II. The Worst Floods in Thailand in Half a Century:

The 2011 Floods

September 2016

Preface

Whilst Asia is ranked as the most disaster prone region in the world in terms of both natural and man-made disasters, research and training in the Asia-Pacific region is limited. Better understanding of the disaster epidemiological profile and human health impact will enhance response, preparedness and mitigation of the adverse human impact of disaster. The concept of case-teaching method has been used extensively in research and teaching of disasters and humanitarian studies at schools of public health around the world, including Harvard School of Public Health, Johns Hopkins Bloomberg School of Public Health and London School of Hygiene and Tropical Medicine. Through the existing partners and networks of The Jockey Club School of Public Health and Primary Care, the Public Health Humanitarian Initiatives of The Chinese University of Hong Kong, and the Collaborating Centre for Oxford University and CUHK for Disaster and Medical Humanitarian Response, this disaster and humanitarian relief monograph series composed of 8 case study reports have been developed using a standardized analytical and reporting framework. Methods for case study including literature review, stakeholder interviews and retrospective data analysis have been employed.

This case study series aims at highlighting the key lessons learnt in disaster medical and public health response in the Asia. The goal is to develop Asia-specific teaching materials for public health and medicine in disaster and humanitarian response.

The "Guidelines for Reports on Health Crises and Critical Health Events" framework has been adopted as a reference for the literature search and the identification of key areas for analysis (1). We acknowledge that disaster management is a multidisciplinary area and involves much more than health issues, but we believe that the public health impact of all interventions should be appreciated across all disciplines.

This report is developed from a research conducted by Emily Ying Yang CHAN, Polly Po Yi LEE, Cecilia CHOI, Bryant HUANG and Kevin Kei Ching HUNG in 2011. Ms Choi and Mr Huang were

then Graduate Fellows and Dr Hung Research Manager of the Collaborating Centre for Oxford University and CUHK for Disaster and Medical Humanitarian Response.

Authors

Professor Emily Ying Yang CHAN (陈英凝教授)

MBBS (HKU), BS (Johns Hopkins), SM PIH (Harvard), MD (CUHK), DFM (HKCFP), FFPH, FHKAM (Community Medicine), FHKCCM

Director, Collaborating Centre for Oxford University and CUHK for Disaster and Medical Humanitarian Response (CCOUC)

Associate Director (External Affairs and Collaboration) and Professor, JC School of Public Health and Primary Care (JCSPHPC), The Chinese University of Hong Kong (CUHK)

Honorary Research Fellow (Emerging Infectious Diseases and Emergency Preparedness), Nuffield Department of Medicine, University of Oxford, United Kingdom

Visiting Scholar, François-Xavier Bagnoud Center for Health and Human Rights, Harvard University, United States

Convener, Public Health Humanitarian Initiatives, JCSPHPC, CUHK

Convener, Climate Change and Health Study Group, JCSPHPC, CUHK

Ms Polly Po Yi LEE (李宝仪)

RN, BN, MPH (CUHK)

Project Manager, CCOUC

Senior Research Assistant, JCSPHPC, CUHK

With the support of CCOUC fellows

Contact point: Professor Emily Ying Yang CHAN

TABLE OF CONTENT

Executive Summary

From late July to November of 2011, a series of floods started in northern Thailand and swept into the central region, causing adverse impacts on both the population and the economy. These floods, the worst to hit Thailand in the past 50 years in terms of water volume and damage, affected over five million individuals across 62 out of the 77 provinces of the country. By mid-December of 2011, a death toll of 744 had been recorded.

Adopting a framework for analysing health crises based on the guidelines proposed by Kulling et al. (1), this case study describes the events and effects of the 2011 floods in Thailand, with a unique additional objective of critically examining the role of the news media in the context of disaster response and relief efforts.

After sourcing information from international organizations and agencies, disaster-related databases, as well as NGOs, it was found that approximately one-third of the media reports covering the 2011 floods in Thailand (136 out of 348 items) were related to the business sector, focusing on the economic and financial implications of the floods. In addition, most of the coverage (78 out of 101 items) found in this study dealt with the situation in Bangkok and the surrounding areas in central Thailand, overlooking the more heavily affected northern and north-eastern regions.

The role of the media is of vital importance in disaster and emergency situations, since media coverage can affect government decisions, influence public attitudes and save lives. To facilitate future response, relief, and recovery efforts, the findings of this case study suggest that media reporting in the immediate aftermath of disasters and emergencies should focus on areas that are of immediate concern to the victims, including shelter, food, water, health, and sanitation. Highlighting these key areas is crucial to both the safety of individuals in affected areas and the coordination among institutional bodies (i.e., the national government, the United Nations, the World Health Organisation, and various non-governmental organizations).

1. Introduction/Material/Methodology

1.1 Introduction

Media are believed to have the power of arousing international attention, informing the public and raising awareness when disasters strike. The guidelines for journalists covering disasters published by the United Nations International Strategy for Disaster Reduction (UNISDR) advocate for focusing more on reporting disaster risk reduction (DRR) and the root causes of disasters, which would hopefully help influence policy change, increase capacity to cope with disasters and overcome vulnerabilities. In this case study, the experience of 2011 Thailand floods was highlighted and the potential role of media reporting discussed.

From late July to November of 2011, a series of floods swept through Thailand, causing destruction to both the population and the economy. These floods, the worst to hit Thailand in the past 50 years in terms of water volume and the number of individuals affected, coincided with a period of continuous rainfall in the northern and north-eastern regions and affected more than five million people across 62 out of the 77 provinces of country. By mid-December of 2011, a death toll of 744 deaths had been recorded.

In response to the floods, the Royal Thai Government, in coordination with various non-governmental organizations (NGOs), devised and implemented emergency relief efforts in early November after water levels began to subside.

There was hardly any comprehensive news report analysing the 2011 floods in Thailand from a health perspective. Instead, a majority of the coverage either focused on the descriptive statistics or actions taken by government agencies and NGOs. The objective of this study is to critically examine the government response efforts, the involvement of the international community, and the role of the media, so as to provide basis for developing better flood mitigation, preparedness, and response protocols.

1.2 Material

Information is primarily obtained from the Royal Thai Government, as well as international organizations and agencies (e.g., United Nations Educational, Scientific and Cultural Organization (UNESCO), World Health Organization (WHO), World Bank, and Central Intelligence Agency (CIA) of the United States), disaster-related databases (e.g., Asian Disaster Reduction Center and Relief Web), and NGOs (e.g., Thai Red Cross Society).

1.3 Methodology and a theoretical framework for a flood case study

To achieve a systematic examination of the case, major public health principles of disaster response and the disaster cycle model will form the theoretical framework for this analysis.

I. *Public health principles of disaster response*

According to the *Oxford Handbook of Public Health Practice*, the three main principles of public health response to disasters include securing basic human needs required to maintain health, determining the current and the likely health threats to the affected community, and acquiring and providing the resources to address the above two principles (2). The discussion in this case study will focus on the five basic human health needs.

The five basic requirements for health include food, health services, information, clean water and sanitation, as well as shelter and clothing. Securing the access to the basic needs is considered as the main goal of the emergency relief.

As a global effort in setting the standard for emergency relief, the international Sphere Project hosted by the International Council of Voluntary Agencies (ICVA) in Geneva is “a voluntary initiative that brings a wide range of humanitarian agencies together around a common aim - to improve the quality of humanitarian assistance and the accountability of humanitarian actors to their constituents, donors and affected populations.” The Sphere Handbook, *Humanitarian Charter and Minimum Standards in Humanitarian Response*, provides a level of standard that has been agreed upon by a multitude of

front line agencies (3). It contains the minimum standards for most aspects of the basic requirements for health, specifically water supply, sanitation and hygiene promotion; food security and nutrition; shelter, settlement and non-food items; and health action. For each specific sector, it has distinct indicators to measure whether the minimum standards are being reached.

II. *Definition of health*

Health is a state of complete physical, mental and social well-being instead of the mere absence of disease or infirmity (4). Specifically public health is defined as "[t]he science and art of preventing disease, prolonging life and promoting health through the organized efforts of society", according to Sir Donald Acheson (5).

III. *The disaster cycle model*

Apart from the general public health principles, it is important to recognise the different actions required during the various phases of disasters. The disaster cycle model helps highlight the key stages in post-disaster emergency response. It can serve as a useful reference for different parties to take actions during disaster management.

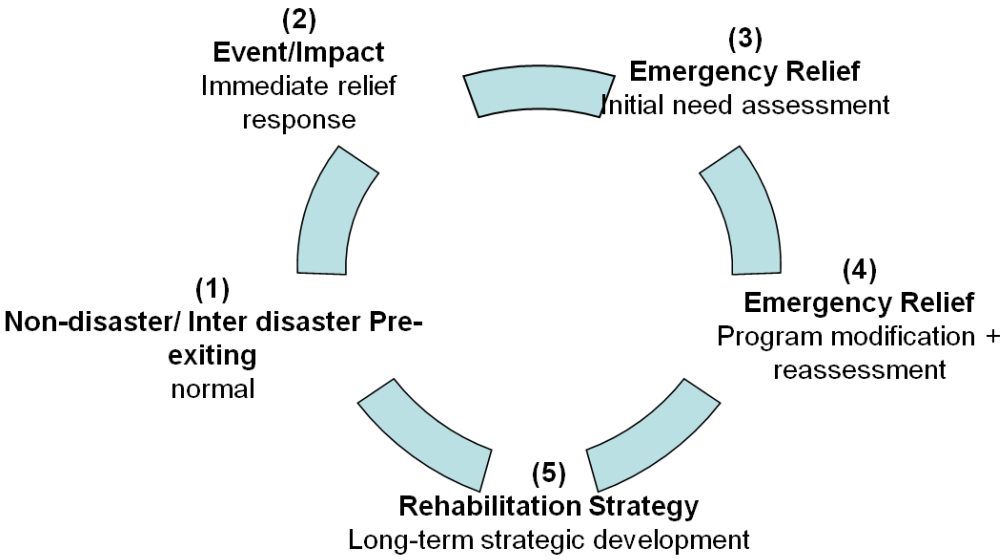

Figure 1 Disaster cycle

Source: Chan EYY, Sondorp E. Natural disaster medical intervention: missed opportunity to deal with chronic medical needs? An analytical framework. Asia Pacific Journal of Public Health. October 2007;19(Special Issue):45-51.

2. Pre-Event Status

2.1 Background

Thailand has a landmass of 514,000 square kilometres and is centrally located in mainland Southeast Asia, bordered by Myanmar, Laos, Cambodia, and Malaysia (6). Thailand is often subdivided administratively into four regions: Northern, North-eastern (Isaan), Central/Eastern, and Southern Thailand.

The northern region is characterized by mountainous terrain and rich forestation. The North-east, which accounts for nearly one-third of Thailand in terms of land mass and population size, is a region of sprawling hills that also includes the Khorat Plateau and the Phu Phan Mountains. The southern region, while also mountainous, is distinguished from its northern and north-eastern counterparts by the absence of rivers. Central Thailand, which includes the Bangkok Metropolitan Region, is often referred to as the “Rice Bowl of Asia” in reference to its extensive fertile land and rice-producing patties.

Each region is characterized by distinct climatic features, but in general, many parts of Thailand are prone to irregular weather patterns that fluctuate between periods of severe drought and flood. While the South experiences the highest amounts of annual rainfall, the North is particularly prone to seasonal floods due to the tropical savannah climate.

Map by: Central Intelligence Agency (CIA) – Public domain

Map showing Thailand's location in Asia

Map of Thailand

Map by: Central Intelligence Agency (CIA) – Public domain

The country had a total population of about 62 million in 2008, around 95% of which was Thai and about 94.6% Buddhists (7). The population of the capital city Bangkok reached 6.9 million in 2009 and 37% of the Thai population resided in urban areas in 2011 (8).

The life expectancy at birth was 70 years for male and 75 for female in 2000 (7), gradually rising to 71 for male and 77.5 for female in 2014 (8). Health expenditures comprised 4.1% of GDP in 2011. Nation-wide, there was 0.34 physician per 1,000 people in 2006 and 1.99 hospital beds per 1,000 people in 2008 while there remained a large disparity among regions (1.13 physicians and 3.21 beds per 1,000 people were available for the capital during the same years while only 0.05 physician and 1.28 beds per 1,000 people for North-eastern region (7)). Moreover, there was a high risk of contracting major infectious diseases, for example leptospirosis for water contact diseases and bacterial diarrhoea for food or waterborne diseases. Malaria, dengue fever and Japanese encephalitis were common vector-borne diseases. In 2011, 95.8% of population (96.7% in urban and 95.3% in rural) had access to improved water source while 93.4% (88.7% in urban and 95.9% in rural) had access to improved sanitation (8).

In 2011, Thailand's GDP (purchasing power parity) was 614.2 billion USD and GDP (purchasing power parity) per capita was 9,100 USD. About 38.2% of the country's workforce was in the agricultural sector, 13.6% in the industrial sector and 48.2% in the service sector (8).

Thailand has a political system of Constitutional monarchy: a Prime Minister serves as the head of the government, which is formed by a coalition of political parties, while the Thai King is the head of the state (9). Administratively, the country is divided into 77 provinces (8).

2.2 *Preparedness and resilience*

Regarding disaster preparedness defined as the disaster knowledge and capacities developed to anticipate, respond to and recover from, the impacts of hazard events or conditions (10), Thailand has set up a comprehensive disaster management system within the territory, which is based on the Civil

Defence Act, 1979 and Civil Defence Plan, 2002. According to the Civil Defence Act, 1979, the disaster management system comprises of 3 levels (11): national (National Civil Defence Committee (NCDC), Department of Disaster Prevention and Mitigation (DDPM), National Safety Council of Thailand (NSCT), National Disaster Warning Centre), regional and local. (See Appendix I for the structure and role of disaster management system)

Concerning resilience as the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner (10), programmes, workshops, forums have been held in Thailand to increase community resilience towards disaster, including efforts from the international community. For example, UNESCO (United Nations Educational, Scientific and Cultural Organization) Bangkok had conducted workshops to develop preparedness of local stakeholders, wherein Education for Sustainable Development (ESD) had been adopted as the appropriate framework for disaster preparedness with the support of Japanese Funds-in-Trusts (JFIT) and the Education Task Force (ETF) had organized programmes to integrate Disaster Risk Reduction (DRR) into school education for strengthening DRR education in the community and empowering children on issues of disaster preparedness (12)(13). Creative education materials were also produced, such as packages named "Understanding Landslide Hazards and Preparedness in Northern Thailand" and "PLANET 4", which included animations/VCD, supplementary reference booklets and posters, as well as a board game named "Disaster Master", which aimed to convey disaster preparedness messages to the community, especially to the secondary school students for empowerment (14)(15)(16) In addition, Save the Children also provided children with basic natural disasters and disaster preparedness information through story book "The Alert Rabbit" and special training manual "Child-led Disaster Risk Reduction in Schools and Communities", of which Thai versions were available to cater for local children(17)(18)(19)

2.3 Hazard, vulnerability and risk

Regarding hazard defined as a dangerous phenomenon, substance, human activity or condition that may cause adverse health impacts, property or environmental damage, social and economic disruption,

etc. Thailand faces the hazard of rain storm. The Asian monsoon (seasonal reversing wind) plays a vital role in determining the variability of rainfall in the country (10). Thailand's rainy season starts in May and ends in October, during which strong southwest monsoons and monsoon troughs bring about heavy rainfall (20)(21). In Northern (Figure 2) and Central Thailand (Figure 3), high precipitation occurs from August to October every year, leading to frequent floods (20). Moreover, the number of rainy days and the amount of rainfall from 1990s onwards have shown an increasing trend (Figure 4) (22). The rainfall of the Northern and North-eastern Thailand (Figure 5) during the rainy season in 2011 was much higher than that in other years (23).

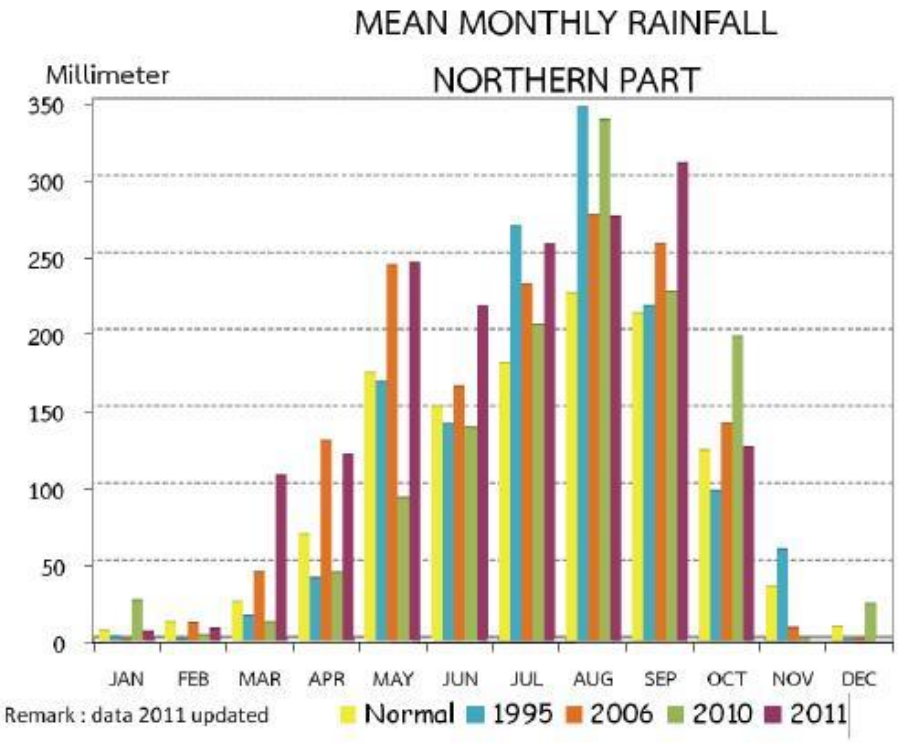

Figure 2 Mean monthly rainfall in Northern part of Thailand in different time periods(23)

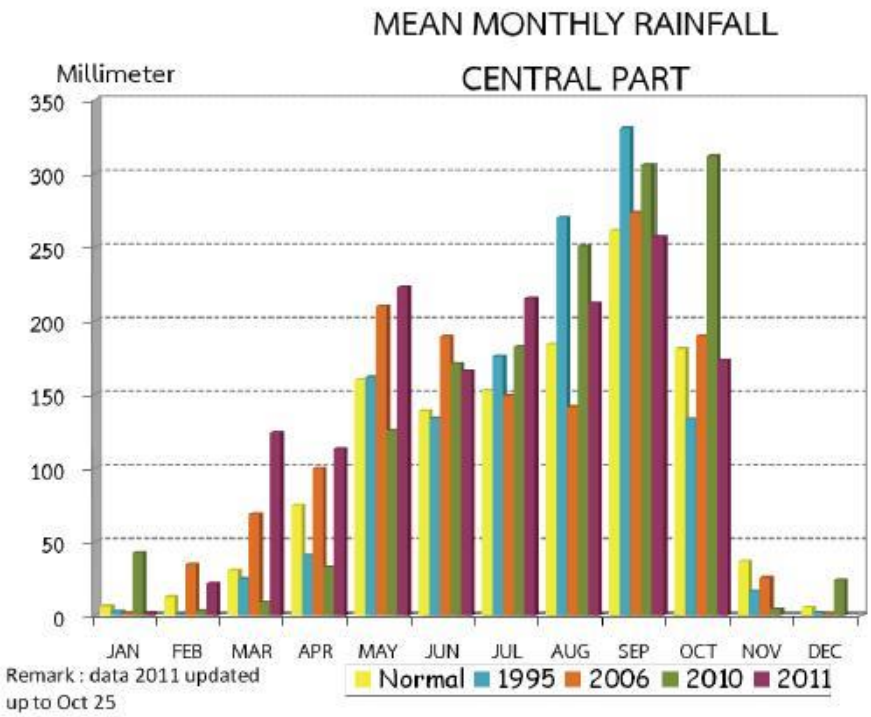

Figure 3 Mean monthly rainfall in Central part of Thailand in different time periods (23)

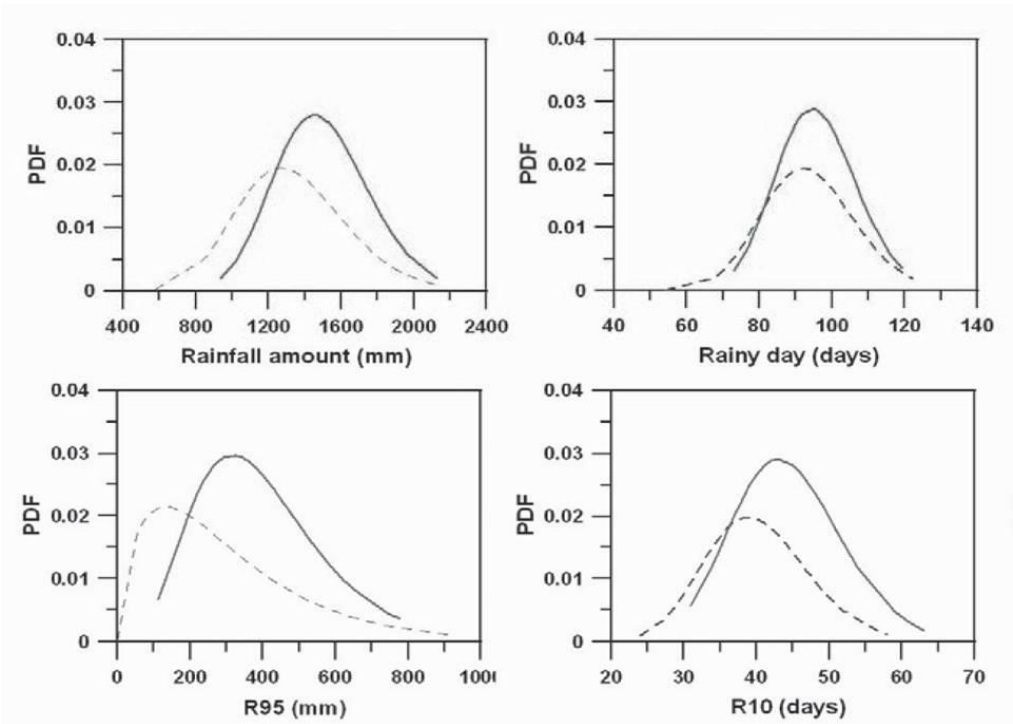

Figure 4 Annual probability distribution function (PDF) of selected rainfall extreme indices(22)

(PDF: probability distribution function; R95: very wet days (annual total rainfall when rainfall >95 percentile); R10: number of heavy rainfall days (annual count of days when rainfall >= 10mm); dashed line: before 1990; solid line: after 1990.)

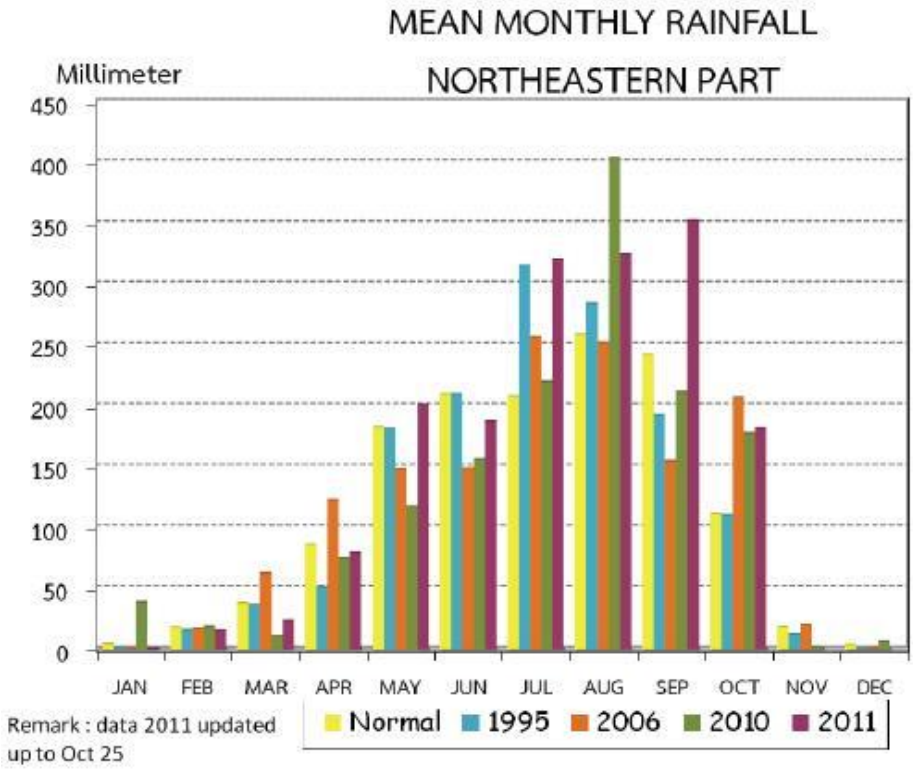

Figure 5 Mean monthly rainfall in North-eastern part of Thailand in different time periods(23)

Regarding risk defined as the combination of the probability of an event and its negative consequences, Thailand had experienced 54 major natural disasters in the decade of 2000-2009, of which 32 were floods while the rest included storms, drought, epidemics, etc. (10)(24) In 2010, the country was struck mainly by floods in the Northern, Central, North-eastern and Southern regions, which affected 9 million people. Yet, another 6.5 million people were affected by droughts in the same year. The hydrological and climatological disasters together brought negative impact on 22.8% of Thailand's population in 2010 (25). In 2011, more than 11.2 million people were adversely affected by natural disasters, of which more than 10.2 million were affected by floods (26). The economic loss caused by floods totalled more than US$ 40 billion in that year (27). During 1991-2011, Thailand has experienced 52 floods out of a total of 99 natural disasters, which affected about 42.7 million people and led to more than US$ 43.7 billion damages (28).

Vulnerability is the characteristics and circumstances of a community, system or asset that make the population or organization susceptible to the damaging effects of a hazard (10). The factors behind the vulnerability of Thailand to floods include its climate, its environment and the health of its population.

Regarding its climate, Thailand is made susceptible to floods by tropical storms (including the stronger typhoons and the weaker tropical depressions). The tropical storm season lasts from May to December. Storms are more frequent during August to November, with a peak frequency in September and October. On average, 3.5 storms occur annually, among which 0.9 storm occur during September and October. Storms bring heavy rain in its passage over land and thus the low-lying areas usually suffer from flooding (29). In addition, as the number of rainy days and amount of rainfall have been increasing from 1990s onwards and the rainfall in the Northern and North-eastern parts was particularly higher in 2011, the vulnerability of these regions to severe floods increased (23)(22).

Furthermore, environment-related factors aggravate the flood problem. These include insufficient capacity of rivers and canals, poor drainage and sewerage systems, inadequacy of reservoirs, forest destruction and poor land management. For the capital city, in particular, flooding is due to overbank flow on the flood plain of the Chao Phraya River, tidal effect superimposed on the flood wave of the river, land subsidence because of groundwater abstraction and waterways obstruction (29).

Besides, there is a great health disparity among regions: 1.14 physicians and 4.5 beds per 1,000 people for the capital while only 0.13 physicians and 1.3 beds per 1,000 people for North-eastern areas (7). Since the Northern and North-eastern parts have high probability of floods, the vulnerability of the population resulting from inadequate health resources in these regions increase the health risk. The vulnerability was worsened by the threat of contracting infectious diseases.

3. Health Crisis and Critical Health Events

3.1 Primary and secondary events

The rainy season in Thailand started in May 2011 as usual. The active southwest monsoon and monsoon trough brought about heavy rainfall in many locations in the country in June. Later in the month, tropical depression "Haima" led to heavy rainfall especially in the north of the country where flash floods and landslides were reported. Continued downpour rain exacerbated by tropical depression "Nock-Ten" in late July caused widespread floods in the Northern and North-eastern regions of Thailand (21). The floods were most severe in the Chao Phraya River basin as well as the Mekong River basin. Lower northern and central parts of the country were worst hit during August to September, while the run-off draining south combining with a seasonal high tide had threatened most areas of northern, eastern and western Bangkok and its vicinity in October (21)(23). The rainfall amount in Thailand from 1 January to 31 October was 1822.4 millimetres, about 28 percent above normal and the October rainfall was 201.8 millimetres, 10 percent above normal. Seasonal rainfall from May to October in 2011 was above normal of 20 – 60% in the northern part of the country (21). In late October, the wind-wave in the Gulf of Thailand was about 2 meters high (23). Apart from that, a high sea tide hit the west side of the Chao Phraya River on 15 November 2011 (30). Population displacement was limited in this slow onset of flooding.

One-third of Thailand had been flooded within the 3 months of heavy rainfall since late July, severely affecting 30 provinces (while 62 provinces out of the 77 were affected to some extent), 223 districts, 1,532 sub-districts, and 11,605 villages during peak-time, i.e. early to mid-October (23)(31)(32)(33)(34).

4. Damage & Consequences of Damage

4.1 Damage and disturbances (human)

The total number of death in the floods reported was 774 and three people were missing (35). The number of affected families and people topped in mid-November when about 1.9 million household (around 5.3 million people or about 8% of the total population) were affected (36).

Water-borne diseases during the floods resulted in about 400,000 people falling ill, while 367,656 people had contracted flood-related diseases. The common diseases included athlete's foot, flu, muscle pains, skin diseases and anxiety (37). In addition, the public were warned of dengue fever outbreak post disaster since about 40,000 people had developed the symptoms across the country. Out of the 37,728 dengue fever patients, 27 died eventually. The Central region had the highest number of patients followed by the North, the Northeast and the South (38). Over 5-10 % of flood victims had history of chronic diseases, while 100 victims suffered from severe food poisoning, nausea and diarrhoea after consuming the donated cooked food (39)(40).

4.2 Damage and disturbances (environment)

During the height of the crisis (mid to late October), 79 main highways in 15 provinces and 194 rural roads in 30 provinces were inundated and could not be passed (41). All the 14 north-bound railway routes were cancelled. The disaster had destroyed at least 837 factories in 6 industrial estates, resulting in a loss of 370,316 jobs. At least 1,300 food factories were affected, which accounted for 15% of all food plants in Thailand (42). An estimate of at least 2,050 formal schools, 155 non-formal education centres, 21 private schools and 155 vocational institutes and one university were affected. In total, about 3,214 educational institutions were damaged (43).

As Thailand is one of the major rice exporters in the world, the damage of the agricultural lands had made the price of benchmark 100% B grade Thai white rice jump as much as 34% to US$ 850 a tonne. Moreover, as most of the paddy seeds were washed away by floods, the seed shortage phenomenon was expected to lead to a drop in the next second smaller crop (44). Thailand has a second smaller crop producing around 7 million tonnes a year.

The total economic damages and losses as of 1 December 2011 were 1,425 billion THB (45.7 billion USD). 90% of the total loss was borne by private owners. The greatest damages and losses of a total of 1,007 billion THB (32 billion USD) were in the manufacturing sector (45). The giant industrial

zones Ayutthaya and Pathum Thani, which have many factories that produce goods like cars, electronic parts and clothes, were inundated, leading to temporary loss of jobs for thousands of people as factories were forced to suspend operations (46). The tourism sector was estimated to suffer from damages and losses of 95 billion THB (over 3 billion USD) as a result of the loss of tourism revenues for approximately 6 months. The agricultural sector had lost about 40 billion THB (1.3 billion USD) from the loss in production. The housing sector's damages and losses mainly in furniture and housing cleaning expenditures amounted to 84 billion THB (2.7 billion USD) (45). The damage of educational institutions led to an estimated damage cost of 2.5 billion THB (80 million USD) (43). Affected farming areas and fish/shrimp ponds were estimated at 12.63 million rai (2.02 million hectares) and 216,720 rai (about 34,700 hectares), respectively (35).

5. Responses

Responses refer to the provision of emergency services and public assistance during or immediately after a disaster to save lives, reduce health impacts, ensure public safety and meet the basic needs of the people affected (10). The humanitarian responses implemented can be divided into relief responses, recovery responses, and development. The objective of relief responses is to provide immediate, comprehensive actions and assistance to the affected areas and victims, while recovery responses are interventions carried out to restore functions to their pre-event status. Development is the improvement done and lessons learnt in light of the catastrophic event. After the floods in 2011, various committees in Thailand were assigned to handle flood relief and rehabilitation. The government's strategy for relief and rehabilitation could be discussed separately in three overlapping phases: Rescue, Restore and Rebuild (the 3 Rs).

5.1 Relief responses

Rescue or relief efforts were completed within 1 to 2 months. Flood Relief Operations Centre (FROC) was established to address the needs and distribute relief assistance to the victims, manage the floods and receive donations (47).

I. *Health*

109 million THB (3.5 million USD) was funded by the government to restore the medical system including hospitals, medical equipment and staffs. 20 million THB (640,000 USD) was spent additionally on water-borne diseases prevention measures (48).

Regarding physical health, the Department for Development of Thai Traditional and Alternative Medicine had increased the production of traditional medicines together with hospitals to provide herbal medication kits to victims for relieving flood-borne diseases and common illness such as sore throats, fever and joint pains. The department had also recruited around 1,000 volunteers who had been trained in acupuncture and those who are experienced in Thai massage therapy to treat the evacuees (49)(50). The Ministry of Public Health had provided more than 800,000 medication kits to the victims and had sent about 120 medical teams to take care of the flood-affected population (50)(51). In addition, the Government Pharmaceutical Organization had produced its own 2,000 kits to ensure enough medications for every flood victim who needed them (52). Moreover, the Office of National Health Security had established a medication centre to distribute medicines to flood victims promptly under emergency situations (53). Besides, the Ministry of Science and Technology had given out the newly-invented plastic boots to prevent spread of water-borne diseases (54).

As to mental health, the Department of Mental Health had recruited volunteers from 17 mental health institutions to care for flood victims (55). Psychologists and psychiatrists from both the government and the private sector were sent to help flood victims with high stress level (48)(56).

UNICEF had provided 20,000 insecticide-treated mosquito nets to help protect victims from dengue fever and other mosquito-borne diseases (57). NGOs such as Thai Red Cross had sent mobile health units (which consisted of a medical doctor, a pharmacist and a nurse) to the affected areas (58).

II. *Food and nutrition*

The government had allowed the import of food supply and other necessary consumer goods to ease shortage problems. These included canned fish, eggs, condensed milk, soy milk, UHT fresh milk, instant noodles, instant food and vegetables (59). In addition, milk powder for babies and dried food were available as donated items (60). A mobile kitchen set up by Thai Red Cross produced 4,800 hot cooked meals per day in Chai Nat and Phra Nakhon Si Ayutthaya provinces (58).

III. *Information*

A warning of disaster crisis was issued by the government to facilitate every sector to work together to tackle the flood problem (61). ICT had instructed its sub-divisions to put the communication system in place for reaching out to the victims effectively. An IT system was established to help people in various affected provinces. The hi-speed internet broadband, satellite telephones, home phones, electricity generators, mobile satellite transmitters and an e-conference system were developed to solve the communication problem. Coordination with vocational school students was in place to help fix victims' household electrical appliances and communication devices (62).

IV. *Shelter*

A total of 1,743 evacuation centres were arranged, which could provide accommodation for more than 800,000 people. 158 schools in 24 districts in Bangkok had been designated as temporary shelters (63). Thai Red Cross had distributed 448 shelter box sets which consisted of a tent with raised floor, bedding, kitchen utensils and daily necessities that could support a family of 10 people (58). JICA had also delivered tents, sleeping bags, blankets and mattresses (64)(65).

V. *Water and Sanitation*

A national-level committee was set up to directly oversee water management in 25 river basins of Thailand (66). Department of Water Resources had provided water purification, drinking water dispensers and distributed bio solution for treatment of waste water in affected areas(35)(41). Water

quality was improved by having Effective Micro-organism (EM) balls (67). Besides, personal hygiene products including sanitary napkins, tissues, soaps and toothpastes were imported (59). More than 300,000 water, hygiene and sanitation items such as soap, chlorine drops for water purification, alcohol hand-wash gel and garbage bags were provided by UNICEF to the affected families (68). Moreover, Thai Red Cross had moreover distributed 122,265 packs of bottled water and deployed water purifier trucks. Floating toilets have also been put into service (58). JICA had donated water tanks and water purifiers (64)(65).

VI. *Security*

Soldiers from all units were instructed to assist victims and operate at flood-risk areas in the country. Army officials also worked with the police to protect the flood walls in Eastern Bangkok (69). Police officials were ordered by the flood relief operation unit of the Metropolitan Police Bureau to prepare vehicles and equipment for the rescue of flood-affected residents. Moreover, the Ministry of Defence and the Armed Forces were ordered to guard important places such as the Grand Palace, power plants, waterworks offices, Suvarnabhumi and Don Mueang Airports, etc. Security guards and police officers were required to watch for any danger and report to the FROC (61).

In addition, various government agencies and private bodies had together worked on water diversion of the flood water. The Marine Department, the Fisheries Department and the Thai Ship Owners Association had jointly mobilized more than 1000 ships to divert water from the Chao Phraya River into the sea. This operation took place simultaneously at 3 major rivers (the Chao Phraya, the Tha Chin and the Bang Pakong) (70). The Bangkok Metropolitan Administration and the Department of Irrigation had cooperated and coordinated for the actions undertaken (71). The Marine Department had dispatched 13 inspection boats to monitor the situation and facilitate the water traffic (72). 3,000 large-sized sandbags were used to create a 3.5 kilometre-long dyke from Khlong Prem Prachakorn to Lak Hok (30).

While the relief responses had rightly employed the joint effort from the Thai government, local NGOs and international partners, notably aid fund and materials provided by relief agencies in foreign countries including Japan, China and others, better preparedness at local level and development of local resilience could be improved to tackle future disasters include flooding (64)(65)(73)(74)(75).

5.2 Recovery responses

I. *Health*

MoPH had organized rehabilitation campaign in Ayutthaya province. The province was chosen because it was one of the worst-affected locations as well as one of Thailand's major historical sites and tourism centres. The campaign involved activities such as rehabilitation of mental health, repair of damaged public health facilities and disease control (76).

II. *Shelter*

The government had compensated each household at least 5,000 THB (162 USD) for the flooded houses and damaged property (77). Affected people were also entitled to have a maximum of 100,000 THB (3,200 USD) tax deduction for repairing their homes (78).

III. *Water and Sanitation*

The Pollution Control Department had checked the water quality in flood-hit industrial. It also worked with the Ministry of Industry to inspect industrial waste and suggest effective ways to dispose the waste to protect the public from toxic chemicals (79). Canals and waterways were cleared to facilitate water drainage (80). 3.2 billion THB (102.4 million USD) would be spent on the irrigation system and reservoirs (78).

IV. *Economy*

A package of assistance measures was offered to flood-hit companies by BOI. A maximum of 325 million THB (10.3 billion USD) was set aside as loans for affected population and business operators (67). Customs and import duties were waived on imported machineries, components brought in for

replacing and repairing those damaged, and vehicles brought in for offsetting a domestic supply shortage (81)(82)(83)(84). Income tax exemption was offered to affected people (83). There were also other measures on taxes and investment incentives such as visa application and employment licensing procedure facilitation to promote economy recovery (67)(77)(83).

The rising price of rice (850 USD a tonne) due to the destruction of the agricultural areas and products had threatened Thailand with its position as one of the major rice exporters, since rice produced in India was sold at a price of 460-470 USD a tonne, almost half of that of Thailand at that time. The Thai government therefore stepped up its rice buying scheme to support affected farmers in order to promote a faster recovery of the economy (44).

V. *Infrastructure*

Restoration efforts are expected to complete within 1 year (47). More than 17.9 billion THB (573 million USD) would be spent on 4 major projects for recovery and rehabilitation of damaged infrastructure. The projects included restoration of runways, taxiways and other facilities at Don Mueang Airport; urgent repair of 708 highways; rehabilitation of 549 rural roads and restoration of 790 flood-hit educational institutions and offices (85).

The recovery responses involved mostly a top-down approach in monetary terms. More participation of local and international NGOs involving local communities in a bottom-up approach may help tailor the recovery efforts to local needs and achieve more cost-effective use of recovery resources.

6. Development

"Rebuild" or development consisted of works to build confidence, restore prosperity and stability, and improve future preparedness for floods. These include system improvement and community resilience.

I. *System improvement*

Two committees (SCRF and SCWRM) were set up to work on rehabilitation and putting a national

water resources management system into place (47). A National Water Information Centre will also be set up for developing effective and unified information, forecast and warning systems with the use of modern technology, such as satellite and long-distance monitoring systems (86). Moreover, four more canals in Nakhon Pathom and Samut Sakhon were to be dredged to strengthen water drainage capacity (87). More water retention sites (Kaem Ling - Monkey's Cheek) were planned to be built (80). In addition, more embankments, sluice gates and pumping stations would be built and reinforced for water management in industrial estates (86)(88). Besides, a data system would be set up in collaboration with JICA to more accurately estimate information about the water volume in coming years, which in turn would help create confidence in flood prevention and control (89).

II. *Community resilience and empowerment*

Community resilience plays an important role to mitigate the adverse effect of disaster. A major flood drill was expected to be held in August 2012 to look for problems that might arise (80). Moreover, people's participation in national water and water resource management were to be enhanced through facilitating consultations and public hearing in the process of making provincial development plan, in order to link up the communities, public organisations, local administration and private sectors (67).

III. *Risk communication*

After the 2011 floods, the flood warning system would be improved for efficient flood emergency management to ensure effective communication and warning in affected areas as well as to monitor and examine disaster information from meteorological satellite. The national and local information centre would be established to link communication and warning system. Handbook of disaster and emergency policies would also be published and distributed to national and local organisations for communication purpose (67).

The development phase provided a good example through a combination of centralized investment in infrastructure to enhance disaster preparedness, localized measures in building up community resilience and empowerment, and a risk communication and disaster warning system covering both

national and local levels.

7. Media reporting

To understand the role of media reporting during the 2011 Thailand floods, Factiva was used as the database to search for media reports. Factiva is one of the most widely used news information database, covering 6,500 newspapers, magazines, wire services, and academic and trade journals all over the world.

From the database, 348 items were identified, in which 136 focused on business/economy impact (e.g. manufacturing, agricultural loss) (table 1). The coverage of the North/North-east region was about one-third of that of Bangkok (table 2) and after mid-September 2011, almost all reports focused on the capital city (29)(77). All these have reflected the imbalance in reporting the impact of the floods on different sectors and regions.

Role of the media

In addition to creating awareness and disseminating information, the United Nations International Strategy for Disaster Reduction (UNISDR) believes that the media can play more crucial role in disaster response: "The media can influence political decisions, change public attitudes and, of course, save lives." (90). Media should report disastrous events, their causes and effects in a balanced and objective way so that appropriate evidence-based preparatory, relief, recovery and developmental actions can be taken. The role of the media in disaster response can be summarised as follows:

- Reporting the disastrous event

  The media is responsible for reporting the fact about disastrous event in an objective way. This includes reporting what disaster has happened, as well as when, where, and how it happened. Apart from this, the magnitude of the disaster, extent of its adverse effect, details of the areas worst affected should also be reported. During flooding, weather forecast should be widely communicated to the public to allow them to know the latest situation and take necessary action to prepare and respond.

- Providing practical information to victims, donors and volunteers

  The media could inform victims where they can obtain provisions of shelter, food and nutrition, hospital and medical supplies, and other necessities, as well as where they can find news of their missing relatives and friends. Media could also inform donors and volunteers on possible actions that they can take.

- Holding relevant body accountable

  In its guide book for journalists covering disaster risk reduction, UNISDR suggests that "holding people accountable for their areas of responsibility is one of the basic purposes of a properly functioning media" (90). The media could hold relevant bodies accountable for a disaster by exposing its root cause, including any human factor that triggered the disaster, worsened the its impact, hindered the process of its relief and recovery, etc.

Factiva (n=348)				
Focus	Business/Economy	Education	Food	Health
	136	1	14	56
	Jobs	Other life-forms	Prevention	Recovery
	2	2	7	3
	Relief	Security	Shelter	Structure
	5	5	1	6
	Tourism	Transport	Water and sanitation	General effect
	4	14	2	89
	Critics			
	1			

Table 1 Number of articles found in Factiva concerning different aspects of the floods

Factiva (n=348)				
Affected region	North/North-east	Central	Bangkok	South
	23	9	78	9
	Thailand as a whole	Unspecified	Regions outside Thailand	
	175	45	9	

Table 2 Number of articles found in Factiva concerning the impact of the floods in different regions of Thailand

8. Discussion

Even though Thailand has developed a coordinated system in disaster preparedness, the number of people affected by the floods in 2011 occurred from north to south of the country following heavy rainfall remained very high (about 1.9 million households or 5.3 million people) (36). Other than the unusual heavy raining, the inadequate drainage system might be another major factor behind the huge impact of the floods, which suggests a low level and quality of preparedness in terms of infrastructure.

The prolonged period of time taken for the flood water to recede had led to a high number of people falling sick during the rainy season (367,656 people had contracted flood-related diseases) (37). While people were warned of the possible outbreak of dengue fever since it is one of the most common infectious diseases in the country, about 40,000 people had developed the symptoms. This is attributable to the rainy weather and the long-stay of flood water, which provided ideal breeding grounds for mosquitoes. The flood water might also contaminate the water source and cause food to spoil more easily, resulting in many flood victims suffering from health conditions like severe food poisoning and diarrhoea after consuming the water and food (40). This may illustrate a low level of community preparedness toward the health risk of disaster.

The developments post-disaster seemed to be rightly tackling these two problems via system and infrastructure improvement, as well as community resilience enhancement.

Media reporting

During the course of the 2011 floods, the media was found to have played only a very limited role in disaster risk reduction and exploration of the causes of disaster. The media tended to focused more on the situation of the capital, as well as the business sector and the economy.

Little attention was paid to the situation in the North/North-east regions, perhaps due to the annual occurrence of floods in these regions, which makes flooding in those regions of less news value.

However, people in these regions are actually more vulnerable to the impact of floods because of the high frequency of flooding in these regions and the disparity in health resources between the capital and the rest of the country.

The media might also focus too much on the economy and business side of the impact of the floods at the expenses of those essential issues for flood victims, such as water and sanitation, food and nutrition, as well as shelter. As the UNISDR points out, journalist usually "treat the incident and not the cause" in their disaster reporting (90). However, previous experience has shown that the media could play a leading role in terms of advocating for policy changes in disaster preparedness and response, raising awareness and education in disaster and its impacts, addressing vulnerabilities and thereby saving lives.

Limitations

Firstly, this study is limited by its range of information source. Information about the flood situation and the effort paid in relief and recovery responses were mostly obtained from websites of different government departments in Thailand, which may be comprehensive enough to address the facts of the flood situation as Thailand has established a highly-coordinated system in reporting and tackling the disaster, while more information about the relief and recovery response may need to come from non-governmental organisations to determine whether the responses were effective.

Moreover, language barrier is another limitation to the study. While English content is available in most of the Thai government departments' websites, much government and non-government information is available only in Thai language, which limits the source of information for the study.

The framework is adopted from the "Guidelines for Reports on Health Crises and Critical Health Events". It is for on-site reporting of the disaster cases and mainly focuses on the immediate impact on human and environment, with minor focus on the relief and recovery responses. In this disaster case study, focus was given to the relief and recovery responses and the aspects on media reporting.

Information search was done on the government's and NGO's websites and other online sources, without any on-site reporting, and thus information on the damage to and impacts on human and environment was limited. In fact, much of the information found online had documented the relief and recovery response in a fairly holistic manner; hence the information search was sufficient to address the questions while this is one of the gaps to be addressed on the framework.

Moreover, another gap for the framework is that it does not suggest on issues of media reporting. As most of the countries do, media reporting has been playing a significant role on reflecting the situation, holding accountability of relevant body etc., therefore media reporting is worthwhile to be addressed in this case study.

9. Lessons Identified and Actions Recommended

In addition to general enhancement of infrastructure against flooding and community resilience mentioned in the discussion section, other lessons to be learnt from the 2011 Thailand floods include the need to develop the health system in Northern and North-eastern Thailand and the health volunteer network, to provide and promote flood-resistant crops, structures and shelters, to improve coordination, and to promote more appropriate media reporting mentioned above.

Firstly, there is a need to develop the health system in Northern and North-eastern Thailand. As mentioned above, there is a great disparity in health between Northern Thailand and Southern Thailand, while the Northern part is threatened by annual flooding and its people more vulnerable than those in the South. Development of sustainable health system and infrastructures in the North and North-eastern parts of the country could help reduce the vulnerability of the people and the government should take the initiative to spend more resources on healthcare in these regions. Reform on the medical training and practice in the country might guarantee the supply and availability of healthcare workers in the Northern part: medical graduates are required to spend certain number of years to practice in the north before they can practise in other parts of the country.

Secondly, while the Royal Thai Government took up the main response role, a comprehensive health volunteer network should be set up to build capacity in the community and to enhance the effectiveness and efficiency in emergency preparedness and response in the future.

Thirdly, the Royal Thai Government had only provided assistance in monetary terms to affected populations (including the farmers) in this disaster. While in the long term, seeds of flood-resistant crops, structures and shelters should be provided and promoted. The introduction of flood-resistant crops could minimize potential agricultural loss. These seeds may be too expensive for farmers to afford and thus the government should encourage the usage by providing free seeds and subsidies to help farmers sustain this practice. Besides, flood-resistant structures and shelters should be built and promoted to mitigate future physical destruction caused by flooding. This could be achieved through using more durable materials, planting water-resistant plants and trees around the structures as a barrier to flood water and organising community outreach activities to promote flood-resistant design. It is important that the post-flood rebuilding programmes be based on the lessons learnt regarding the impact of floods on houses and its long-term consequences.

Fourthly, coordination should be improved among different governmental organizations, NGOs and other UN partners. The capacity of the government could be further enhanced by having different organizations to support the response effort and reflect on the response plan developed by the government. This could be achieved by having regular meetings among different parties to share such information as different hazards concerned, and the corresponding action plans needed.

Fifthly, a media checklist has been proposed by the guideline published by the UNISDR on media reporting, which includes the following useful advices: general questions on the context, the structural and non-structural elements behind the disaster, the preparedness measures, the economics, the recovery process and the responsibility. Apart from focusing on the economic impact of the disaster, media should report information on areas essential for disaster victims (such as shelter, food, water and sanitation), so that they would know what the current situation is and where they can seek help

from. Moreover, the media reports should not be biased toward a particular region, such as the capital, but should also concern other affected regions, in order to give the public and the officials a comprehensive picture of the disaster.

As mentioned above, post-disaster developments and improvements in the overall disaster response system, community resilience and empowerment, as well as risk communication would also go a long way for the country to prepare for future floods. As to improvements in the overall response system, the development of information system in estimating the water volume at the National Water Information Centre could more accurately determine the threat and help the government make well-planned actions and responses. Moreover, the construction of canals and improved water management system could help relieve the severity of the impact of the flood water on the country. In addition, public's participation in the national water and water resource management could be enhanced. Making people aware of the importance of the overall disaster response system could help build up their resilience. Last but not least, warning system should be improved, which in turn could help the country and the people get better prepared and protect their lives and properties when disasters like flooding are coming.

Lesson learnt	**Details**
1. Development of health system in Northern and North-eastern Thailand	- Development of sustainable health system and infrastructures to reduce vulnerability in the regions - Reform on the medical training and practice to guarantee the supply and availability of healthcare workers in the Northern part of the country
2. Development of health volunteer network	- A comprehensive health volunteer network to be set up for capacity-building in the community and for enhancing effectiveness and efficiency in emergency preparedness and response in the future

3. Provision and promotion of flood-resistant crops, structures and shelters	- Seeds of flood-resistant crops, structures and shelters provided and promoted to minimize potential agricultural loss - Flood-resistant structures and shelters to be built to mitigate the physical destruction caused by flooding by using more durable building materials and planting water-resistant plants and trees around the structures as a barrier to flood water
4. Improved coordination	- Coordination should be improved by having regular meetings among stakeholders to share information like different hazards concerned and the relevant action plans.
5. More appropriate media reporting	- Media reports should cover different regions of the country and different aspects of the flood impact
6. Other post-disaster developments and improvements	Response system improvement - Development of information system in estimating the water volume at the National Water Information Centre to help the government make well-planned responses - Construction of canals and improved water management system to help relieve the impact Enhancement in community resilience and empowerment - Enhanced participation of the public in the national water and water resource management Risk communication - Warning system to be improved to get the country and people better prepared for future floods

10. Conclusions

The Thailand floods in 2011 were the worst one for the country in recent 50 years. It affected a wide range of sectors, including agricultural and other manufacturing industries. The government had coordinated the relief and recovery response during this disaster. Developments in terms of response system improvement, community empowerment and enhanced risk communication have been made in light of the event. Development of health system in Northern and North-eastern Thailand, development of health volunteer network, provision and promotion of flood-resistant crops, structures and shelters, improved coordination among stakeholders, and more appropriate media reporting are recommended. The effort paid can hopefully mitigate the adverse effect of future disasters in the country, especially that of floods.

11. References

. Kulling P, Birnbaum M, Murray V, Rockenschaub G. Guidelines for reports on health crises and critical health events. Prehospital disaster Med Off J Natl Assoc EMS Physicians World Assoc Emerg Disaster Med Assoc with Acute Care Found. 2010;25(4):377–83.

2. Paul B. Responding to disasters. In: Oxford Handbook of Public Health Practice. 2nd ed. Oxford University Press, USA; 2006. p. 383–5.

3. The Sphere Project. Humanitarian charter and minimum standards in humanitarian response [Internet]. The Sphere Project. 2011. 402 p. Available from: http://www.spherehandbook.org

4. World Health Organization. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York. In: Official Records of the World Health Organization. 1946. p. 100.

5. Acheson D. Public health in England: the report of the Committee of Inquiry into the Future Development to the Public Health Function. Her Majesty's Stationery Office. London, England; 1988.

6. Tourism Authority of Thailand. About Thailand: fast facts.

7. World Health Organization: Country Office for Thailand. WHO country cooperation strategy 2012-2016 Thailand. 2011.

8. Central Intelligence Agency. The world fact book- East and Southeast Asia: Thailand.

9. Tourism Authority of Thailand. About Thailand: politics.

10. United Nations International Strategy For, DisasterReduction. Terminology [Internet]. 2009. Available from: https://www.unisdr.org/we/inform/terminology

11. World Health Organization. Emergency and Humanitarian Action. Country report - Thailand: hazard profile and disaster preparedness.

12. United Nations Educational Scientific and Cultural Organization. Education for natural disaster preparedness in Asia-Pacific in the context of ESD [Internet]. 2005. Available from: http://www.adrc.asia/acdr/2007astana/Presentations/Day2_Panel1/Panel1_UNESCO-BKK.pdf

13. United Nations Educational Scientific and Cultural Organization. Asia-Pacific regional workshop on school education and disaster risk reduction. 2007.

14. Thailand Environment Institute. Production of Thailand-specific educational materials for natural disaster preparedness in the context of education for sustainable development: Thailand national launch [Internet]. 2006. Available from: http://www.unescobkk.org/fileadmin/user_upload/esd/documents/workshops/landslides/Video_Launch_Report_27.10.06.pdf

15. United Nations Educational Scientific and Cultural Organization. Natural disaster preparedness and education for sustainable development. 2005.

16. United Nations Educational Scientific and Cultural Organization. Disaster master- natural disaster preparedness game. 2007.

17. Save the Children Sweden – Southeast Asia and The Pacific Regional Office. The alert rabbit:

part 1 [Internet]. 2008. Available from: http://resourcecentre.savethechildren.se/sites/default/files/documents/3239.pdf

18. Save the Children Sweden – Southeast Asia and The Pacific Regional Office. The alert rabbit: part 2 [Internet]. 2008. Available from: http://resourcecentre.savethechildren.se/sites/default/files/documents/3240_0.pdf

19. Vanaspongse C, Ratanachena S, Rattanapan J, Chuthong S, Intraraksa R. Training manual: child-led disaster risk reduction in schools and communities [Internet]. Bangkok; 2007. Available from: http://resourcecentre.savethechildren.se/sites/default/files/documents/2727.pdf

20. Asian Disaster Reduction Center. Information on disaster reduction of the member countries: Thailand.

21. Thai Meteorological Department. Climatological Center of Meteorological Development Bureau. Rainfall and severe flooding over Thailand in 2011. 2011.

22. Limjirakan S, Limsakul A, Sriburi T. Trends in temperature and rainfall extreme changes in Bangkok Metropolitan Area. J Environ Res [Internet]. 2010;32(1):31–48. Available from: http://www.tci-thaijo.org/index.php/aer/article/view/9699

23. World Meteorological Organization. Flooding in Thailand.

24. Centre for Research on the Epidemiology of Disasters. Search details disaster list. The International Disaster Database, disaster list; country: Thailand, period: 2000-2009, disaster group: natural.

25. Centre for Research on the Epidemiology of Disasters. Annual disaster statistical review 2010: the numbers and trends. 2011.

26. Centre for Research on the Epidemiology of Disasters. Total number of people affected in disasters in Thailand 2011. The International Disaster Database, advanced search; country: Thailand, period: 2011, disaster group: natural, total number of total affected by country and by disaster type.

27. Centre for Research on the Epidemiology of Disasters. Total number of damage in US$(,000) in disasters in Thailand 2011. The International Disaster Database, advanced search; country: Thailand, period: 2011, disaster group: natural, total number of estimated damage costs (US$) by country and by disaster type.

28. Centre for Research on the Epidemiology of Disasters. Summarized table of natural disasters in Thailand from 1991 to 2011. The International Disaster Database, country profile; natural disasters: Thailand.

29. Food and Agriculture Organization. Technical session 1: introduction to flood management-flooding and flood management in Thailand.

30. Reliefweb. Thailand: FROC: overall flood situation has improved, Report- Government of Thailand. 2011.

31. International Federation of Red Cross and RedCrescent Societies. Information bulletin: Thailand flood. 2011.

32. 24/7 Emergency Operation Center for Flood Storms and Landslide. No. 45/2011, Sunday,

October 9, 2011, 11:00 AM. 2011.

33. 24/7 Emergency Operation Center for Flood Storms and Landslide. No. 54/2011, Tuesday, October 18, 2011, 11:00 AM. 2011.

34. Reliefweb. Thailand: Floods in Thailand - Situation Report (SR-14), 20 October 2011, Report- World Health Organization. 2011.

35. 24/7 Emergency Operation Center for Flood Storms and Landslide. No. 98/2011, Tuesday, December 20, 2011, 11:00 AM. 2011.

36. 24/7 Emergency Operation Center for Flood Storms and Landslide. No. 81/2011, Wednesday, November 16, 2011, 11:00 AM. 2011.

37. Reliefweb. Thailand: almost 400,000 across Thailand have been sick due to floods, Report- Government of Thailand. 2011.

38. Reliefweb. Thailand: 40,000 people reportedly sick from dengue fever, Report- Government of Thailand. 2011.

39. Reliefweb. Thailand: 5-10% flood evacuees contracted chronic diseases, Report- Government of Thailand. 2011.

40. Reliefweb. Thailand: flood victims further suffer food poisoning and lack of hygiene, Report- Government of Thailand. 2011.

41. 24/7 Emergency Operation Center for Flood Storms and Landslide. No. 56/2011, Thursday, October 20, 2011, 11:00 AM. 2011.

42. The Government Public Relations Department. No Title. 2011.

43. United Nations Educational Scientific and Cultural Organization. Thailand's worst flooding in decades impact on education and cultural heritage. 2011.

44. Thomson Reuters. Floods may damage quarter of Thai rice crops, exports hit. 2011.

45. World Bank. The World Bank supports Thailand's post-floods recovery effort. 2011.

46. International Institute for Environment and Development. Thailand's floods: complex political and geographical factors behind the crisis. 2011.

47. Reliefweb. Thailand: strategic measures for the country's rehabilitation, Report- Government of Thailand. 2011.

48. Reliefweb. Thailand: MOPH to care for mental health of flood victims, Report- Government of Thailand. 2011.

49. Reliefweb. Thailand: production of Thai traditional medicine stepped up to help flood victims, Report- Government of Thailand. 2011.

50. Reliefweb. Thailand: herbal medication kits to be distributed to flood victims, Report- Government of Thailand. 2011.

51. Reliefweb. Thailand: MOPH sends out 120 medical teams to aid flood victims, Report- Government of Thailand. 2011.

52. Reliefweb. Thailand: medical kits to be distributed to flood victims, Report- Government of Thailand. 2011.

53. Reliefweb. Thailand: hotline set up to supply flood affected people with needed medications, Report- Government of Thailand. 2011.

54. Reliefweb. Thailand: The Science Ministry to hand out plastic boots to flood victims, Report- Government of Thailand. 2011.

55. Reliefweb. Thailand: mental health specialists to care for flood victims, Report- Government of Thailand. 2011.

56. Reliefweb. Thailand: psychiatrists working hard on flood victims in distress, Report- Government of Thailand. 2011.

57. United Nations Children's Fund. UNICEF providing 20,000 mosquito nets to protect flood-affected families. 2011.

58. Thai Red Cross Society. Thai Red Cross fully deployed assisting flood victims. 2011.

59. Reliefweb. Thailand: gov allows imports of necessary consumer goods to reduce shortage during flooding, Report- Government of Thailand. 2011.

60. Reliefweb. Thailand: Labor Ministry donates 1.7 million THB worth of necessary items to flood victims, Report- Government of Thailand. 2011.

61. Reliefweb. Thailand: gov issues disaster crisis warning, Report- Government of Thailand. 2011.

62. Reliefweb. Thailand: ICT Ministry establishes communication system to help flood victims, Report- Government of Thailand. 2011.

63. United Nations Population Fund. During Thailand's floods, UNFPA steps in. 2011.

64. Reliefweb. Thailand: Japan offers aid to flood victims, Report- Government of Thailand. 2011.

65. Reliefweb. Thailand: MFA: four nations offer help to flood victims in Thailand, Report- Government of Thailand. 2011.

66. Reliefweb. Thailand: government to set up special committee to manage water resources nationwide, Report- Government of Thailand. 2011.

67. Royal Thai Embassy. Summary of the Government's relief and recovery plan and package. 2011.

68. United Nations Children's Fund. UNICEF providing 300,000 water, sanitation, hygiene items for flood victims. 2011.

69. Reliefweb. Thailand: soldiers from all units told to operate at all flood-risk areas, Report- Government of Thailand. 2011.

70. Reliefweb. Thailand: PM launches locally pooled efforts to drive excessive run-off to the sea, Report- Government of Thailand. 2011.

71. Government House Media Center. FROC's briefing on 23 October 2011 at 11.25 hrs: Klong Prapa overflow stopped, while focus will be on controlled diversion. 2011.

72. Reliefweb. Thailand: water diversion operation to start Tuesday, Report- Government of Thailand. 2011.

73. Reliefweb. Thailand: China offers aid to Thailand, Report- Government of Thailand. 2011.

74. Reliefweb. Thailand: Ambassador of Brunei Darussalam provides flood relief assistance to Thailand, Report- Government of Thailand. 2011.

75. Reliefweb. Thailand: the Kuwait government has authorized 3.5 million USD aid to the flood victims in Thailand, Report- Government of Thailand. 2011.

76. The Government Public Relations Department. Water drainage in Bangkok and nearby provinces adjusted in line with the changing situation. 2011.

77. Union of Catholic Asian News (UCAN). Flood victims decry compensation offer. 2011.

78. The Government Public Relations Department. More projects and tax measures approved to help flood victims. 2012.

79. The Government Public Relations Department. Energy assistance to flood-hit industries. 2011.

80. The Government Public Relations Department. Plans underway to prevent a recurrence of severe flooding. 2011.

81. The Government Public Relations Department. Accelerating further measures to help flood victims and flood-hit businesses. 2011.

82. The Government Public Relations Department. Post-flood restoration in Don Mueang and additional tax measures to help flood victims. 2011.

83. The Government Public Relations Department. Assistance for flood-affected entrepreneurs. 2011.

84. The Government Public Relations Department. An additional fund to restore flood-hit facilities and a move to restore investor confidence. 2011.

85. The Government Public Relations Department. Almost 18 billion baht approved for four flood recovery projects. 2011.

86. The Government Public Relations Department. Master plan on water resources management. 2011.

87. Reliefweb. Thailand: Irrigation Department ready to propose long-term flood solution, Report- Government of Thailand. 2011.

88. The Government Public Relations Department. Inspecting flood prevention measures from upstream to downstream provinces. 2011.

89. The Government Public Relations Department. Short- and long-term operations approved for water management. 2011.

90. United Nations International Strategy for Disaster Reduction (UNISDR). Disaster through a different lens - Behind every effect, there is a cause: a guide for journalists covering disaster risk reduction [Internet]. 2011. Available from: http://www.unisdr.org/files/20108_mediabook.pdf

12. Appendices

Appendix I: Structure and role of disaster management system in Thailand

For the national level, the NCDC is the main policy-making body which coordinates activities relevant to disaster management and civil defence. The committee is chaired by the Ministry of Interior. Governmental organizations concerning with disaster management response are the members of the committee. For DDPM, it was established in 2002 under the Ministry of Interior, acting as the NCDC Secretariat. It is responsible for coordinating other agencies which are also in charge of disaster relief response such as TMD, RID, Department of Water Resources for DRR etc. DDPM also helps in identifying disaster prevention measures and policies and formulate the National Civil Defence Plan- the master plan providing guidelines to responsible management bodies for formulating their own operational plan. Moreover, the agency provides technical assistance, equipment and training courses for the public and local organizations[11]. NSCT was established in 1982 and is responsible for handling man-made disaster management only. National Disaster Warning Centre was established to detect earthquake and to analyse seismic data to determine the tsunami generation possibility before issuing notification to the public, related authorities and rescuers for evacuation of people.

For regional level, 12 Regional Disaster Prevention and Mitigation Centres of DDPM were established to provide technical assistance and auxiliary services to local Civil Defence Committees. For local level, the local Civil Defence Committees are the main actions at provincial, district levels[11]. There is no single division devoted to EHA/HAC in the MoPH. The Narenthorn Centre, which provides EMS throughout Thailand, is planned to be strengthened by the MoPH. Thailand has established a GIS to manage disaster-related information on chemical risk areas, flood-prone and mudslide-prone areas as well as database of the network of concerned agencies and experts[11]. In addition, a disaster emergency relief fund of 50 million THB (1.2 million USD) was set up in every province for enhancing immediate response capacity.

Appendix II: Terminology (from UNISDR)

Disaster risk reduction	The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.
Hazard	A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
Preparedness	The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.
Recovery	The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
Response	The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.
Risk	The combination of the probability of an event and its negative consequences.
Vulnerability	The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

13. Keywords

2011 Thailand floods; crisis event management; crisis management; critical health event; disaster; Disaster Case Studies Series; disaster cycle model; disaster management; disaster response; emergency; emergency medical service(s); floods; health crisis; preparedness; Thailand

14. Abbreviations

BMA	Bangkok Metropolitan Administration
BOI	Board of Investment
DDPM	Department of Disaster Prevention and Mitigation
DRR	Disaster Risk Reduction
EHA/HAC	Emergency and Humanitarian Action/Health Action in Crises
EMS	Emergency medical services
ESD	Education for Sustainable Development
ETF	Education Task Force
FROC	Flood Relief Operations Centre
GIS	Geographic Information System
ICT	Ministry of Communication and Technology
JFIT	Japanese Funds-in-Trusts
JICA	Japan International Cooperation Agency
MoPH	Ministry of Public Health
NCDC	National Civil Defence Committee
NGOs	Non-governmental organizations
NSCT	National Safety Council of Thailand
PRD	Public Relations Department
RID	Royal Irrigation Department
SCRF	The Strategic Formulation Committee for Reconstruction and Future Development

SCWRM	The Strategic Formulation Committee for Water Resources Management
SME	Small and medium-sized enterprise
THB	Thai Baht
TMD	The Meteorological Department of Thailand
UHT	Ultra heat treated
UN	United Nations
UNICEF	United Nations Children's Fund
UN-ISDR	United Nations International Strategy for Disaster Reduction
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization