such as financial impact, destruction of personal assets, death of family members, and needing sick treatment were not associated with probable PTSD for those who experienced river floods or flash floods (Table 8).

Interestingly, the total sample found that only "no impact" from flooding events was associated with probable PTSD (Table 8).

Table 8 Association between impact from flood, level of flood concern, and probable PTSD among different flood types (n = 752)

Variable	Probable PTSD							
	Total sample		P - value	River flood		p-value	Flash flood		p-value
	Positive n (%)	Negative n (%)		Positive n (%)	Negative n (%)		Positive n (%)	Negative n (%)	
No impact			0.096			0.574			1.00
Yes	12 (12.6)	50 (7.6)		12 (15.8)	39 (13.0)		0 (0)	11 (3.1)	
No				64 (84.2)	261 (87.0)		19 (100.0)	19 (96.9)	
Financial			0.875			0.219			0.246
Yes	75 (78.9)	514 (78.2)		56 (73.7)	198 (66.0)		19 (100.0)	316 (88.5)	
No				20 (26.3)	102 (34.0)		0 (0)	41 (11.5)	
Migrate			0.678			0.703			0.001*
Yes	25 (26.3)	160 (24.4)		11 (14.5)	38 (12.7)		14 (73.7)	122 (34.2)	
No				65 (85.5)	262 (87.3)		5 (26.3)	235 (65.8)	
Destroy personal assets			0.346			0.798			0.605
Yes	52 (54.7)	393 (59.8)		37 (48.7)	140 (46.7)		15 (78.9)	253 (70.9)	
No				39 (51.3)	160 (53.3)		4 (21.1)	104 (29.1)	
Sick (no treatment)			0.27			0.015*			0.012*
Yes	9 (9.5)	89 (13.5)		1 (1.3)	28 (9.3)		8 (42.1)	61 (17.1)	
No				75 (98.7)	272 (90.7)		11 (57.9)	296 (82.9)	

*Statistically significant difference (p-value <0.2)

Table 8: Association between impact from flood, level of flood concern, and probable PTSD among different flood types (n = 752) (cont.)

Variable	Probable PTSD								
	Total sample			River flood			Flash flood		
	Positive n (%)	Negative n (%)	P - value	Positive n (%)	Negative n (%)	P - value	Positive n (%)	Negative n (%)	P - value
Sick (treatment needed)			0.849			0.737			0.569
Yes	19 (20.0)	126 (19.2)		14 (18.4)	51 (17.0)		5 (26.3)	75 (21.0)	
No				62 (81.6)	249 (83.0)		14 (73.7)	282 (79.0)	
Death of family members			0.312			0.353			
Yes	0	7 (1.1)		0 (0)	7 (2.3)		0 (0)	0 (0)	
No				76 (100.0)	293 (97.7)		19 (100.0)	357 (100.0)	
Others			0.29			0.666			
Yes	2 (2.1)	6 (0.9)		2 (2.6)	6 (2.0)		0 (0)	0 (0)	
No				74 (97.4)	294 (98.0)		0 (0)	0 (0)	
Level of flood concern			0.69			<0.001*			0.356
- Not at all concerned	9 (9.5)	48 (7.3)		9 (11.8)	30 (10.0)		0 (0)	18 (5.0)	
- Slightly concerned	12 (12.6)	56 (8.5)		12 (15.8)	29 (9.7)		0 (0)	27 (7.6)	
- Somewhat concerned	25 (26.3)	257 (39.1)		20 (26.3)	163 (54.3)		5 (26.3)	94 (26.3)	
- Moderately concerned	32 (33.7)	161 (24.5)		27 (35.5)	49 (16.3)		5 (26.3)	112 (31.4)	
- Extremely concerned	17 (17.9)	135 (20.5)		8 (10.5)	29 (9.7)		9 (47.4)	106 (29.7)	

*Statistically significant difference (p-value <0.2)

4.4 Associated risk factors of probable PTSD among different flood types

All associated factors with a p-value of less than 0.2 from the Chi-square test were considered for further analysis of the logistic regression. Multiple logistic regression was performed to determine the risk factors of having probable PTSD among the study participants who experienced different flood types. The significance level was at a p-value less than 0.05.

From previous Chi-squared test analysis, monthly income, sickness with no treatment needed, and level of flood concern were significantly associated with probable PTSD in river-flooded areas. Whereas, age, education, year of living in affected areas, underlying diseases, migration, and sickness with no treatment were significantly associated with probable PTSD in flash-flooded areas. In addition, age, education, monthly income, number of family members, and no physical or psychological impact were associated factors of having probable PTSD among the total population who experienced any flood types (Table 8). Therefore, all these associated factors were selected for further analyses to find the associated risk factors, as shown in Table 9.

The results show that monthly household income and sickness (no treatment needs) could be 5.4%, explaining the chance of having probable PTSD in river-flooded areas. While the years of living, migration, and sickness (no treatment needs) could be 33.3% explained the chance of having probable PTSD in river-flooded areas. However, none of the variables could predict probable PTSD in the total population (Table 9).

A monthly household income of more than or equal to 6,001 baht has a 43% (AOR: 0.57; 95% CI: 0.33 - 0.99) decrease in odds of having probable PTSD in river-flooded areas (Table 9).

Amongst participants who experienced flash floods, those who had to migrate from their houses had 6 times more chances of having probable PTSD (AOR: 6.06; 95% CI: 1.85 - 19.88) compared to those who did not need to migrate (Table 9).

The sicked (no treatment needed) participants who experienced river flooded areas have an 88% (AOR: 0.12; 95% CI: 0.02 - 0.93) decreased chance of probable PTSD. In contrast with the flash flood, where the sicked (no treatment needed) participants had 5 times more chances of probable PTSD (AOR: 5.08; 95% CI:1.68 - 15.38) compared to those not being sick (Table 9).

Therefore, the study found that in participants who experienced a flash flood, associated risk factors were 1) sicked (no treatment needed), and 2) had to migrate from their house had 5 and 6 times more chance of having probable PTSD, respectively (Table 9).

On the other hand, the study did not find any associated risk factors for participants experiencing river floods. Instead, the results show the factors that might decrease the percentage of having probable PTSD. Those factors were 1) having a monthly household income of more than or equal to 6,001 Baht, which showed a 43% reduction in having probable PTSD, and 2) being sicked (no treatment needed), which showed an 88% reduction in having probable PTSD (Table 9).

In addition, the study did not find any associated risk factors for all participants experiencing any flood types (Table 9).

Table 9 Associated risk factors of probable PTSD among different flood types

	Total population			Flood types					
				River flood			Flash flood		
Variables	AOR	95% CI	P-value	AOR	95% CI	P-value	AOR	95% CI	P-value
Age									
- ≤ 55	ref			ref			ref		
- ≥ 56	1.56	0.91 - 2.65	0.10	1.06	0.56 – 2.00	0.87	4.12	0.98 - 17.31	0.05
Education									
- ≤ primary	ref			ref			ref		
- ≥ high school	1.08	0.60 - 1.95	0.79	1.11	0.55 2.22	0.77	0.32	0.40 - 3.65	0.31
Monthly household income									
- ≤ 6000	ref			ref			ref		
- ≥6001	0.66	0.40 - 1.07	0.09	0.57	0.33 - 0.99	0.05	0.30	0.08 - 1.22	0.09
Underlying disease									
- Yes	1.01	0.64 - 1.60	0.97	1.21	0.70 - 2.09	0.49	0.45	0.13 - 1.54	0.20
- No	ref			ref			ref		
Years of living in the affected area									
- ≤40	ref			ref					
- ≥41	0.71	0.44 - 1.13	0.15	1.07	0.60 - 1.90	0.82	0.16	0.05 - 0.50	<0.001*

Number of family members									
- 1-2	ref			ref			ref		
- ≥3	0.73	0.46 - 1.16	0.18	0.97	0.55 - 1.69	0.90	1.21	0.40 - 3.65	0.74
Migrate impact from flood									
- Yes	1.18	0.71 - 1.96	0.54	1.37	0.64 - 2.93	0.42	6.06	1.85 - 19.88	<0.001*
- No	ref			ref			ref		
Sick (no treatment) – impact from flood									
- Yes	0.74	0.36 - 1.55	0.43	0.12	0.02 - 0.93	0.04*	5.08	1.68 - 15.38	<0.001*
- No	ref			ref			ref		
No impact from flood									
- Yes	1.72	0.80 - 3.69	0.17	1.29	0.57 - 2.90	0.54	0	0	1.00
- No	ref			ref					
Level of flood concern									
- Not at all concerned	ref			ref					
- concerned	0.97	0.42 - 2.25	0.95	0.90	0.36 - 2.21	0.81	0	0	1.00
Nagelkerke R^2	*0.038*			*0.054*			*0.333*		

*Statistically significant difference (p-value <0.05); AOR-adjusted odd ratio

Chapter 5
DISCUSSIONS, CONCLUSION, AND RECOMMENDATION

5.1 Discussions

Characteristics of participants

This study had two general objectives to determine the prevalence of probable PTSD in different flood types in Thailand and to compare the proportion of people who were identified as having probable PTSD among different flood types in Thailand. The special objectives were to find the associations between independent variables and probable PTSD. The study was cross-sectional and gathered data from previous research on flood events in 2019 – 2020. The 752 participants were recruited from two flood-prone provinces, Nakhon Sawan in central and Nakhon Si Thammarat in southern Thailand. The questionnaires were used to collect the data.

The characteristics of participants show that samples from two flood-prone provinces were not different in terms of gender, age, educational level, or history of underlying diseases. The major participants were women aged more than 50 years with a primary school education level. Because of random walk sampling, the data collectors could only collect the data from those who stayed at home in the daytime or for convenience to answer the questions. Most participants had household income less than minimum wage per day (three hundred baht). The secondary data might have missed the other populations who worked during the day, which might be a working age group.

However, some independent variables linked with flood differed between the two types. The participants tended to report no physical impact in those who experienced river floods. In flash floods, physical impacts such as financial, migration, destruction of personal property, sickness, or death were reported. The severity of the flood could explain these findings. A previous study pointed out that the flash flood victims reported a physical impact. (Fernandez et al., 2015) Moreover, the participants were likely to have more concern in these areas.

Prevalence

In this study, PTSD was measured using PC-PTSD 5, designed for use in the community setting and has a high detection rate. The results of this study found that the prevalence of probable PTSD is 12.6 % from a total of 752 participants. The river flood areas had significantly higher flood victims with probable PTSD (20.2%) than flash flooded areas (5.1%). According to studies from China, the prevalence of PTSD was around 15 - 20% from flood events. (Chen & Liu, 2015) (Dai et al., 2016). This study had a lower prevalence of probable PTSD might be because the data was collected long after flooding events. Since the prevalence of PTSD can be reduced as time passes (Mulchandani et al., 2019; Sadock, 2019), the communities in Thailand might recover better due to flood mitigation programmes and psychological support by MCATT. Therefore, the findings in this study were less than the previous studies that examined PTSD right after the flooding events. The study could have a prevalence of PTSD up to 44.4%, like a study from the south of Thailand in 2017. (Sonpaveerawong et al., 2017). Nevertheless, the study in 2017 from the south of Thailand used GHQ-12 as the screening of PTSD, which is normally assessed for general mental health distress self-reports rather than specific PTSD screening tools. While PC-PTSD 5 has a higher specificity for detecting PTSD, as previously reported (Bovin et al., 2021).

Related factors associated with probable PTSD

This study found an association between age, type of flood, education, income, underlying disease, living years, and the number of family members with probable PTSD. Moreover, migration, sickness, concern, and no physical impact are also linked with probable PTSD. Participants who lived in river-flooded areas have a chance of probable PTSD 4.836 times live in flash-flooded areas.

Age

The results demonstrated that age was associated with probable PTSD at a significant level of less than 0.2. However, it cannot predict the probability model in any flooded areas. A study from China (Dai et al., 2017) shows no association between age and PTSD. In contrast, the systematic review stated that the elderly have

more chance of PTSD than other age groups. (Fernandez et al., 2015) (Hrabok et al., 2020) The future study has to be recruited the sample in the same proportion.

Flood type

From literature reviews, people exposed to flash floods have more chance of having PTSD than those who experienced fluvial floods. The severity of the flood and a higher level of water are highly associated with PTSD. (Fernandez et al., 2015) In contrast to our study that fluvial floods had more chance of PTSD than flash floods. Our study does not screen for other mental health problems such as depression or anxiety. These two conditions are also the comorbidities of PTSD. If the participants from Nakhon Sawan had an underlying condition, this issue would be missed. (Sadock, 2019) The study from Germany stated that the type of flood might be not associated with mental health issues, but the severity and impact of events are. (Hrabok et al., 2020) So, future studies have to be covered by screening more possible comorbidities.

Monthly household income

In our study, there is a relationship between monthly income with probable PTSD at a significant level of less than 0.2. Most of the participants have salaries less than minimum wages in both areas. The findings are in contrast to literature reviews which showed that lower-income or unemployed were more likely to have psychological health deteriorate after being exposed to floods. (Cruz et al., 2020) (Hrabok et al., 2020)

In the prediction model, if the salary of the flood victims increases by more than 6,001 baht, they will be reduced to having probable PTSD by 43%. This finding is associated with the studies from Thailand. They stated that flood mitigation programs or psychosocial support are the protective factors for mental health problems. (Saneha et al., 2015) (Sonpaveerawong et al., 2017) However, the samples are less than the calculated sample sizes and lack working age proportion. The future study has to be covered and more generalized to the population.

Years of living in affected areas

The number of years living in flash-flooded areas is associated with probable PTSD. This finding was associated with the systematic review stating that the elderly have more chance of PTSD than other age groups. (Fernandez et al., 2015) (Hrabok et al., 2020) Moreover, in the prior study from China, the prevalence of PTSD after 13-14 years is 19.4%. (Dai et al., 2016) In contrast, three years follow-up cohort prevalence of PTSD decreased from 33.2 to 17.1%. (Mulchandani et al., 2019) In addition, the prevalence of PTSD can be reduced as time pass because people can recover themselves and from adequate social support. (Sadock, 2019; (Saneha et al., 2015).

Underlying disease / medical conditions prior to a flood event

The underlying disease was related to probable PTSD, with a significant level of less than 0.2. In contrast, limited studies of a prior medical condition that directly causes PTSD. Chronic illness patients in flood-prone areas are vulnerable to worsening disease or relapse due to the shortage of medical supplies and are not well prepared to flood events. (Saneha et al., 2015) However, PTSD patients are more likely to report physical health problems and medical conditions related to chronic disease. There is a consistent association between PTSD and several disorders, including cardiovascular and pain. (Sareen et al., 2007) (Pacella et al., 2013) (Fontalba-Navas et al., 2017). Unfortunately, this variable could not be included in the predicted model.

Impact from flood

From our study, there are associations between physical and psychological impact with probable PTSD at a significant level of less than 0.2. These impacts are migration, sickness (no treatment needed), and no physical impact. The study from Thailand stated that prior physical conditions and mental health impacts are associated with probable PTSD. (Sonpaveerawong et al., 2017) Physical illness could be found after 6 to 18-month follow-up PTSD patients. The illness is pain, cardiovascular problems, or respiratory problems. The causes of illness are consequences of trauma and lack of taking care of themselves since psychological

distress. (Sareen et al., 2007) (Pacella et al., 2013) (Fontalba-Navas et al., 2017). However, there are only migration and sickness (no treatment needed) after the regression analysis. In the prediction model of river flood, if the participants have sickness after the events, they will reduce the chance of probable PTSD by 88 % (OR: 0.12; 95%CI (0.02 - 0.93)). In contrast to flash flooded areas, if the victims have sickness after the events, they will increase 5 times chance of having probable PTSD (OR :5.08; 95%CI (1.68 - 15.38)). The severity of flood might be explained for the flash flooded areas. (Fernandez et al., 2015) Moreover, the destroy infrastructure could be the barrier for access to care. For the river flooded areas, there could have the resilience or better social support, so they would be protective factors in river flooded areas. (Saneha et al., 2015) (Witthayamet et al., 2016) (Sonpaveerawong et al., 2017)

However, loss of sentimental items, financial loss, or destruction of personal assets is not significantly associated with probable PTSD, which contrasts with the UK study. (Tempest et al., 2017) Moreover, migration could be predicted probable PTSD in flash flooded areas. The studies stated that factors that affected mental ill-health in people exposed to flooding were female, water depth, low income, minor ethnicity, lack of post-flood support, displacement, and absence of flood warnings. (Cruz et al., 2020) (Hrabok et al., 2020) In the prediction model of a flash flood, if the participant is affected by migration or displacement, they could have a 6 times chance of having probable PTSD (OR:6.06;95%CI(1.85 - 19.88)). The psychological impacts are measured in concern levels for flood events.

Level of concern from flood

The findings indicate an association with probable PTSD in river-flooded areas with a significant level of less than 0.2. Most participants with probable PTSD are in moderate to a high level of concern. The study from China showed that the level of concern or risk perception is high in populations with low income, higher education, and less trust in local authorities for flood prevention. (Liu et al., 2018)In addition, a study from Germany showed that risk perception is associated with

preparedness for flooding. (Hrabok et al., 2020). However, a concerning level cannot predict the probability model in any flooded areas in this study.

5.2 Conclusions

Thailand has been facing many challenges from flooding events annually. The cumulative flooding events happen mainly in the Central and Southern parts of Thailand, such as the Nakhon Sawan and Nakhon Si Thammarat provinces. There is a limited study on the prevalence of probable PTSD among flood-prone communities. Primary Care PTSD 5 (PC-PTSD-5) is a screening tool to help identify PTSD during and after flood events in communities. This study aims to determine the prevalence and related factors associated with probable PTSD in flood-prone provinces. The data were analyzed from secondary data. The prevalence of probable PTSD was 20.2 % in river-flooded areas, and 5.1% flash flooded areas. PTSD has been discovered in flood-prone districts in Thailand. As a result, public health officials must handle mental health concerns in addition to physical injuries or damages caused by floods. Following flood events, public health authorities should conduct a rapid screening for psychological effects, and periodic follow-up may be required because psychological symptoms take time to develop. More attention and care are required in regions devastated by flash floods than in places hit by river floods.

5.3 Limitation

1. This study was a secondary analysis; therefore, the sample size was predetermined, and selection bias might also be possible from the use of walking random sampling in the original cross-sectional survey. In addition, as a consequence of using secondary data analysis, a dataset was limited for the sample size and questions asked.
2. The probable PTSD was not assessed right after the flooding events; therefore, the results might be under-reported.
3. The questionnaire was self-administered, and trained professional raters did not verify that symptoms may be found to be subjective bias.

5.4 Recommendation

For future study

1. Due to unequally sampling, more study is needed to prove the result that can be inferred from all of the populations in the provinces. Selection of samples in the study, there may be selections or randomization in more diverse groups for more coverage, to be generalizability.
2. A Follow-up study of PC-PTSD-5 in another trauma situation like wildfire, storm, mass shooting, or explosion is needed.
3. Screen all possible comorbidities associated with PTSD, such as depression, bipolar disorder, anxiety, or substance use disorder.

For policy making

Thailand faces flood events annually. There are many flood mitigation programs which interested in physical or structural support. The Department of Mental health has psychological support guidelines for trauma situations. The MCATT teams are training in the local mental health networks annually. The mental health screening tools for trauma situations must be trained before use, So the training takes much time to finish. PC-PTSD 5 is a probable PTSD screening tool for primary healthcare, which everyone who works at the community level can use.

1. Encourage the use and distribution of PC-PTSD 5 in primary healthcare. So, this tool can be used for early detection of probable PTSD after the trauma situation and mitigation programs
2. Create support referral systems if probable PTSD is detected. The susceptible people need early intervention like mental health support or crisis intervention. If they are not improved, the referral system can aid in making them see a psychiatrist.
3. Integrate PTSD items into the national Health Data Center (HDC) database for easier monitoring and evaluation systems. PTSD is combined with anxiety disorder in the HDC database.

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APPENDIX:

Questionnaire

ข้อความถามต่อไปนี้เป็นข้อคำถามจากแบบสอบถาม โครงการวิจัย แผนปฏิบัติการเพื่อบรรเทาผลกระทบต่อสุขภาพจากการอุปโภคบริโภคน้ำในกรณีอุทกภัย – การวิจัยเชิงบูรณาการ โดย ภาควิชาวิศวกรรมสิ่งแวดล้อม คณะวิศวกรรมศาสตร์ และวิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย และคณะสาธารณสุขศาสตร์ มหาวิทยาลัยวลัยลักษณ์

แบบสอบถามนี้แบ่งออกเป็น 5 ส่วน ดังนี้

ส่วนที่ 1 คุณลักษณะทั่วไปของผู้ตอบแบบสอบถาม

ส่วนที่ 2 ประสบการประสบภัยน้ำท่วม

ส่วนที่ 3 ความกังวลต่อการเกิดน้ำท่วม

ส่วนที่ 4 ผลกระทบจากน้ำท่วม

ส่วนที่ 5 สภาวะป่วยทางจิตใจเมื่อเผชิญกับเหตุการณ์ที่กระทบกระเทือนจิตใจอย่างร้ายแรง

คำชี้แจง โปรดทำเครื่องหมาย ✓ ให้ตรงกับช่องลำดับความสำคัญตามความคิดเห็นของท่าน

ส่วนที่ 1 คุณลักษณะทั่วไปของผู้ตอบแบบสอบถาม

1. เพศ ☐ ชาย ☐ หญิง
2. อายุ .....ปี
3. ระดับการศึกษาสูงสุดของท่าน

   ☐ ต่ำกว่าประถมศึกษา ☐ ประถมศึกษา ☐ มัธยมศึกษา

   ☐ อนุปริญญา / ปวส ☐ ปริญญาตรีหรือสูงกว่า
4. อาชีพปัจจุบัน

   ☐ เกษตรกร ☐ ค้าขาย ☐ รับจ้าง

   ☐ แม่บ้าน/พ่อบ้าน ☐ พนักงานเอกชน ☐ รับราชการ

   ☐ ว่างงาน ☐ อื่นๆ (โปรดระบุ.....)
5. รายได้เฉลี่ยของครัวเรือน .....บาท/เดือน
6. จำนวนสมาชิกในครัวเรือนของท่านทั้งหมดมีจำนวน.....คน (รวมตัวท่านเอง)
7. ท่านมีโรคประจำตัวหรือไม่

   ☐ ไม่มี

   ☐ มี (โปรดระบุ) 1.....

   2.....
8. บ้านที่ท่านอาศัยอยู่เป็น:

☐ บ้านเช่า ☐ บ้านของท่านเอง ☐ อื่นๆ โปรดระบุ.....

9. จังหวัดที่อยู่อาศัย

☐ จังหวัดนครสวรรค์ ☐ จังหวัดนครศรีธรรมราช

10. ท่านอาศัยอยู่ในพื้นที่แห่งนี้มาเป็นระยะเวลานาน.....ปี

ส่วนที่ 2 ประสบการประสบภัยน้ำท่วม

จำนวนครั้งที่ประสบอุทกภัย ในรอบ 10 ปีที่ผ่านมา

☐ 1 ครั้ง ☐ 3-5 ครั้ง ☐ 6-10 ครั้ง

☐ มากกว่า 10 ครั้งขึ้นไป ☐ มากกว่า 15 ครั้งขึ้นไป

ส่วนที่ 3 ความกังวลต่อการเกิดน้ำท่วม

ท่านมีความกังวลต่อการเกิดน้ำท่วมมากเพียงใด

☐ 5 = มากที่สุด ☐ 4 = มาก ☐ 3 = ปานกลาง ☐ 2 = น้อย ☐ 1 = ไม่กังวลเลย

ส่วนที่ 4 ผลกระทบจากน้ำท่วม

น้ำท่วมส่งผลกระทบต่อท่านอย่างไร *(ตอบได้มากกว่า 1 ข้อ)*

☐ ไม่มีผลกระทบ ☐ ขาดรายได้

☐ อพยพ/ย้ายที่พักพิง ☐ ทรัพย์สินเสียหาย (บ้าน รถ เฟอร์นิเจอร์ เป็นต้น)

☐ เจ็บป่วย (**ไม่ต้อง**รับการรักษาพยาบาล)

☐ เจ็บป่วย (**ต้อง**ได้รับการรักษาพยาบาล)

☐ ถึงแก่ชีวิต (สมาชิกในครอบครัว) ☐ อื่นๆ โปรดระบุ.....

ส่วนที่ 5 สภาวะป่วยทางจิตใจเมื่อเผชิญกับเหตุการณ์ที่กระทบกระเทือนจิตใจอย่างร้ายแรง

ในเดือนที่ผ่านมาท่านเคย.....

1. ฝันร้ายเกี่ยวกับเหตุการณ์น้ำท่วมที่เคยเกิดขึ้น โดยที่ท่านไม่ต้องการจะนึกถึง

   ☐ เคย ☐ ไม่เคย

2. พยายามที่จะไม่คิดหรือนึกถึงเหตุการณ์น้ำท่วม หรือหลีกเลี่ยงสถานการณ/สถานที่/สิ่งใดๆที่ทำให้ท่านนึกถึงเหตุการณ์ดังกล่าว

   ☐ เคย ☐ ไม่เคย

3. มีความตื่นตัว ขวัญผวา เฝ้าระวัง หรือตื่นตกใจง่าย อยู่เป็นประจำ

   ☐ เคย ☐ ไม่เคย

4. รู้สึกเฉยชา หรือไร้ความรู้สึก ปลีกตัวเองออกจากคนอื่นๆ หรือสิ่งต่างๆรอบตัว

   ☐ เคย☐ ไม่เคย

5. รู้สึกผิดหรือไม่สามารถหยุดโทษตัวเองหรือผู้อื่นเกี่ยวกับเหตุการณ์ที่เกิดขึ้น หรือเกี่ยวกับปัญหาต่างๆที่ตามมา

   ☐ เคย ☐ ไม่เคย

ETHICAL APPROVAL

The Research Ethics Review Committee for Reseach Involving Human Research Participants, Group I, Chulalongkorn University
Chamchuri 1 Building, 2nd Floor, 254 Phayathai Road, Pathumwan, Bangkok 10330 Thailand
Telephone: 02-218-3202, 02-218-3049 Email: eccu@chula.ac.th

COA No. 118/65

Certificate of Approval

Examption for Ethics Review

Study Title No. 650063 : COMPARISON BETWEEN THE PREVALENCE OF PROBABLE POSTTRAUMATIC STRESS DISORDER AMONG DIFFERENT FLOOD TYPES IN THAILAND

Principal Investigator : Mr. Natakorn Ritbunyakorn

Place of Proposed Study/Institution : College of Public Health Sciences, Chulalongkorn University

This Research proposal is exempted for ethics review in compliance with the Office for Human Research Protections (OHRP Exempt Categories) 45 CFR part 46.101(b).
Certified under condition: To conduct this research project, the researcher (s) must strictly adhere to research proposal approved by the committee. If there is any amendment, it must be sent to the committee for review before carrying on the project.

Signature Prida Tasanapradit
(Associate Prof. Prida Tasanapradit)
Chairman

Signature Raveenam Mingpakanee
(Assistant Prof. Dr. Raveenan Mingpakanee)
Secretary

Date of Approval : 30 May 2022

Remarks

Final report (AF 01-15) and abstract is required for a one year (or less) research/project and report within 30 days after the completion of the research/project.

The Research Ethics Review Committee for Research Involving Human Research Participants Group 1

Study Title No. 650063
Date of Approval 30 May 2022
Approval Expire date 29 May 2023

VITA

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