

**TYPHOON PREPAREDNESS  
IN SOUTHERN VIETNAM**

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Vietnam**

45<sup>th</sup> International Course in Health Development  
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TITLE

**TYPHOON PREPAREDNESS IN SOUTHERN VIETNAM**

A thesis submitted in partial fulfilment of the requirement for the degree of

Master of Public Health

by

Thuan Huu Vo

Vietnam

Declaration:

Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.

The thesis **Typhoon Preparedness in Southern Vietnam** is my own work.

Signature:.....

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## **ABSTRACT**

Although typhoons have not occurred frequently in Southern Vietnam, they caused huge damage for this region. Their effects are on human deaths, injuries, and infrastructure caused by cyclonic winds, storm surges and heavy rains. In this thesis the likely reasons for this damage are explored and the extent to which these hazards could have been prevented by comparing the typhoon preparedness in Southern Vietnam against the international recommendations for disaster preparedness.

This comparison was made based on literature and by using the nine elements for disaster preparedness by Randolph Kent: vulnerability assessment, planning, institutional framework, information systems, resource base, warning systems, response mechanisms, public education and training, and rehearsals.

Three main strong points are that Vietnam has a National Strategy for Natural Disaster Prevention, Response and Mitigation; a well-known response mechanism: "four-on-the-spot"; and a large-scale Community-Based Disaster Risk Management project for the most nationwide vulnerable communities.

Gaps were found in all nine elements of typhoon preparedness for Southern Vietnam, of which four could be considered the most important ones. Firstly, vulnerabilities have not been assessed systematically so that decision-making for typhoon preparedness plans could be focused on vulnerable groups and written for the worst case situation. Secondly, there is lack of coordination among national committees and an insufficient legal framework to support disaster management activities. Thirdly, there is no comprehensive national training program targeting both professionals and responders. Finally, resources are mainly used for response activities, neglecting the preparedness; and disaster funds and insurances are not developed.

Recommendations are made for improvement of typhoon preparedness in Southern Vietnam.

Key words: storm, typhoon, hurricane, cyclone, tropical cyclone, disaster, emergency, hazard, vulnerability, risk, disaster management, disaster preparedness, plan, response, mitigation, capacity, readiness, response mechanisms, warning system, information system, rehearsal, health impacts, affected population, communicable diseases, good practices and lessons learned.

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## **ABBREVIATIONS**

ADPC	Asian Disaster Preparedness Center
ADRC	Asian Disaster Reduction Center
CBDRM	Community-Based Disaster Risk Management
CCSFC	Central Committee of Flood and Storm Control
CHC	Community Health Centers
COPD	Chronic Obstructive Pulmonary Diseases
CRED	Center for Research on Epidemiology Disasters
CSFC	Committee of Flood and Storm Control
DCC	Disaster Coordinating Council
DHF	District Health Facilities
DM	Disaster Management
DOC	Disaster Operations Center
DP	Disaster Preparedness
DPC	Disaster Preparedness Committee
DRR	Disaster Risk Reduction
EOC	Emergency Operations Center
GDP	Gross Domestic Product
GIS	Geographic Information System
HSPH	Hanoi School of Public Health
IFRC	International Federal of Red Cross and Red Crescent Societies
IHPH	Institute of Hygiene and Public Health
IMASH	Information Management System for Hurricane
JICA	Japan International Cooperation Agency
KIT	Royal Tropical Institute
MARD	Ministry of Agriculture and Rural Development
MOH	Ministry of Health
NDMP	Natural Disaster Mitigation Partnership
NEMO	National Emergency Management Organization
NGO	Non-Government Organization
NSNDPRM	National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020
PHF	Provincial Health Facilities
PTSD	Post-Traumatic Stress Disorders
RHA	Rapid Health Assessment
SOPs	Standard Operating Procedures
VA	Vulnerability Assessment
VRC	Vietnamese Red Cross
VU	Vrije Universiteit Amsterdam
WHO	World Health Organization

## DEFINITIONS

**Hazard:** any substance, phenomenon or event which has the potential to cause disruption or damage to communities<sup>α</sup>

**Risks:** the consequences of exposure to a hazard<sup>α</sup>

**Emergency:** any situation in which there is imminent or actual disruption or damage to communities<sup>α</sup>

**Vulnerabilities:** Factors which increase the risks arising from a specific hazard in a specific community. Vulnerabilities are determinants of risks.<sup>α</sup>

**Disaster:** an emergency in which local administrative authorities cannot cope with the impact or the scale of the hazard, and therefore the event is managed from outside the affected communities<sup>α</sup>

**Mitigation:** Any action taken to minimize the extent of a disaster or potential disaster. Mitigation can take place before, during or after a disaster, but the term is most often used to refer to actions against potential disasters. Mitigation measures are both physical or structural (such as flood defenses or strengthening buildings) and non-structural (such as training in disaster management, regulating land use and public education).<sup>β</sup>

**Preparedness:** Specific measures taken before disasters strike, usually to forecast or warn against them, take precautions when they threaten and arrange for the appropriate response (such as organizing evacuation, stockpiling food supplies, and have plans available and capacity development of different stakeholders involved). Preparedness falls within the broader field of mitigation and response adequately and timely.<sup>β</sup>

**Prevention:** Activities to ensure that the adverse impact of hazards and related disasters is avoided. As this is unrealistic in most cases, the term is not widely used nowadays.<sup>β</sup>

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<sup>α</sup> Source: World Health Organization

<sup>β</sup> John Twigg. Disaster risk reduction. Overseas Development Institute. 2004, p.12-13

## **INTRODUCTION**

My background is a medical doctor. After graduating from medical college, I have been working in the public health sector. And now I hold a position of Head of Disaster Management Unit and concurrent post of Deputy-Head of Planning Division of Institute of Hygiene and Public Health (IHPH). The main functions of IHPH are to research, train, guide technically and supervise on public health activities for the Southern provinces of Vietnam, including disaster management (DM). My main responsibilities are to train, provide technical supports on DM and outbreak response. Other responsibilities are to research problems related to disasters, and to monitor and supervise the DM activities of Vietnam's southern provinces. In addition, I also cooperate with other domestic and foreign organizations such as Vietnam Red Cross (VRC), World Health Organization (WHO), Japan International Cooperation Agency (JICA) to organize conferences, workshops, training courses as well as projects on issues related to disasters.

Climate change in current decades has altered the frequency and intensity of natural disasters, especially typhoons.<sup>1,2</sup> This may result in huge devastations in human beings, property, public services, environment and livelihood. Similarly in Vietnam, there were changes in disaster pattern in last decades. Typhoons were considered as a rare event in Southern Vietnam but they occurred and lead to a large number of deaths and injuries of local people.<sup>3</sup> Different factors may contribute to a high number of casualties and people affected. These include factors related to weakness in disaster preparedness (DP) of public services as well as limited awareness of local people. Hence, this study is to review the causes and effects on health and health services caused by typhoons, and to find out the weakness and strengths in preparedness and response periods in order to make recommendations on actions for local people, health and public services on what they should do to cope with typhoons better. In addition, this study also help us to recognize the areas of training needs to build up capacity for health workers as well as to raise awareness of local people.



# CHAPTER 1: BACKGROUND INFORMATION OF VIETNAM

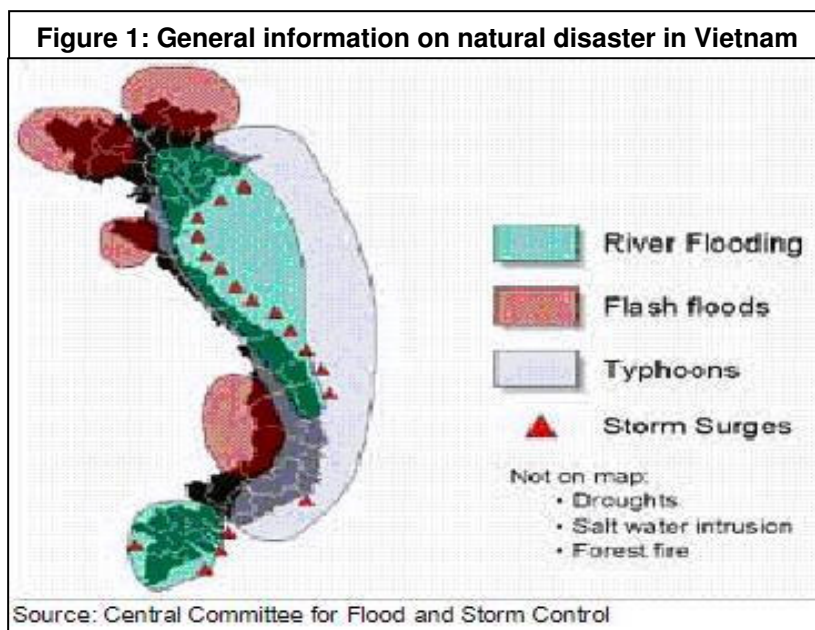
## 1.1. Geographic

Vietnam is located in South-East Asia and lies between longitude 8°02'-23°23' North and 102°08'-109°28' East whose borders are contiguous to China in the north, to Laos and Cambodia in the west, to the East Sea in the east and the Pacific Ocean in the east and south. Total land area of Vietnam is 332,600 square kilometres in which three quarters of Vietnam's territory consist of mountains and hills, and 3,260 kilometre coastline.<sup>4</sup>

## 1.2. Climate

Vietnam is located in monsoon tropical area with 4 seasons. Because of the length of country and the divergence of topography, there are many kinds of natural disaster risks in its different regions (Figure 1 and Table 1).<sup>4</sup>

In addition, Vietnam is next to one of five typhoon routes of the world, so the developments of hydrometeorology phenomena are difficult to predict.<sup>4,5</sup> The annual average rainfalls are high and different from region to region, they are about from 1400 to 2400 millimeters concentrated mainly in rainy season.<sup>4</sup> On average, there were about seven typhoon hits mainly in the northern and central areas of Vietnam from June to November each year.<sup>6</sup> According to Dusgupta et al,<sup>7</sup> climate change will cause rising sea level increasing level of storm surges and flooding, the impacts will depend on factors of land, population, gross domestic product (GDP), urban area, agricultural land, and wetlands. Vietnam is one of the top 5 most affected countries by this phenomenon. With one meter of sea level rise, it affects about 5.2% of Vietnam's territory, 10.8% of population, 10.2% of GDP, 10.7% of urban area, 7.1% of agriculture land and 28.7% of wetlands.<sup>7</sup>



Region	Zone	Principal Hazards
North	1-Northern Mountainous	Flashfloods, landslides, earthquakes
	2-Red River Delta	Monsoon river floods, typhoons, storms surges
Center	3-Central Coast Provinces	Typhoons, storm surges flash-floods, droughts
	4-Central Highlands	Flashfloods, landslides
South	5-Mekong River Delta	River flooding from upstream, typhoons, storm surges

Source: TP, Nguyen. Asian Development Bank, 2007

### **1.3. Demography**

The total population of Vietnam is 86,116,559 people. The ratio of male/female is 49.14/50.86 and the percentage of children under 15 years old account for 26.4%.<sup>8</sup> One quarter of the total population is living in coastal areas and is affected directly by typhoons and storm surges<sup>9</sup> and about 80-90% of Vietnam's population are potentially affected by typhoons.<sup>5</sup> In addition, approximately 58% of these live by occupations which depend on marine resource whose export value accounted for about 10% of the total national export value.<sup>9</sup> The two delta lowlands around the Mekong River and the Red River "are extremely fertile and densely populated, and most of Viet Nam's agriculture and industry are concentrated there".<sup>9</sup> However, populations in these areas are also vulnerable to natural disasters, especially with typhoons. There is about 72-73% rural population whose occupations are mainly agriculture, aquaculture, fisheries.<sup>8,10</sup>

### **1.4. Socio-Economic**

Vietnam's economy has developed rapidly in two recent decades when "renovation" policies were implemented. The proportion of poverty decreased from 58% (1993) to 20% (2004) and to 15.5% (2007). "However, many households have risen barely above the poverty line and therefore remain vulnerable to falling back into poverty".<sup>10</sup> Most of the poor live in places vulnerable to disasters and 90% of them live in rural areas. Also, ethnic minorities who account for 14% of the population but make up 30% of the poor live in remote rural areas. Annual average GDP growth rate in period of 1998-2008 were 7.06% and GDP per capita was USD 1,047 in 2008. Adult literacy rate was 94% (2005), however, the literacy rate of ethnic groups are quite low despite efforts and allowances for these groups from Vietnam's government.<sup>10</sup> Percentage of people used safe water was 85% in 2006.

### **1.5. National health policy and health financing**

Budget for health was about USD 1.5 billions accounting for 2.45% of GDP and 8.39% of health budget in State budget expenditure in 2006.<sup>8</sup> Health budget per capita was USD 17.8.<sup>8</sup> However, there is no budget for DM. When disasters happen, health sector and other sectors usually use spare budget for all contingency situations whose total is 1% or less of their budgets. Additionally, there was no health policy, legislation, and guidelines for health DM up to now.

### **1.6. Disaster management and health systems**

DM system of Vietnam consist of different committees such as Central Committee for typhoon and flood control, National Committee for Search and Rescue victims, National Committee for Safety Transportation, National Committee for accident and injuries control, National Committee for serious communicable diseases control. System of typhoon and flood control is structured by vertical and horizontal systems. In vertical system, there are 4 levels divided into Central, Provincial, District, and Commune



levels with leading of Committee for Flood and Storm Control of each level (Figure 5). Central Committee of Flood and Storm Control (CCSFC) is mainly responsible for guiding the implementation of the national plan. It is accountable to and directly directed by the Prime Minister. It is established with leading by Ministry of Agriculture and Rural Development (MARD) and all related ministries were member with a network at all levels from central to community (Figure 4). Each ministry established its own committee based on its function and type of hazard with a network at all levels.<sup>4</sup> Ministry of Health (MOH) established committee of disaster control, and victims search and rescue led by Deputy-Director of MOH. Health DM system has been organized and integrated in the existing health care system (Figure 6). To horizontal system, health sector at each level is directed by Committee for Flood and Typhoon Control at this level correlatively (Figure 5).



## CHAPTER 2: PROBLEM STATEMENT

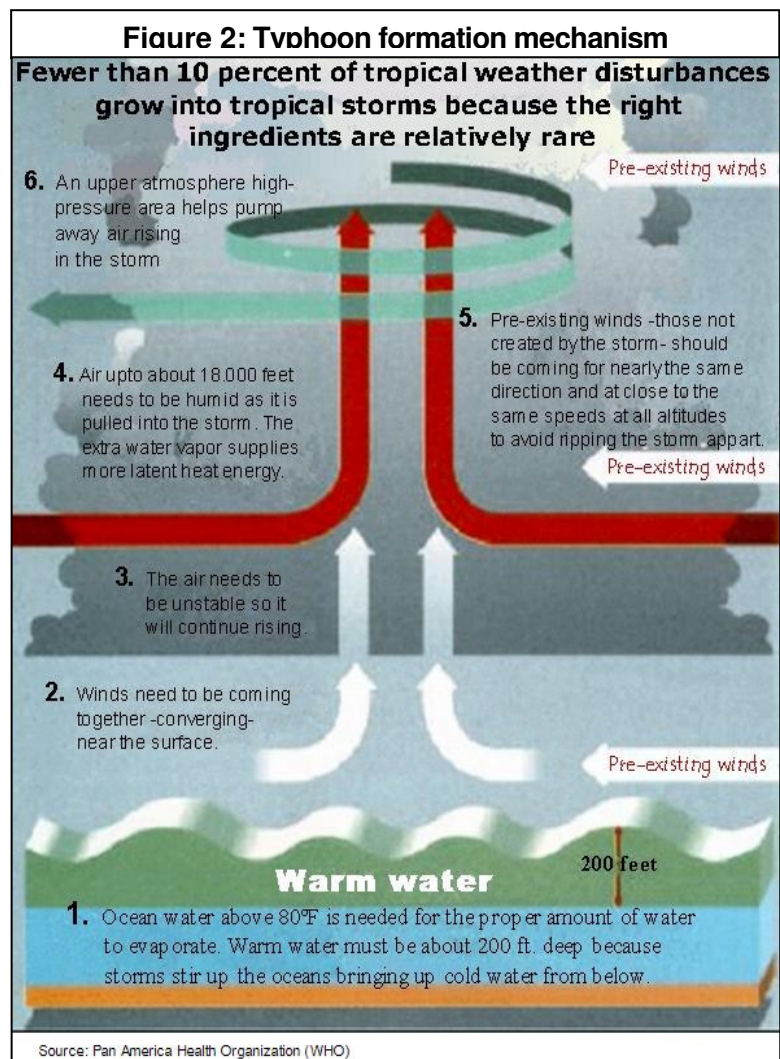
### 2.1. Introduction to problem statement

#### 2.1.1. Definition of typhoons

Typhoons are low-pressure weather systems that develop over areas of oceans between the latitudes of 30° North and 30° South.<sup>11</sup> It is proceed from oceanic unstable atmosphere areas with cyclonic air rotating counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. Typhoon-eye's diameter is usually from 30 to 50 kilometers.<sup>11</sup> Its average life cycle is about 9 days and it can travel more than 10,000 kilometers.<sup>11,12</sup>

#### 2.1.2. Typhoon formation mechanism

There were needs of six ingredients to form a tropical storm (Figure 2). When sea-surface temperature is above 26°C (80°F) with a depth of 60 meter (200 feet), warm water will evaporate abundantly into the air. Together with pre-existing winds, water vapor will converge and come up. With unstable atmosphere, it will continue to rise higher. When water vapor rises to a height of about 7000m (18,000ft), high humidity makes it saturate and condensate into droplets and clouds. This condensation will release heat energy and the energy will be bigger and bigger with more water vapor and then induces drop in pressure. Pre-existing winds with nearly same direction and speeds at all altitudes will spin and circulate around an air column and then cause low-pressure. The



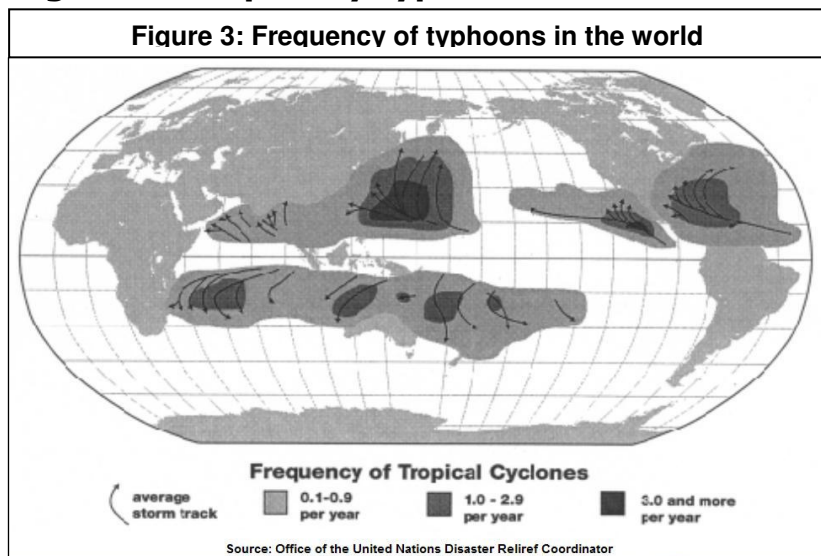
The different temperature of upper and lower atmosphere areas will form vertical cloud convection. High altitude winds carry away air and induce cyclonic winds around low-pressure centers.<sup>13-15</sup> Status starts from tropical wave, tropical disturbance, tropical depression, and to tropical storm, and then it develop into typhoon, hurricane or cyclone (Table 7).<sup>13</sup>

### 2.1.3. Classification

The degree of wind force is classified by The Beaufort Wind Scale (Table 8). Tropical cyclone is generic term to cover weather systems when wind speeds are more than 62 km/hour. It is called in different names based on geographic areas: **typhoons** in the Western Pacific, **hurricanes** in the North Atlantic, the Caribbean Gulf, the eastern North Pacific, and the west coast of Mexico, and **cyclones** in the Indian Ocean and Australasia.<sup>12</sup> With these names, it is also classified in different categories of different scales such as Saffir-Simpson Scale, Cyclone Severity Categories. The use of names and kinds of scales depends on each country. For example in Vietnam, it is called "typhoon together with force wind" when force wind is from level 8 or above.

### 2.1.4. Factors causing more frequently typhoons

Typhoons usually occur in six regions in the world: "inlands in South-West Pacific, South-East Asia, the Bay of Bengal, South-East Africa, the Caribbean and parts of the United States and Latin America around the Gulf of Mexico and Atlantic Ocean" (Figure 3).<sup>16</sup> Global warming has increased the



frequency and intensity of typhoons,<sup>1,2,17,18</sup> In Vietnam, typhoons "often occur from June to November but mainly in September and October".<sup>6</sup> There are about 6-10 typhoons and tropical depressions annually which often strike in Northern and Central Vietnam.<sup>6</sup> In Southern Vietnam, there have been two typhoons and tropical depressions occurring between 1989-1998 while four hit this region in period of 1999-2008.<sup>19</sup>

### 2.2. Problem statement

The number of natural disasters shows a global upward trend in recent years. The number of these events increased by 8.4% per year from 2000 to 2007 in which typhoons contributed considerably to this increase. In 2007, Asia was the continent which was most affected by natural disasters with 90% of total global reported victims and 46% of total global economic loss. More specific to typhoons; There were 105 events in 2007 all over the world which affected about 24 million people and caused damages up to about USD29.6 billion. Asia accounted for 28% of the number of typhoon worldwide while 94% of the victims and 40% of economic damage occurred in Asia.<sup>1</sup>

Vietnam is one of the most disaster-prone countries in the world in which the number of disaster victims, deaths and economic losses was in the top ten affected countries in 2006 and 2007.<sup>1,20</sup> Natural disasters caused huge losses to Vietnam with total economic losses about USD2.8 billion in the decade of 1990's. In this decade, natural disasters killed more than 8,000 people and destroyed about 9,000 boats and 6 million houses,<sup>5</sup> especially the devastation of crops and infrastructure in Mekong Delta.<sup>9</sup> Only in 2007, the total estimated economic loss was up to nearly USD1 billion.<sup>1</sup> In all disasters affecting to Vietnam, typhoon was classified as the most frequent and damaged natural disaster. In the period of 1980 to 2008, in the total of victims, deaths and economic losses caused by all natural disasters, typhoons made up 67% of total reported victims, 61% of total deaths and 53% of total economic losses.<sup>21</sup>

There are two main natural disasters in southern Vietnam: river flooding and typhoon (Table 1). Annually seasonal river flooding exists in long history in this area with good preparedness of public and health services. In addition, after deathly flood in 2000, the biggest historical flood,<sup>6</sup> local authorities of flooding-affected provinces built up surrounding embankments to protect local population and their crops, and constructed residential areas for local people to live in flooding season.<sup>22</sup> Also, local people have a good knowledge and experience to cope with this slow onset hazard. In addition, many programs and projects have been implemented to mitigate the effects of flooding in this region.<sup>4</sup> A phrase used to depict for these good preparedness is "living with floods".<sup>23</sup> Whereas, typhoon is a hazard which was not properly cared in this region while climate change in current decades has changed the occurrence of typhoons in this region.<sup>17,24</sup> According to WHO,<sup>25</sup> a hazard is assessed based on two main components: its frequency and intensity. Although typhoons appear infrequently in this region, their intensity is powerful and causes huge devastation.<sup>22,26</sup> For example, typhoon Linda hit the west of southern Vietnam in 1997 and killed 3,682 people, injured 1,232 and affected 697,225, and typhoon Durian in 2006 with 95 dead/missing, 1,578 injured cases and 975,000 affected people.<sup>3,19,27</sup> In addition, most people living in the coastal areas have been staying in poor constructed houses and have no experience to cope with typhoons while their knowledge on typhoon safety may be considerably low.<sup>28</sup> Furthermore, there were a number of problems on health DM system such as lack of policies, legislation, technical guidelines, resources and capacities.<sup>29,30</sup> Another reason which can make this problem become more serious might be the lack of close coordination inside and outside the health sector.<sup>29,30</sup> These reasons may contribute to the increase of dead and injured cases before, during and after typhoons in southern Vietnam. So, overall preparedness for typhoon seems insufficient which can protect vulnerable communities in the region. The purpose of the thesis is to help health services and other public services improve typhoon preparedness status which mitigates the impacts of typhoon in the future.

### **2.3. Study questions**

1. What are the effects on health and health systems that follow from typhoons?
2. How should local people, health system, and public services be prepared for typhoons?

### **2.4. Objectives and specific objectives**

#### ***General objectives***

Review the typhoon preparedness to mitigate the effects of typhoon on people's health, and on health and public services in Southern Vietnam and make recommendations on actions that can be taken to improve these

#### ***Specific objectives***

1. Describe the most frequent consequences of typhoon on health, health system and public services in general
2. Describe morbidity, mortality and health hazards resulting from typhoons affecting on health, health system and public services in Vietnam and Southern Vietnam
3. Describe good practices with regard to disaster preparedness based on international disaster preparedness guidelines and core descriptions of Vietnam, Southern Vietnam and some other countries
4. Analyze strengths and weaknesses of the current preparedness with regards to typhoons in Southern Vietnam
5. Define recommendations for actions that can be taken to improve the preparedness capacity of health services and other public services in order to mitigate the effects of typhoons in Southern Vietnam

### **2.5. Methodology:**

Study type: Literature review

Data collection techniques:

- Collect available data from books, articles on Royal Tropical Institute (KIT) and Vrije Universiteit Amsterdam (VU) libraries, CCFSC, WHO, International Federal of Red Cross and Red Crescent Societies (IFRC), Center for Research on Epidemiology Disasters (CRED), Asian Disaster Reduction Center (ADRC) and Asian Disaster Preparedness Center (ADPC), Pub-med, PreventionWeb, Google websites, to get information on typhoon epidemiology and its consequences on health and health system of those
- Collect available books, articles and typhoon-related websites to find out the ideal cases on preparedness
- Collect available documents of Southern Vietnam to compare typhoon preparation of Southern Vietnam with those of ideal cases and other parts of Vietnam, and identify the strengths and weakness in the different phases of typhoon preparation

- Compile good practices and DP used for references to compare that of Southern Vietnam

Search strategy: Internet search on KIT and VU libraries, CCFSC, WHO, IFRC, CRED, ADRC, ADPC, Pub-med, PreventionWeb and Google websites

Key words: (please see page iv)

Data processing and analysis: The analytical framework was based on Disaster Preparedness Framework of Randolph Kent, Disaster Preparedness, United Nations Development Programme (UNDP) Disaster Training Programme, 1994. The analysis was based on good practices found in literatures and used to compare the typhoon preparedness in Southern Vietnam with good practices and lessons learned.

Ethic considerations: No. Because this thesis is a pure literature review, it is no harm to human and animals and does not conflict with culture and traditions as well as confidentiality.

Quality assurance mechanism:

- Validity: samples were chosen from south region and compared with review literatures from other parts of Vietnam and different areas of the world to draw ideal cases

Limitations to the study:

- Many materials collected to analyse are mainly documents and official reports with not much research papers.
- Data from other countries may have some differences because of differences in elements of vulnerability.
- Data from Vietnam does not include those of private sector.
- Disaster database of Vietnam was built up after The Natural Disaster Mitigation Partnership (NDMP) was established in 1999, so some data are retrospective and quality of data is not in details.
- Available data may not reflect sufficiently the current existing information
- Language used to collected information is only in English and Vietnamese.





## CHAPTER 3: CONSEQUENCES OF TYPHOONS

### 3.1. Consequences of typhoons in general

Table 2 : Consequences of typhoons	
1. Direct health impact	<ul style="list-style-type: none"> <li>- Deaths or missing/loss of family</li> <li>- Injuries</li> </ul>
2. Impact on health infrastructure	<ul style="list-style-type: none"> <li>- Health facilities damage</li> <li>- Drugs, supplies and equipment damage, supply chain</li> <li>- Death/injuries of health workers</li> <li>- Health services (emergency, cure, public health): no supply, delays</li> <li>- Bad response to direct health impact</li> <li>- Epidemic diseases</li> <li>- Exacerbates of pre-existing diseases, psychological and mental health impact</li> </ul>
3. Indirect health consequences due to impact on other infrastructure	<ul style="list-style-type: none"> <li>- Roads: referral system, supply chain</li> <li>- Communication</li> <li>- Electricity</li> <li>- Water supply: epidemics</li> <li>- Houses and properties: poverty, displacement (epidemics)</li> <li>- Workplace: loss of job and income, poverty include crops and livelihoods</li> <li>- Psychological, mental health impact</li> </ul>

#### 3.1.1. Direct health impacts

Typhoons usually cause direct health impacts such as injuries, deaths or missing/loss of family members (Figure 7). The majority of deaths (90%) were attributed by drowning from storm surges, and floods, flashfloods and landslides accompanied by torrential rains in typhoon-affected areas.<sup>11,31</sup> Also, many deaths are due to structure collapses, flying debris, and falling trees. Some deaths occurring outside inundation and evacuation zones were due to violent winds, and others were caused by electrocutions.<sup>11,27,32,33</sup> Another aftermath of typhoon is injuries but most of these are minor injuries. In the beginning of typhoon, injuries are mainly lacerations from object debris and a few bone-fractures, wound punctures and blunt trauma. However, a few days after typhoon, many injuries is from cleanup injuries because of cutting by building materials and stepping on nails or sharp objects.<sup>11,33</sup>

Main determinants to mortality and morbidity caused by typhoon are early detection and warning system, timely evacuation, safe sheltering and appropriate safe responses of citizens. Improvement of these determinants reduces typhoon-related avoidable deaths and injuries.<sup>11,31</sup> Poor house construction, noncompliance with timely evacuation, inadequate shelters, land-use, and settlement patterns are factors exacerbating the effects of typhoons.<sup>11,31,34</sup>

#### 3.1.2. Impacts on health infrastructure

Typhoons can damage or destroy health facilities, drugs, medical supplies and equipment, and supply chain as well as deaths and injuries for health workers (Figure 7). These greatly influence on health services including

emergency, hospital treatment, and public health services.<sup>35</sup> These impacts of typhoon lead to delays of accessibilities, delays of health care provision or the disruption of health care services and bad response to direct health impact. These delays or disruption may exacerbate injuries and pre-existing diseases, and increase deaths during and immediate after typhoon as well as consequences on epidemic diseases, psychological and mental health in later days.<sup>34,35</sup>

### **3.1.3. Indirect health consequences due to impact on other infrastructure**

Indirect impacts on people's health are considerable consequences of typhoons. Firstly, the disruption of roads, communication, and electricity systems may delay health care services, especially emergency activities and referral system.

Secondly, the damage of water supply, sanitation system and environmental contamination make affected population become vulnerable to epidemics and may increase mortality and morbidity.<sup>34,35</sup> Epidemic diseases that often happen after typhoon are waterborne diseases (diarrhea, typhoid and paratyphoid fever, hepatitis, gastroenteritis), airborne diseases (measles, respiratory infections), vectorborne diseases (malaria, dengue). These are due to changing in disease levels, ecology, population displacement, population density, public utilities, and basic public health services.<sup>11,33</sup> However, this does not mean that epidemic diseases will always follow typhoons if prevention measures are planned and implemented properly.<sup>31</sup>

Thirdly, the damage or destruction of houses, properties (assets, crops, foods, livestock), and workplaces/livelihoods may bring people back to unemployment and poverty. These damage or destruction and losses of human lives must be affecting on psychological and mental health of affected people. Emotional and physical distress, non-psychotic psychological disturbances and post-traumatic stress disorders (PTSD) are common mental health problems after typhoons.<sup>11,33,34</sup> Mental health sequelae may be severe and chronic in a short/long-term period whose degree associates in contributing factors such as the presences, nature and length of disasters, the disaster perception and objective losses of citizens (house, property, social contacts, employment, monetary), and social and psychological supports of authorities.<sup>31,36</sup> These damage and losses also exacerbate pre-existing diseases such as heart attacks, hypertension, chronic obstructive pulmonary diseases (COPD), diabetes during typhoon.<sup>11,33-36</sup>

Fourthly, the damage or losses of houses make people become homeless and displaced. The crowded living and contaminated environment status also lead to higher vulnerabilities to epidemics.<sup>11,31,34</sup>

Finally, these damage or losses including loss of crops caused by typhoons may result in diet changes, food and nutrition insufficiency or starvation. These losses force local people to have to spend more time to work, to take part in different routine or dangerous activities, and to work in the inappropriate periods of time which ultimate effects may force people to be

more vulnerable and increase the mortality and morbidity, especially on women, young women and children. Other problems are dermal conditions, and animal bites and stings (snake bites, insect stings).<sup>11,33-36</sup>

### 3.2. Consequences of typhoons in Vietnam and Southern Vietnam

#### 3.2.1. Direct health impacts

Direct health consequences of typhoons are similar as that of others including injuries, deaths or missing. According CCFSC's reports in whole Vietnam<sup>19</sup>, the number of deaths has an upward trend in recent years from 26 cases (2004) to 189 (2006) and 263 (2008), especially in children from no

	2004	2005	2006	2007	2008
No. of deaths	26	95	189	167	263
-in which children	0	2	11	12	25
No. of injuries	30	132	1,949	305	259
No. of missing	30	18	266	16	62
No. of health facilities					
-Collapsed	0	196	27	12	6
-Damaged	0	0	195	806	92

*Source: Central Committee for Flood and Storm Control*

case (2004) to 25 cases (2006). These differences may be due to the number, intensity and landfall area of typhoons in each year as well as typhoon preparedness. While there were two typhoons with force 8 winds in 2004, ten typhoons occurred in 2008 with higher force winds. Also, the numbers of injuries and missing were still high. Particularly in 2006, there were 1,949 injured and 266 missing cases (table 3). This is due to typhoon hit in Southern Vietnam.

In Southern Vietnam, the numbers of deaths/missing and injuries caused by typhoons were very huge, especially in 1997 and 2006 (table 4).<sup>19,27</sup> The high dead and missing cases caused by one typhoon with force 9-10 wind in 1997 were due to little warning which was informed to fishermen on the sea while majority of them did not have radio and life-preserver on their boat.<sup>37</sup> The dead cases caused by one typhoon with force 8-9 wind in the South in 2006 accounted for 45% of total deaths nationwide and the injuries accounted for 81% of total injuries nationwide. However, there were no the causes, mechanisms, typhoon's phase time of direct health impacts reported or recorded. These show that the typhoon preparedness of this region was not careful.

There were four rapid health assessments (RHA) implemented after typhoon: two in Northern, one in Central and one in Southern Vietnam. To two typhoons occurring in provinces of Northern Vietnam, more than 93% of total deaths were caused by drowning from flashflood and flooding after typhoon and most of injuries were minor.<sup>38,39</sup> These consequences show that in areas vulnerable to these hazards the citizens were not warned.

	1997	1998	2006
No. of deaths	778	47	85
- in which children	0	0	0
No. of injuries	1232	0	1,578
No. of missing	2,904	4	10
Health facilities			
-Collapsed	16	0	2
-Damaged	62	14	135

*Source: Central Committee for Flood and Storm Control*

To super-typhoon Xangsane with force 13-14 wind (133-165kph) occurring in Central Vietnam in 2006, there were about 55% (38 cases) of total deaths caused by flooding while 45% (31 cases) of total deaths were killed directly by violent winds. Most of injuries were minor although the classification by causes and mechanism was not implemented in assessment time. It was assessed that preparedness for this typhoon was very good and typhoon's consequences were due to very strong typhoon.<sup>32</sup>

On the contrary, typhoon Durian with force 8-9 wind (62-88kph) in 2006 hit in the provinces of Southern Vietnam but killed more people and injured three times higher than those of typhoon Xangsane. Majority of deaths and injuries were caused by cyclonic winds (collapsed houses and fallen trees). These consequences were because of lack of knowledge and skills of public services in disaster preparedness and of knowledge and experience of citizens to cope with typhoon. Additionally, citizens disregarded warnings because of inaccurate forecasting. Hence, local people were not evacuated to safe places.<sup>27</sup>

### **3.2.2. Impacts on health infrastructure**

In total Vietnam, the damage and destruction of health facilities were recorded in reports of CCFSC.<sup>19</sup> The number of collapsed health facilities was very high in 2005 which it was caused by one very strong typhoon with force 17 wind. Also, the number of damaged ones was very high (806) in 2007 (table 3) in which one typhoon with force 11-12 wind accounted for 91% of the figure. However, the function, damaged proportion and degrees of these health facilities were not reported.

In term of Southern Vietnam, the losses of health facilities caused by typhoons were quite high (table 4).<sup>19,27</sup> The number of damaged health facilities made up nearly 70% of total damaged ones of nine typhoons of whole country in 2006. It seems there was little preparedness of health facilities to cope with typhoon. The CCFSC's reports did not specify the damaged degrees and kinds of health facilities nor the response capacity of damaged health facilities. Also, there was no report on the damages of drugs, supplies and equipment damage, on death and injuries of health workers and on health services provided. Similarly, direct health impacts, epidemic diseases, exacerbation of pre-existing diseases and mental health were not recorded.

According to four RHAs, there were no provincial health facilities (PHF) and district health facilities (DHF) damaged by two typhoons in provinces of Northern Vietnam. Most of Community Health Centers (CHC) in areas affected of typhoon was damage in different levels but about 90% of them still maintained their function. There were only three affected CHC that lost their function because of flooding and needed to be relocated. There was no loss of health staff and the damage of drugs, medical supplies and equipment was inconsiderable.<sup>38,39</sup> It may infer that the structure of CHCs was not strong enough to typhoon.

To typhoon occurring in central Vietnam, 37% PHF, 75% DHF and 48% CHC of affected provinces were partly damaged, so they maintained their function and accessibilities exception to one DHF and five CHCs destroyed by violent winds. There was no loss of health staff and the damage of drugs, medical supplies and equipment was inconsiderable excepting the old destroyed DHF.<sup>32</sup> This shows there was good preparedness but structures of health facilities could not suffer force 13-14 wind of this typhoon.

There were 60% PHF, 33% DHF and 28% CHC damaged in three assessed provinces to typhoon hitting in Southern Vietnam. All health facilities did not lose their function with exception of two destroyed CHCs. Although there was no loss of health workers, drugs and medical supplies and equipment were seriously damaged.<sup>27</sup> The damaged proportion of PHF and health facilities' properties was high; it seems there was little typhoon preparedness in this region.

There is no research on direct health and health infrastructure impacts, so reasons of differences on kinds of damage are unknown. Because there is no uniform assessment standard, data of CCFSC and RHA reports can not compare. Addition, the purpose of RHA is for relief, so reported data often overestimate.

### 3.2.3. Indirect health consequences due to impact on other infrastructure

In reports of CCFSC to total Vietnam, typhoons caused the huge damage of infrastructure including transportation, communication, electricity, house, properties, excluding water supply in Vietnam (table 5).<sup>19</sup> Many bridges were collapsed and damaged from 2004-2008. Particularly, there were 2,050 and 1,350 in 2007 and 2008 respectively which could not be used after typhoons. Although no damage of communication in 2004, there were a big damage of communication poles in 2005 (6,751) and 2006 (4,821). Also, typhoons damaged more than 7,100 voltage poles in 2005, 2006 and 2007, and 569 power stations were not working in 2007 after typhoons. The year which many houses destroyed and damaged (nearly 600,000) was in 2006. The biggest damage of boats and vessels was in 2006 (2,215) while the cultivated surface of crops was the most damage in 2005 (616,052 hectares). The damaged number of livestock was high, in which about 95% of the figure

Table 5: Summary of infrastructure damages caused by typhoon from 2004-2008 in Vietnam					
	2004	2005	2006	2007	2008
<b>Road</b>					
Bridge collapsed (unit)	0	650	93	376	326
Bridge damaged (unit)	11	21	133	1,674	1,024
Length of damaged (km)	4	871	46	154	365
Surface damaged (m <sup>2</sup> )	23,261	72,140	249,800	25,000	205,399
<b>Communication</b>					
Pole (pole)	0	6,751	4,821	1,371	1,139
Wire broken (m)	0	15,680	1,329,413	167,600	52,230
<b>Electricity</b>					
High-voltage collapsed (pole)	0	586	199	36	142
Low-voltage collapsed (pole)	0	6,544	7,056	7,206	1,284
Electric wire broken (m)	3,300	24,300	624,840	385,678	120,660
Power station damaged (unit)	0	0	132	569	34
Transformers damaged (unit)	0	0	0	3	12
<b>House</b>					
No. of houses collapsed (unit)	368	5,289	73,854	3,351	4,276
No. of houses damaged (unit)	1,546	170,081	524,669	453,514	80,656
<b>Properties</b>					
Boat, vessel (unit)	78	347	2,215	156	228
Crops (ha)	138,882	616,052	335,809	356,084	102,245
Foods (ton)	258	0	12,712	44,211	12,146
Live-stocks: Animal (unit)	136	135,717	74,606	445,916	332,104
Fishes (ton)	931	3,314	556	1,610	1,709
<b>Estimated in money (Mil VND)</b>	307,199	4,698,757	17,684,636	5,734,806	4,280,000
Million USD	18.6	284.8	1,071.8	347.6	259.4

Source: Central Committee for Flood and Storm Control

was of poultries. There were a huge loss of shrimps and fish which the highest number was in 2005 (3,314 ton). In the period of 2004-2008, total damage caused by typhoons was nearly 2 billion USD in which the damage of 2006 made up more than 50%.<sup>19</sup>

To damage caused by three typhoons in Southern Vietnam (table 6), while the huge damage of road systems happened in 1997, there was no damage in 2006. Communication systems were seriously damaged in 1997 and 1998 but there was no big influence of these systems in 2006. However, the big concern is the house damage to provinces of Southern Vietnam. There were nearly 110,000 and 50,000 houses destroyed by typhoon in 1997 and 2006 respectively and about 200,000 houses damaged by each typhoon in the two years. Inundated crop lands were very large, especially in 1997. This figure is larger than that of nationwide of each year from 2004-2008. Also the damage and destruction of boats and vessels were quite high in 1997 (4,753) and 2006 (1228, accounted for 55% of this year). Three typhoons in this region lost more than 1.1 billion USD.<sup>19</sup>

**Table 6: Summary of infrastructure damages caused by typhoon from 1997-2008 in Southern Vietnam**

	1997	1998	2006
<b>Road</b>			
Bridge collapsed (unit)	302	7	0
Bridge damaged (unit)	1,846	195	0
Length of damaged (km)	3,208	202	0
Surface damaged (m2)	24,000	21,000	0
<b>Communication</b>			
Pole (pole)	309	1,125	149
Wire broken (m)	73,164	66,530	8,313
<b>Electricity</b>			
High-voltage collapsed (pole)	1,060	22	194
Low-voltage collapsed (pole)	3,111	177	5,474
Electric wire broken (m)	25,146	146	0
Power station damaged (unit)	0	0	0
Transformers damaged (unit)	0	0	0
<b>House</b>			
No. of houses collapsed (unit)	107,892	924	49,787
No. of houses damaged (unit)	204,564	28,267	195,118
<b>Properties</b>			
Boat, vessel (unit)	4,753	207	1,228
Crops (ha)	697,799	126,287	117,680
Foods (ton)	193	5,008	0
Live-stocks: Animal (unit)	28,331	2,521	3
Fishes (ton)	34,281	5	0
<b>Estimated in money (Mil VND)</b>	<b>7,179,615</b>	<b>317,055</b>	<b>7,234,300</b>
Million USD	683.8	30.2	438.4

*Source: Central Committee for Flood and Storm Control*

When comparing the damage caused by one typhoon in Southern Vietnam to that of nine typhoons in total Vietnam in 2006, the damage of Southern Vietnam accounted for high percentage was mainly in electricity voltage (78%), collapsed houses (67%), damaged houses (37%), boats (55%), crops (35%) and total economic losses (41%). The differences of data and damage may be explained by typhoon's characteristics while there was little preparedness from public services and citizens. It grazed very fast and reached deeply in land with not much heavy rain and flooding. Hence, most of its consequences were due to cyclonic winds. All CCFSC's reports are data tables without explanation for causes of damage, impacts on health, health services and public services. These reports seem to call for relief and to take compensation from government.

In four RHAs, water resources, sanitation systems and environment were damaged, especially seriously damaged in provinces in Northern and Southern Vietnam. Although there was no reported epidemic at assessment time, there were concerns about potential epidemic risks of acute diarrhea, conjunctivitis, acute respiratory infection, common influenza, malaria and dengue fever.<sup>27,32,38,39</sup> Indeed some increase were noted in acute diarrhea and conjunctivitis during the assessment.<sup>27,32</sup> There are no detailed data on long-term effects or these diseases.

## CHAPTER 4: PREPAREDNESS TO TYPHOON

### 4.1. Preparedness to typhoon in general

#### 4.1.1. Definition

Preparedness is the implementation of specific precautionary measures to an imminent specific hazard or potential threat. Preparedness includes (a) forecasting hazard and issuing warnings to communities and responsible authorities to take precautionary measures against it and (b) arranging appropriate responses to the effects of an emergency by planning available, developing and strengthening capacity of different involved stakeholders to delivery timely and effective rescue, relief and assistance.<sup>40</sup> "Preparedness falls within the broader field of mitigation and response adequately and timely."<sup>41</sup>

#### 4.1.2. Analysis framework

Disaster Preparedness Framework		
a. Vulnerability Assessment	b. Planning	c. Institutional Framework
d. Information Systems	e. Resource Base	f. Warning Systems
g. Response Mechanisms	h. Public Education and Training	i. Rehearsals

\* Source: R. Kent, *Disaster Preparedness, UNDP Disaster Training Programme, 1994*

Kent describes a framework including 9 elements. The analysis will sequence from vulnerability assessment (VA) to planning, institutional framework, information systems, resource base, warning systems, response mechanisms, public education and training and rehearsals. VA will be the first step in order to have enough information for planning. However, institutional framework is the basis for carrying out other activities. Other activities can be implemented in the same time.<sup>40,41</sup>

#### 4.1.3. Description of important issues of the nine elements

##### a. Vulnerability assessment

The purpose of VA is to recognize trends of risks in community, to use collected information for decision-making of preparedness plans and to monitor unsafe conditions (houses, location, livelihood, skills, awareness and basic services) and dynamic pressure (population, migration, deforestation, funds and limited access to resources). The identification, evaluation and mapping of hazard should precede in a procedure of VA.<sup>40</sup>

VA should identify specific geographic areas and communities at risk with typhoons. Coastal areas and communities living in these and adjacent areas are threatened by a typhoon in typhoon-prone areas. Vulnerability needs to be continuously and dynamically assessed to identify the change of hazard and of communities at risk. VA should also look at specific groups of people or inequities within communities (stigma, gender, socioeconomic status, etc) There are two kinds of information needs to be assessed: static infrastructure and dynamic socioeconomic status.<sup>40</sup> In static infrastructure, vulnerability is assessed in population, houses, basic services (health care,

education, water supply, communication, transportation and electricity), livelihood (farmland, production means, food security), and other infrastructure.<sup>40,42</sup> Dynamic socioeconomic status is assessed in community's awareness, participation of social organizations, discrimination (races, social status, religion, belief and ideology), attitude (solidarity, cooperation and unification), and shifts (demography and livelihoods).<sup>40,43</sup> Poverty reduction and economic conditions improvement will reduce many aspects of vulnerability, so VA should focus on these issues.<sup>44</sup>

### **b. Planning**

Plans should be written for "the worst case scenario"<sup>42</sup> and based on situation analysis of risk assessment, existing structures and systems, and resources available in place which will implement it.<sup>41,42</sup> Objectives must be clear or "SMART" (specific, measurable, appropriate, relevant and time bound) and subsequent activities must be stated in a clear, logic and systematic way with roles and responsibilities assigned specifically. Activities need to be effective and timely in term of response, and meet with community's needs. To risk reduction, activities of related-stakeholders should integrate to achieve overall objective with supporting from legislation, operational coordination system and adequate resources. Planning should be reviewed and updated regularly.<sup>40,41,43</sup> Plan is only a product of planning process. If it is considered as a main goal, this will be a paper plan.<sup>41,43</sup>

### **c. Institutional Framework**

There is no standard for setting up an effective coordination. However, a preparedness plan will fail if it lacks effective coordination mechanism. The mechanism establishing should be based on existing structures and systems with roles and responsibilities assigned clearly and appropriately of each stakeholder. To reduce bureaucracy, it should be focused on strengthening existing vertical and horizontal coordination mechanism and assigned focal points or coordinators instead of building up new organizations. It includes legal framework if necessary.<sup>40</sup>

### **d. Information Systems**

Early warning systems consist of different elements and relate to different organizations and institutions. A reliable information system should be set up in order to describe relevant and important information. Inter-ministerial information committee is responsible for this system to integrate input information and to propose guidelines for executing, formats, mechanisms and procedures for reporting as well as to exchange information (capacities and resources) within and among stakeholders. Procedures and forms of early warning should be fully evaluated to ensure that population at risk receive and understand it. Information system need to be monitoring and updating data of risk assessment and post-disaster investigations.<sup>40</sup>

### **e. Resource Base**

Resources are also called in form of "3M" in place: Men with availability, training, leadership, command and control; Material is prepared and



available, sufficient quantity, special needs; and Means for evacuation, communication, hospital contingency plan.<sup>43</sup>

Needs in emergencies increase, so it is necessary to have available, accessible resources of human, funding, services and goods to respond to the crisis.<sup>40,41</sup> Human resources need to be trained both professionals and responders.<sup>41,43</sup> Human resources should take into account for alternative resources in cases of in-place resources which were seriously affected or lost their function. To professionals such as medical personnel, police, firefighters, engineers, architects, scientists, media, and to responders including volunteers, management staff, rescue teams, civil defense and public awareness agencies and youth clubs, they should be trained on these above subjects and other skills such as first-aid, search and rescue techniques, and/or resuscitation, basic life support for drowning cases, triage.<sup>41-43</sup>

Relief funding and/or disaster insurance are important for logistics (search and rescue equipment, vehicles, boats) and to stockpile relief goods (life-saving drugs, shelters, foods, clothes, water, water purification tablets, energy, cooking utensils) as well as needs uneasily stockpiled and unanticipated. It is also necessary for other activities of planning process such as public awareness, capacity building, studies.<sup>40</sup>

#### **f. Warning Systems**

Early warning process includes three components of forecasting, warning and response. There must be first need experts and advanced technologies to evaluate data and predict accurately and timely locations and severity of typhoon. The next step is issuing warning into messages or signals adequate for local people to understand, and then timely transmit them to at-risk population and stakeholders, targeting the specific geographic areas at risk rather than making generalized statements. Finally is to turn them into precautionary actions.<sup>41,43</sup> The accurate operation of this system leads to timely evacuation and safe sheltering which reduce or prevent a large number of deaths and injuries.<sup>11</sup>

In planning process, warning systems must consider kinds of communication systems which are not available or working during emergencies and kinds of alternative communication systems. Also, warning systems should consider perceptions, attitudes and experience of public on warning and reacting to warnings.<sup>40</sup>

#### **g. Response Mechanism**

When receiving warnings and orders from an incident commander, DP plan in place must be activated. The activation will include procedures for timely evacuation and safe shelters, sending rescue teams and other responders for search and rescue, life-saving supports and for security of affected areas. After typhoon, sending needs assessment teams in field, and activation of emergency lifeline facilities such as hospitals, electricity and water supplies. After receiving data on needs of affected population from assessment teams, distribution system will be deployed for relief, and emergency reception centers and shelters will be set up for displaced

people.<sup>40,41,43</sup> According to professor Guha-Safir (CRED)<sup>11</sup>, this needs assessment does not need in details and perfect which take long time but should be "quick and dirty" to delivery relief and essential needs (shelters, clothes, foods, water, energy) to affected population through distribution systems which are set up before.

#### **h. Public Education and Training**

Capacity building is an indispensable activity in preparedness plan which consists of three categories: education for at-risk population, training for professionals and for responders. Vulnerable communities must be educated to raise knowledge of typhoon risk and reaction to warnings through public information, extension programs, training courses and workshops. In addition, DP has to be introduced into standardized curricula of education systems to raise disaster knowledge and procedures of appropriate response for students.<sup>40</sup>

#### **i. Rehearsals:**

All training on DP will become useless without simulations and rehearses. This is a compulsory element which should exist and be implemented in vulnerable areas.<sup>43</sup> Simulations and rehearses are opportunities to test and to find out inevitable errors and weakness of plans for improvements and updating. There are many forms for these such as desktop simulation exercises, field exercises, drills and system-wide rehearses.<sup>40</sup>

### **4.2. Preparedness in Vietnam and Southern Vietnam**

#### **4.2.1. Present situation in Vietnam and Southern Vietnam**

##### **a. Vulnerability assessment**

In National Strategy for Natural Disaster Prevention, Response and Mitigation to 2020 (NSNDPRM),<sup>45</sup> Vietnam have planned to implement mapping typhoon areas and residential layout of coastal areas in period of 2007-2010. However, there were no results on this exercise reported until July 2009. Additionally, the information on static infrastructure and dynamic socioeconomic status of vulnerabilities has not been planned to assess completely yet. This is due to no consensus mechanism and standardized assessment tools in place. Furthermore, VA is not a compulsory part in socioeconomic development projects and plans.<sup>29</sup> However, some pilot VAs in the most vulnerable areas were carried out such as "*Theory and Practice in Assessing Vulnerability to Climate Change and Facilitating Adaptation*"<sup>37</sup> but there is no information system to update and share the information.<sup>29</sup>

In Southern Vietnam, typhoon is a hazard which was not paid attention to in NSNDPRM.<sup>45</sup> Hence, vulnerability information was ignored in typhoon preparedness plans and reports of provinces in this region.

##### **b. Planning**

In NSNDPRM and its following project,<sup>46</sup> there were comprehensive goals and objectives as well as task assignments for key actors. However, actors assisting the key actors were not stated specifically. Although NSNDPRM emphasized on DP activities, ministries and provinces have mostly focused

on response activities. Additionally, typhoon management was not pay much attention in Southern Vietnam, so there was no program/project in NSNDPRM planned for typhoon preparedness in this region.<sup>30</sup>

In Southern Vietnam, DP plans have comprehensive goals to aspects of DP and a good structure of plan. In addition, there are also assigning and decentralizing of tasks to sectors under direct management and lower levels. However, many of plans in Southern Vietnam are similar from year to year. In the plans, there is no information of VA. Also, objectives are not clear enough to be specific, measurable and relevant what need to be done and do not have time bound such as proactive prevention, timely response to minimize the losses of lives, properties caused by natural disasters.<sup>30</sup> All actors in the plans are public organizations which their assigned tasks still have overlaps among related-sectors; there is no participation of UN agencies, NGOs, and donors. Similar to health sector plans, objectives and subsequent activities are common or without objectives. Also, their tasks assigned to under-organizations are unspecific and have overlap. For example Preventive Medicine Center is responsible for preparing ten cholera drug packs, drugs, chemicals and equipment to respond to outbreaks and to treat environment; Provincial Pharmaceutical Company is responsible for preparing available 200 drug packs to respond to outbreaks.

### **c. Institutional framework**

Vietnam has an institutional structure. In vertical coordination structure, there are four hierarchies of Committee of Flood and Storm Control (CFSC) divided into administrative levels from Central, Provincial, District to Commune levels in which CFSC is the top of hierarchy and related-sectors are members (Figure 4 and 5). In horizontal coordination structure, CFSC of each level coordinates related-sectors in activities of DM.<sup>4</sup> In addition, at the central level, there are four other national committees taking part in these activities: National Committee for Search and Rescue victims, National Committee for Safety Transportation, National Committee for accident and injuries control, National Committee for serious communicable diseases control. There is not one oversight committee with the mandate to coordinate all individual committees.

In each related-sector, other vertical and horizontal coordination structures was also established and called Sector CFSC.<sup>4</sup> However, there has been lack of uniform and synchronized coordination because there is lack of legislation, regulations and guidelines which stipulate powers, roles and responsibilities of related-organizations and clear operational coordination mechanism to integrate activities of stakeholders in operational coordination system from central to commune levels as well as guarantee of implementation in place.<sup>29,30,47</sup> The weakness of Vietnam was leadership in horizontal coordination and lack of non-public organizations.<sup>47</sup>

In NSNDPRM, roles and responsibilities of health sector were not included as a key actor.<sup>45</sup> However, MOH established a structure of CFSC of health

sector (Figure 6). Tasks of related-ministries at central level assigned by government are clear in spite of some overlaps. These tasks at lower levels are not concretized.

#### **d. Information systems**

CCFSC is considered as an inter-ministerial information committee. Early warning information is sent to CCFSC and other related-agencies by National Center for Hydro-Meteorological Forecasting. Implementing guidance and reporting mechanisms and procedures were established by CCFSC/MARD.<sup>30</sup> Furthermore, citizens no longer believe in information of forecasting and early warning and they do not comply with timely evacuation because of wrong forecasting.<sup>48</sup> Information systems were obviously improved with the support of Royal Netherlands Embassy and UNDP in establishing of NDMP in 1999, which it was transferred to CCFSC in 2009.<sup>4</sup> It is also the place for information exchange within and among stakeholders on programs, projects, capacities, resources and historical disaster database.<sup>29</sup>

Although the quality of information improved, it still lacks information on VA because it has not been planned. Also, the information of post-disaster reports is not detailed enough to analyse the causes of problems and the effect of relief activities which help proposing measures for decision-making process, it only used to count the damage for relief activities.<sup>29</sup> Additionally, there were no clear mechanism and procedures as well as uniform reporting forms; each sector, each province reported on different forms which leads to difficulties in summary, store and analysis of data. Also, all collected data were from public sector while those of private sector were not included.<sup>27,32,49</sup>

#### **e. Resource base**

Vietnam is in the progress of improving the resource base.<sup>45</sup> However, current capacities and resources are only partially met for DM activities in all administrative levels because of limited budget. Most of current financial resources are used for relief and relocation activities after disaster. Additionally, there is no long-term strategy and plan to develop human resources for DM.<sup>29</sup> Training programs for the rest of professionals such as medical personnel, police, engineers, architects and so on are not carried out. In RHA, health workers were not trained and did not have knowledge and skills to respond to emergency,<sup>27,38</sup> especially in mass casualty management in Southern Vietnam which resulted in avoidable overload in hospitals after typhoon.<sup>27</sup> Current search and rescue forces are limited to military forces.

Relief funding is mainly from the contribution of citizens after disasters such as one-day salary contribution of civil servants and fixed-amount contribution of each household outside of affected areas. There are no official organizations for relief funding as well as for disaster insurance because law and regulations have not been developed on this issue.<sup>29,30</sup>

Stockpiles are carried out through consignment contracts or from the contribution of providers. However, there was no stockpile or provision from higher levels chemical and equipment to control communicable diseases and to treat environment as in QuiChau District of Nghean province after typhoon Lekima (2007),<sup>39</sup> especially in provinces of Southern Vietnam because of lack of preparedness.<sup>27</sup>

#### **f. Warning systems**

Although no lack of advanced technologies for forecasting was reported, there are inadequate capacity of officers or experts for evaluating data, predicting locations and landfall time; warning messages were covered on wide geographic areas and the update messages were transmitted to population at risk and actors relatively late.<sup>48</sup> In one month of 2008, there were four times of wrong forecasting and relatively late warning, which included two typhoons and two floods.<sup>48</sup>

The means and network of communication are varied such as telephone, fax, radio, television. Particularly, loudspeaker system covers most of population at risk in remote areas. Signals of radio system cover up to a wide area of 3,500km from the lands to East Sea.<sup>29</sup> However, the systems have not reached to some remote rural areas because of limited infrastructure and geographic conditions.<sup>29</sup> Communication systems of military and police, and mobile-cars can be used as alternative means in the cases of non-functions of common means.

To communities of Southern Vietnam, they have not experienced to cope with typhoons while their knowledge on typhoon safety may be considerably low.<sup>28</sup> Local people did not know typhoon risks and went to beach to see it while local authorities were not insisting and enforcing to evacuate local people.<sup>27</sup> There is no research on the coverage of communication systems and the actual reach of the message to all individuals at risk.

#### **g. Response mechanism**

To response activities, Vietnam uses principles of "four on the spot": "command on the spot, man-power on the spot, materials on the spot and logistics on the spot".<sup>45</sup> All response activities were commanded by head of CFSC at each level who is the president of each administrative level. All resources are mobilized to response if disaster occurs. Using public services are free to affected population with sponsor of government. According to RHA,<sup>27,38,39</sup> health workers mobilized to serve for affected population was insufficient while they were not trained to cope with emergency situation. Additionally, chain supply was ineffective which led to lack of chemical and equipment to control communicable diseases and to treat environment in Northern and Southern Vietnam.<sup>27,39</sup> However, responding to typhoons of provinces in the Central Vietnam were very good because health needs were assessed and materials and logistics were prepared in place a few months at all levels before typhoon season. Also, drugs and medical equipment were moved to safe places. Health staff was available 24hours per day in their posts and evacuation shelters.<sup>32</sup>

## **h. Public education and training**

After success of pilot projects on the community-based disaster risk management (CBDRM) for vulnerable communities, Government of Vietnam has approved “the Community based disaster risk management project”<sup>46</sup> in large-scale for all natural disasters which included 6,000 most vulnerable communities in whole country. The project will be implemented from 2009-2020 for building capacity for vulnerable communities, cadre and volunteer team, and local authorities. Knowledge of DP was planned to be introduced into curricula of schools in period of 2007-2020.<sup>45</sup> However, it is only in small-scale pilot stage up to now because there are no regulations and guidelines promulgated by Ministry of Education and Training.<sup>29</sup> VRC has been training for volunteers and communities in a few places and rescue teams of military forces have been trained by military forces.

## **i. Rehearsals**

Small field simulations and drills were sometimes carried out in a few places and mainly focused on search and rescue activities.<sup>30</sup> Simulations or rehearsals in a logic and systematic way have not been implemented routinely in all regions of Vietnam. Rehearsals were not been mentioned in DP plans.<sup>29</sup>

### **4.2.2. Strengths and weaknesses**

#### **a. Strengths**

- Government of Vietnam has a NSNDPRM with overall vision for DP and mitigation. This strategy includes all components of DP framework.
- CBDRM project which includes most nationwide vulnerable communities in 12-year period is an important step forward in DM. It not only improves VA and planning status but also builds capacity for communities, responders and management staff in place.
- National government has formed a coordination structure in which CCFSC is considered to be representative for government to coordinate all activities of the strategy with the roles of the top of hierarchy in vertical and horizontal coordination structure. Hence, it is designed as a national disaster operational coordinating committee and information center which stakeholders can collect and exchange information. Also, it proposes guidelines for implementation, and mechanisms and procedures for reporting.
- Vietnam also has an excellent stockpile system through consignment contracts. Also, there is the solidarity of citizens and internal donators in supporting for affected population.
- “Four-on-the-spot” is a well-known response mechanism with community participation which is commanded and controlled by the top person of administrative levels (authority decentralization). This also facilitates for mobilizing and using all social resources in place to response to emergencies. In addition, public services are provided absolutely free for affected population in emergency period.

## ***b. Weaknesses***

- Data on health impacts were so common without information of the causes, mechanisms, typhoon's phase time of direct health impacts. Hence, using epidemiology to describe and analyze the causes and mechanism of deaths, injuries, illnesses and their contributing factors can not be implemented in order to be able to determine appropriate kinds of things for preparedness and plan-making.
- VA has not been implemented because there was no consensus mechanism and standardized assessment tools in place as well as information system to update and share it.
- Plans' objectives and their activities of provinces in Southern Vietnam were not clear and specific together without resources analysis. Plans are written annually without much reviewing and updating important information such as vulnerabilities and resources analysis. Most of activities in DP plans focused on response activities. Actors for preparedness and early warning still limited to public sectors only.
- There are many national committees related to disaster or typhoon management operating independently from CCFSC which can result in overlaps in roles and responsibilities, and difficulties in operational coordination.
- Lack of comprehensive legal frameworks with clear powers, roles and responsibilities of stakeholders to support activities in emergencies as well as clear operational coordination mechanism among stakeholders from central to commune levels in place. There are no roles and responsibilities of health sector in NSNDPRM.
- Information systems lack important information on risk assessment and post-disaster investigations. Data of these reports on infrastructures were general and could not be used to assess their impacts on health services while the risks of potential epidemics due to the damage of water supply and sanitation system, and environment contamination were not assessed in these reports. There is lack of mechanism and procedures and uniform of reporting forms.
- Resources and capacities are limited at decentralized levels to implement their plans. Furthermore, resources mainly focus on phases after disaster. There is not a long-term strategy for human resources development. Responder forces are almost limited to military forces. The number of trained people to respond to disasters within communities is very limited. There is no disaster funding and disaster insurance. Project of NSNDPRM did not mention to train for professionals.
- Warning systems is not reliable because of lack of human resources or experts while communities' awareness on typhoon is limited. Implementing progress of projects and plans are relative late.
- Rehearsals activities are not interested in DP plans but mainly focused on search and rescue activities. Rehearsals were not planned and implemented in a logic and systematic way.





## **CHAPTER 5: DISCUSSION**

In this chapter, first an overview is given of experiences on preparedness from other countries followed by discussion on what Vietnam can learn from this.

### **a. Vulnerability assessment**

Although VA does not directly reduce the consequences of typhoons, it is foundation information to make decisions for mitigating impacts of typhoons. Guam, one of the highest typhoon-prone places, recognized this and implemented a comprehensive VA study to assess the most damaging hazards of typhoons and use findings for making typhoon preparedness plan. The study is based on historical data of damage levels, response capacities, and engineering information to assess their possible damage on structures, transportation, infrastructure, socioeconomic areas. It also identified areas where public infrastructure can become vulnerable to cyclonic winds, flooding and mudslide.<sup>50</sup>

Saint Lucia conducted a VA by listing hurricane-related hazards and possible damages based on historical evidence. Its findings were used to plan for the worst scenarios of three kinds of hazards: cyclonic winds, flash-flood, and heavy rain and storm surges.<sup>51</sup>

India and the Philippines have used hazard mapping and geographic information system (GIS) as a database to assess vulnerabilities of populations, houses, socioeconomic status.<sup>52-55</sup> Using these systems will facilitate for accessing, sharing and making decisions among actors.

When we look back at the consequences of typhoons in Vietnam (chapter 3), the damage of life, property and infrastructure did not show a downward trend. This may be an outcome of unidentified risk trends and/or lack of information for preparedness decision-making because of lack of monitoring unsafe conditions and/or information on changing of socioeconomic status. While the damages caused by typhoons in Guam and Saint Lucia in the past were insignificant.<sup>3,51</sup> This is likely in part thanks to VA.

Guam and Saint Lucia are small islands and there may be differences in hazard impacts and vulnerabilities because of the differences of geographic, typhoon-landfall characteristics and socioeconomic status. Vietnam has bigger land areas and longer coastal lines, so it should separate into regions based on typhoons' frequency and intensity through historical data. Although historical data of CCFSC are available for a 20-year period of 1989-2008, Vietnam can refer these data in a long period from outside sources such as those of CRED. However, data may be inadequate for a full VA. A comprehensive VA as Guam seems a big challenge to Vietnam because of lack of resources and regulations but it is the best way to identify the most vulnerable elements and public works and construction practices increasing vulnerabilities to typhoon-related hazards. At the beginning, Vietnam can follow the example of Saint Lucia and plan for coping with the worst situations. These may be basis or beginning steps to conduct for a comprehensive VA in the future.

Using hazard mapping and GIS may be applied in Vietnam because it has been a good telecom background with 100% of districts and more than 70% of communes having access broadband internet in 2010, 8-12 internet subscribers per 100 inhabitants and about 25%-35% of total population using internet; it is free to access for public services.<sup>56</sup>

### **b. Planning**

As a result of VA, the goals and activities of typhoon preparedness were identified for different sectors. Therefore, objectives and subsequent activities of typhoon preparedness plan are clear, Saint Lucia as an example. In the plan of Saint Lucia, each key activity was assigned to one key organization (including health sector) that is mainly responsible for it and other organizations were also assigned specifically to assist for the activity.<sup>51</sup> This is to avoid the overlap in implementation among actors. Depending on each action's attribution, sectoral-plans were also developed to implement for activities and determined the readiness of resources.<sup>51</sup> Particularly, these activities were implemented by domestic and foreign actors which was stipulated specifically by policies, guidelines and standard operating procedures (SOPs).<sup>57</sup> These lead to the integration in activities and good coordination of sectors. The plan and procedures are revised and updated regularly, especially after each hurricane<sup>51</sup> so that vulnerabilities are monitored and precautionary measures are taken for them.

The same purposes are applied in India. Context of deadly typhoons, lessons learned are used for review and update plans. Clear roles and responsibilities among actors are a success of preparedness and response activities. DM plan is written specifically for each institution based on its functions. It is reviewed and updated regularly to meet the needs.<sup>58,59</sup>

To assure the integration and coordination in disaster risk reduction (DRR) activities of various domestic and foreign stakeholders, Indonesian Government reformed DM law which UNDP claims that it is a base for sustainable development and benchmarks for other countries to follow.<sup>60</sup>

In Southern Vietnam, 6-10 page plans were written for all natural and man-made disasters without contingency plans. Because of lack of VA, their objectives are often stated so general such as proactive prevention and impacting mitigation of natural disasters to minimize the losses of lives, properties and infrastructure; good performance on principles of "four on the spot". The objectives seem to be too vague to give adequate guidance to implementation of the plans. Furthermore, it should be kept in mind that a plan is only a product of planning process, not a main goal. Overlap in the plans is due to roles and responsibilities of actors which were not assigned specifically. Additionally, the roles and responsibilities of health sector was not identified as a key sector while its roles and responsibilities are indispensable for first-aid, pre-hospital and hospital care to all disasters.

To assure capacity to implement the plans, resources have to be analyzed while these were not mentioned in the plans of Southern Vietnam. It is

clear that public sector can not cover all DM activities while actors for implementing the plans are public sector only.<sup>47</sup> This may be reason why other countries involved non-public sector such as UN agencies, international organizations and NGOs into their plans to fill gaps of public sector, Indonesia as an example. However, to avoid overlap in implementation and confusion in coordination, legislation reform in DRR needs to be carried out first.

Last but not least, these plans of Southern Vietnam are similar from year to year while vulnerabilities and resources change in time. This means these plans should be revised and updated regularly as well as shortcomings and good practices applied or conclusions and adaptations drawn from previous typhoons.

### **c. Institutional framework**

In the Philippines, DM system was led by National Disaster Coordinating Council (DCC) and is the highest organization for making policy, coordinating and supervising to DM-related organizations and the line ministries. It includes a Disaster Operations Center (DOC), three staff section and task units (Figure 8). Roles and responsibilities are assigned specifically. Additionally, there is structural homogeneity of DCC in all administrative levels. DCCs at regional, provincial, municipal and barangay are counterparts of National DCC. During emergencies, DOC will be activated.<sup>61</sup>

In Saint Lucia, there is only one leading organization responsible for preparedness and coordination of all activities related to emergencies, including hurricane, National Emergency Management Organization (NEMO). It includes 14 National Committees, 18 District Disaster Committees and Ex Officio Members (Figure 9). In case of emergency, NEMO converts to become Emergency Operations Center (EOC) and is chaired by Prime Minister. Additionally, five kinds of EOC (Sectoral, Private Sector, International, Crisis Management Center and District) will be coordinated by National EOC based on laws and SOPs (Figure 10).<sup>51</sup> There are laws which stipulated clearly the functions, powers and responsibilities of individuals and organizations in DM activities.<sup>62</sup> Also, coordination is guided by SOPs for the National EOC, a Systematic National Shutdown.<sup>63</sup>

Before law reform of Indonesia in DRR, National Disaster Management Coordination Agency was under the auspices of the Coordinating Ministry for Peoples' Welfare while this ministry had limited powers to mandate, command and control over the line ministries. Also, the agency did not have mandate for operations response together with discord from response organizations while reporting systems are weak and blurred in all administrative levels. Because of these reasons, law reform unified for leading by one civil society agency, the Indonesian Disaster Management Society. It has powers to coordinate all DM activities of all disaster phases and command and control over all actors in coordination response. The position of Head of the agency is equal to a Minister. Counterparts of the

agency have been established at provincial level. The law reform involved and increased the roles of international actors in DM activities.<sup>60</sup>

In DM system of the above countries, there is only one organization to coordinate, command and control all DM activities. However in Vietnam, there are five national committees related to these activities of all individual committees and/or ministries. Because CCFSC was established first, key related ministries also established sector CFSC. After new national committees were established, sector CFSC also changed their name to meet to new functions and tasks. For example in MOH, the name of committee changed from MOH-CFSC to Committee for Disaster Management, and Search and Rescue. This shows that there is no uniform and synchronization at national level which have led to obstacles in horizontal coordination and reporting at national level. Additionally, the DM organization of other countries is at the same level as Ministries while CCFSC of Vietnam is only one of 23 departments of MARD. This may more or less lead to obstacles in command and control that looks like that of Indonesia before law reform. To vertical level, CFSC at lower administrative levels receives many directions from different national committees which result in confusion in implementation and reporting process, especially in sector at these levels. Hence, it had better separate CCFSC from MARD and integrate all national committees to become one independent agency with powers on the line ministries in DRR activities. A legislation reform in DRR as Indonesia should be carried out to assure implementation and coordination of DRR activities and involvement of private sector and international actors. The policies, guidelines and procedures should be developed by the new agency.

Kinds of structures as such of the Philippines or Saint Lucia are those which Vietnam can learn. The Vietnam's structure does not have regional level. For central level (Hanoi), it is difficult to monitor, supervise and support routinely and regularly all DM activities at provincial level. Vietnam and Philippines are similar in land area and population. Philippines's decentralization model is what Vietnam should learn. Also, making counterparts for lower levels and operations centers will assure structural and functional consensus which may clarify roles and responsibilities of actors and facilitate for coordination. Because Saint Lucia is a small island, its centralization model can not apply to Vietnam. However, it may be an option for the lowest levels.

#### **d. Information systems**

In the Philippines, DOC maintains and operates an information system and commands and controls response activities in emergency cases. Receiving and sending alert and warning messages are used through web-based short message service which their contents are understood clearly by public. Reporting mechanism and procedures are a two-way information system under operational guidelines of National DOC. Reported information is formatted in a uniform way nationwide. Its database is updated regularly including vulnerability and post-disaster information to use for analyzing data and making decisions. Information of capacities

and resources of key actors is available which can be used for mobilization in necessary cases. Furthermore, advanced tools as internet-based, web-based, GIS are used to provide solutions for coordination and collaboration as well as disaster risk management activities.<sup>49,61,64</sup>

Warning messages in Australia and the Philippines, they include time, situation, location, strength, movement of typhoon, forecast positions, warning level, warning place, its impacts, precautionary measures to hazards for public and DCC.<sup>65,66</sup> Conversely in Guam, local people did not evacuate because they did not understand warning messages and doubted the accuracy of warnings.<sup>50</sup>

Web-based information system is convenient and easy to access among actors. The information is updated continuously and can be reviewed and compared. Also, information on capacities, resources and information for making decision are available to use, share and mobilize in necessary cases. Vietnam's web system is good enough to apply the advantages of the information system. CCFSC has used some functions of the information system. This limitation may be not due to lack of capacities and resources but lack of laws and regulations. For example, some VA studies conducted in Vietnam but its information was not recorded.<sup>29</sup> Hence, information system should be used officially through web-based system.

As to warning messages, those of Vietnam are not clear enough to be understood by public. An example on warning message of CCFSC is "At 04:00, August 4<sup>th</sup>, the typhoon centre was at 20.4 N, 114.3 E, 420km East Southeast LôiChâu Island (China). The strongest wind near the typhoon centre was at the speed of level 8 (62kph-74kph), with gusts of level 9 - 10",<sup>4</sup> I think that public will not know where typhoon is, when it is expected to hit some places, why it is dangerous to them and what they should do to be safe. Findings from studies of Guam are lessons for kinds of the warnings. Therefore, the contents should learn from those of Australia and the Philippines (Table 9).

As to reporting systems, not uniform information reported of Vietnam will be difficult to use and update while there is no information of post-typhoon investigations. Furthermore, there are little official feedbacks from higher levels in order to be able to improve the quality and forms of reports. Hence, it should develop uniform forms and their procedures for reporting and post-typhoon investigation like the Philippines so that information of previous typhoons and feedbacks will be used to analyse and draw lessons learned to prepare for typhoons in the future. Using advanced information management tools will facilitate to record, update and share information.

#### **e. Resource base**

In Saint Lucia, human resources are planned through National Disaster Management Training Program and National Hurricane Training Program. Before implementing, training programs are planned based on needs assessment, functions and activities of individuals and organizations and implemented following their procedures. The quantity and quality of train-

ees, trainers and the contents, numbers, duration and outputs of training courses are evaluated. Logistics and stockpiles in place are executed by committees and organizations which were stipulated by laws and emergency procedures.<sup>51,62,63</sup>

In India, training for medical staff is also carried out monthly in their faculties by certified trainers. Hospitals also regularly train for firefighters, traffic police on extrication, pre-hospital care and transportation skills as well as train for trainers of Fire Brigade.<sup>59</sup> A web-based online comprehensive disaster risk management program has been used to train practitioners.<sup>54</sup> To disaster funds in India, contributions from different stakeholders such as government, industry, international agencies and NGOs have been made at national level.<sup>59</sup> A micro-insurance scheme for low-income households has been implemented.<sup>67</sup> At village level, the funds are created in each of the community through contributions from households to stockpile essential needs for relief.<sup>58,68</sup>

In Philippines, National DCC has coordinated to other agencies to develop programs and train for local governments.<sup>55</sup> The programs have implemented based on orienting on needs such as full training for new local chief executives on knowledge and leadership. Also, they provide specialized skills such as search and rescue, first-aid, VA, damage assessment, disaster medicine, and evacuation for quick reaction teams, volunteers and public.<sup>69</sup> Furthermore, disaster funds and disaster insurance have been implemented in large-scale to support for DM activities and to reduce catastrophic expenditure of people.<sup>70,71</sup>

Many typhoons hit Vietnam each year but there is no national training program to develop human resources. From method of Saint Lucia should be learned. However, Vietnam is bigger in land and populated country. It should implement a master plan for human resources development of different sectors before conducting training programs. Providing training programs like the Philippines is appropriate because they are based on tasks and positions of different implementers. Personnel of related-sectors has to be trained on knowledge and skills related to their roles and responsibilities. Vietnam does not have professional rescue teams, rescue forces are soldiers and firefighters with 2-3 year-duty term. The training ways of rescue forces of health sector as India for other sectors are suitable for Vietnam.

Response principles of Vietnam are four-on-the-spot but logistics and stockpile was not available in some places.<sup>38,39</sup> Hence, they should be put in plans, assigned specifically and stipulated by laws as those of Saint Lucia. Vietnam does not develop the forms of disaster funds and insurances. It should put the annual budget for disasters into disaster funds at administrative levels and involve domestic and foreign stakeholders for contributions like above countries. However, to maintain and develop the funds, it needs stipulations by laws for expenditure and financial disclosure. Vietnam is a poor country, so a micro-insurance scheme for low-income households as India is good solutions to reduce the burden for government

and population. Additionally, Establishing and operating disaster insurance companies like the Philippines should be developed. Models of disaster funds at community level like in India should be developed. The contributions after disasters as often implemented in Vietnam will be too late. In order for resources to be available on time, there should be an official organization to undertake this routinely.

#### **f. Warning systems**

To improve the quality of forecasting for Southeast Asia, Kitamoto<sup>72</sup> showed a solution by combining data from GMS satellite with NOAA polar orbiting satellite. In China, warning systems were improved through advanced observational network in lands and outer space, data processing, fast transmitting to policymakers and public, information-sharing system among different administrative levels and understandable warning messages by public.<sup>73</sup>

In India and Bangladesh, warnings are disseminated through mobile-phone systems and wireless stations. Additionally, volunteer workers disseminate received warnings to their community and help vulnerable groups for sheltering.<sup>58,71</sup> Because of effectiveness of volunteers in disseminating warnings, consequences of typhoon in 1997 was much lower than that of 1970 with same gale.<sup>71</sup>

Accurate and timely warnings are very important to take precautionary measures. Because of lack of accuracy, warnings often cover very wide geography. This may result in the waste of resources and the subjectivism of both officers and public for precautionary measures. Vietnam should apply studies of Kitamoto and experience of China from combining data from different sources to improve the accuracy of forecasting.

According to Vietnam Media Corporation,<sup>74</sup> total mobile-phone subscribers was about 90 million in July 2009 that was more than total population of Vietnam while its services are quite cheap. Together with existing media means, warning messages should be transmitted through mobile-phone systems and consider the kinds of subscribers actually used. The effectiveness of volunteers in India and Bangladesh are so impressive. Hence, Vietnam should develop volunteers' forces in coastal at-risk communities. However, it should take into account risks of failure and propose solutions to maintain them

#### **g. Response mechanism**

The good preparedness of plans and capabilities before activating response mechanism and multi-sectoral response are typical features of Philippines.<sup>69</sup> Saint Lucia has a comprehensive DM plan with clear objectives and subsequent activities in logic and systematic way. Additionally, roles and responsibilities of individuals and organizations are assigned specifically in each phase of emergency. Responding to emergency is simple with activating plan and executing follow SOPs and in twenty emergency procedures which were stated in hurricane plan.<sup>51,63</sup>

Although Vietnam has a well-known response mechanism, “four-on-the-spot”, and plans in place, there were many problems in implementation. This may be because objectives and activities of the plans are unclear without careful checking resources. Although reviewing plans and capabilities was requested by CCFSC before raining season, it becomes failure due to lack of supervision from higher levels. Hence, it needs to be stipulated to check these issues officially and routinely. Multi-sectoral response should be carried out, especially non-public sector filling gaps of public sector. Also, to avoid overlap in implementation and confusion in coordination, SOPs like Saint Lucia should be developed. In addition, the command and control by president at each administrative level has potential risks of wrong directions. The functions should be transferred to operations centers.

#### **h. Public education and training**

Government of India recognized that participating and empowering community in planning process are good ways to prepare for typhoon. Hence, a safe shelter was built up in each typhoon-prone community which is properly managed by a Disaster Preparedness Committee (DPC). The members of DPC are selected from appropriate young people in community and trained in DP with ratio of one member per 10 families. Task force groups are built from these members with clear roles and responsibilities. Particularly, each member is responsible for monitoring, receiving and issuing warnings, evacuating, providing relief, rescue, medical first-aid and sanitation.<sup>58</sup> Knowledge of DP was introduced into secondary schools in 14 state of India in 2004. A number of extensive training programs have been implemented for teachers and students. Additionally, some universities and institutes are introducing DM as a formal subject.<sup>54</sup>

Similarly in Philippines, DM was introduced into curricula in public school, colleges/universities and even in master-degree course.<sup>55</sup> Training and public education programs are maintained to enhance public awareness. Communication materials are provided to media to implement preparedness program for public. Also, special events are organized to remind preparedness public.<sup>69</sup>

In Guam, findings of a survey show that local people did not evacuate because of: “lack of understanding of the warnings or confusion about the warnings, questionable confidence in the warnings, overestimating the ability of their structures to endure the wind, reluctance to leave the comfort of ones home for uncomfortable, restrictive shelters”.<sup>50</sup> This shows proper public education is very important to reduce mortality and morbidity.

Building capacities, involving and empowering community as India did is very important to create a self-reliant community in DP. DP activities seem a big burden to public sector to cover for whole population instead of letting some responsibilities for communities. DP in Vietnam was mainly implemented by public sector which results in difficulties in establishing such communities and empowering them. So, it should involve UN agencies, international organizations and NGOs to support in planning,



education and training in communities. It is advisable to establish three resource centers for three regions to train for professionals and communities and build database.

Introducing DM program into curricula has wide influences on public and will reduce unnecessary extension and public education programs. Therefore, these programs will be more effective and efficient by focusing on practical needs of communities. However, because of lacking regulations and guidelines from appropriate authorities, the program was not implemented in Vietnam. Additionally, DM studies in higher levels will identify shortcomings and find out solutions to improve current DM activities. The survey from Guam shows public education should assess and identify public awareness and provide programs familiar to community's life so that they can understand the information and take proper precautionary measures in emergency cases. CBDRM program which will be implemented in Vietnam should learn from these experiences.

#### **i. Rehearsals**

Simulation exercises was planned to test DM activities in Saint Lucia such as contingency plans, coordination procedures, performance of personnel, equipment and materials.<sup>51</sup> In Orissa (India), evacuation drills and rehearsals are implemented regularly. This is necessary to maintain awareness and acquire skills, especially just before typhoon season.<sup>58</sup> Also, drills are implemented monthly in hospitals to correct errors and improve weaknesses.<sup>59</sup> In Philippines, many drills and exercises have been implemented by DOC with same purposes.<sup>69</sup>

In Vietnam, it is recognized that simulation exercises and drills are to assure the planned scenarios and developed procedures will be working well when the real situations come. These help raising awareness and improving skills of many kinds of professionals and communities. However, search and rescue drills limited to military. This is due to lack of resources to conduct in large-scale as well as cooperate with other sectors and communities. Also, there are no regulations to punish in wrong implementation. Additionally, presidents of each level have heavy responsibilities. Hence, the function should be delegated to other organization such as operations center together with legislation so that rehearsal activities in plans and implement them regularly.



## **CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS**

### **6.1. Conclusions**

The most frequent consequences of typhoons are deaths, injuries and missing. 90% of deaths or missing cases result from drowning while 10% are from structure collapses, flying debris, falling trees, violent winds, electrocutions. Most of injuries are minor injuries such as lacerations, bone-fractures, wound punctures and cleanup injuries after typhoon. Main determinants to above consequences are early warning, timely evacuation, safe sheltering and citizens' appropriate responses. Impacts on health infrastructure are the damage of health facilities, drugs, medical supplies and equipment and supply chain. Other indirect health consequences are due to impacts on infrastructure of public services such as roads, communication, electricity, water supply, sanitation system and losses of houses, properties, livelihoods and foods.

In Vietnam, consequences of typhoons on direct health showed an upward trend in deaths. Additionally, other direct impacts did not show a downward trend. These consequences in Southern Vietnam were huge. The percentages of deaths and injuries of one typhoon in 2006 accounted for 45% and 81% of total deaths and injuries nationwide. However, causes, mechanisms and time of these consequences were not recorded in CCFSC's reports. Causes of deaths were different from region to region in RHAs' reports. Similar picture was shown on health infrastructure impacts. The damage of health facilities of Southern Vietnam in 2006 constituted to 70% that of nationwide. There were big damages on infrastructure of other sectors, especially on houses and crops. These figures caused by each of two typhoons in Southern Vietnam accounted for high percentages in comparison with those of total Vietnam.

Preparedness is the implementation of specific precautionary measures to an imminent specific hazard or potential threat. A disaster preparedness framework used for analysis in this study includes nine elements: VA, planning, institutional framework, information systems, resource base, warning systems, response mechanisms, public education and training and rehearsals. In Vietnam, information on VA is not assessed. Although NSNDPRM emphasize DP activities, plans of ministries and provinces have mostly focused on response activities while their objectives and subsequent activities are not stated clearly. Vietnam has an institutional structure but there are 5 national committees related to DM activities which influence on coordination while roles and responsibilities of actors have not been stipulated specifically. Additionally, roles of health sector and non-public sector are not paid attention to. Vietnam has good information systems. However, some aspects should improve. Resource base is in the process of improving. Warning systems are good in general but there is a need of experts for forecasting. Vietnam has well-known principles for response mechanism, "four-on-the-spot". Additionally, CBDRM project has deployed in large-scale to build capacities for vulnerable communities,

cadre and volunteer team, and local authorities. However, rehearsals are limited to search and rescue activities of military only.

There are good practices and lessons learned from preparedness in other countries over the world. A comprehensive VA study of Guam or listing hurricane-related hazards and possible damages of Saint Lucia were implemented to plan for the worst scenarios with clear objectives and activities. Structures of DM activities are led by one agency and DOC/EOC is activated to implement response activities working well in the Philippines and Saint Lucia. Law reform in Indonesia was executed to facilitate for DRR activities. Also, the Philippines have a two-way information system with uniform reporting forms and procedures nationwide. Additionally, warning messages are understood by public in the Philippines and Australia. There are national training programs for professionals, responders and volunteers which have been planned and implemented in Saint Lucia, the Philippines and India together with kinds of disaster funds and insurances implementing in India and the Philippines. In warning system, combining data from different sources was advised by Kitamoto and China while good practices of transmitting warnings by volunteers have been implemented in India and Bangladesh. In addition, multi-sectoral response mechanism and standard operating procedures are good ways of DM in the Philippines and Saint Lucia. Education model in community and school of India and the Philippines are typical characteristics for DP together with rehearsals conducting regularly.

## **6.2. Recommendations**

According to WHO,<sup>25</sup> there are four preconditions for a DP plan: VA, needs and benefits awareness of stakeholders, appropriate legal framework and clear coordination mechanism. Hence, Vietnam should assess typhoon-related hazards and possible damages by regions based on typhoons' frequency and intensity through historical data to plan for the worst scenarios. Additionally, it should conduct studies on some aspects of VA on the most at-risk areas and collect VA information of previous studies to update database and use for preparedness decision-making. When resources are adequate, a comprehensive study to VA should be conducted systematically to identify the most damaged hazards and the most vulnerable groups by regions and to identify practices which can result in the vulnerabilities of certain groups to specific hazards.

Plans should be written for the worst situation and based on VA with clear practical objectives and logic and systematic subsequent activities and analyzed resources to assure capacity to implement the plan. Roles and responsibilities of actors should be assigned specifically to avoid overlap in implement and confusion in coordination. It should involve the health sector as a key actor and non-public sector to fill out gaps of public sector. These plans should be revised and updated regularly.

It would be best to create one independent agency for DRR through separating CCFSC from MARD and integrating all national committees. The

new agency must have powers on the line ministries in DRR activities. A legislation reform in DRR as Indonesia should be carried out to assure implementation of DRR activities and involvement of non-public sector. The policies, guidelines and procedures will be developed by the new agency. Kinds of structures as such the Philippines or Saint Lucia are those which Vietnam can learn to unify at highest level and make counterparts for lower levels as well as establish operations centers.

Vietnam should officially use web-based system for information system. Also, contents of warning messages should be clear enough to be understood by public. Standardized forms, their procedures for reporting and post-typhoon investigation and advanced information management tools should be developed.

Vietnam should develop a national training program with taking into account needs in the future and its evaluation. The program should provide appropriate knowledge and specialized skills for leader executives, professionals and responders. A resource center responsible for training professionals and communities and building database should be established for each region. Logistics and stockpile should be put in plans and assigned specifically to assure that these are available in place in emergency cases. Kind of disaster funds and disaster insurances should be developed to reduce the burden for government and population during disasters.

Combining data from different sources should be applied to improve forecasting. It should buy forecasting data from foreign sources and hire foreign experts to treat these data in short-term period and develop human resources for long-term period. Warning messages should be transmitted through mobile-phone systems and wireless network together with through existing media systems. Also, volunteers' forces should be developed in coastal at-risk communities.

Plans and capabilities should be checked officially and routinely before raining season. Multi-sectoral response should be carried out and SOPs should be developed.

Vietnam should consider establishing DPCs in implementation process of CBDRM project. Public sector should involve other organizations to help communities in planning, education and training. Public education should identify public awareness and provide programs familiar to community's life. Public education and training should introduce into curricula education system including higher education.

Simulation exercises and drills should be planned and implemented regularly to correct errors and improve procedures as well as help raising awareness and improving skills of many kinds of professionals and communities. Search and rescue drills of military should cooperate with other sectors and communities.



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## ANNEXES:

Table 7: Stages of development of a tropical storm

Stage	Description
Tropical wave	A trough of low pressure in the trade-wind Easterlies
Tropical disturbance	A moving area of thunderstorms in the tropics that maintains its identity for 24 hours or more
Tropical depression	A tropical cyclone in which the maximum sustained surface wind is $\leq 61$ km/hour ( $\leq 38$ miles/hour)
Tropical storm	A tropical cyclone in which the maximum sustained surface wind ranges from 62 km/hour (39 miles/hour) to 117 km/hour (73 miles/hour)
Hurricane/typhoon/cyclone	A tropical cyclone in which maximum sustained surface wind is $\geq 118$ km/hour ( $\geq 74$ miles/hour)

Source: National Weather Service, National Oceanic and Atmospheric Administration

Table 8: The Beaufort Wind Scale

Force	Wind	WMO classification	Appearance of Wind Effects	
			On the Water	On Land
0	<1 mph <1 kph	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-5 kph 1-3 mph	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	6-11 kph 4-7 mph	Slight Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	12-19 kph 8-12 mph	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	20-28 kph 13-18 mph	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	29-38 kph 19-24 mph	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	39-49 kph 25-31 mph	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	50-61 kph 32-38 mph	Moderate Gale	Sea heaps up, waves 13-20 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	62-74 kph 39-46 mph	Fresh Gale	Moderately high (13-20 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind
9	75-88 kph 47-54 mph	Strong Gale	High waves (20 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	89-102 kph 55-63 mph	Whole Gale	Very high waves (20-30 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	64-73 mph, 103-117 kph	Storm	Exceptionally high (30-45 ft) waves, foam patches cover sea, visibility more reduced	
12	74-82 mph 118-132 kph	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	
13	133-148 kph 83-92 mph	Hurricane		
14	149-165 kph 93-103 mph	Hurricane		
15	104-114 mph 166-183 kph	Hurricane		
16	184-200 kph 115-125 mph	Hurricane		
17	>200 kph >125 mph	Hurricane		

Source: National Weather Service, National Oceanic and Atmospheric Administration

Table 9: Tropical Cyclone Advices (Warning & Watch) Sample of Australia

IDW24100  
BUREAU OF METEOROLOGY  
WESTERN AUSTRALIAN REGIONAL OFFICE

Transmitters serving the Onslow and Barrow Island areas are requested to sound the Standard Emergency Warning Signal before broadcasting the following warning.

TOP PRIORITY

TROPICAL CYCLONE ADVICE NUMBER 24  
Issued at 11:55 pm WST on Sunday, 29 February 2004  
BY THE BUREAU OF METEOROLOGY  
TROPICAL CYCLONE WARNING CENTRE PERTH

A CYCLONE WARNING for a SEVERE CATEGORY 4 CYCLONE is now current for coastal areas between Roebourne and Exmouth. A CYCLONE WATCH extends south to Coral Bay and includes adjacent inland parts of the western Pilbara.

At midnight WST SEVERE TROPICAL CYCLONE MONTY was estimated to be 185 kilometres west northwest of Karratha and 170 kilometres north of Onslow and moving southwest at 10 kilometres per hour.

Severe Tropical Cyclone Monty is expected to cross the coast in the vicinity of Onslow during Monday. Gales with gusts to 125 kilometres per hour are likely in coastal communities between Roebourne and Onslow extending to Exmouth during the day.

Very destructive winds with gusts to 250 kilometres per hour are likely to develop at Barrow Island tonight and in the vicinity of Onslow during Monday.

Residents of Onslow are specifically warned of the potential of a very dangerous storm tide as the cyclone centre approaches the coast.

Tides are likely to rise significantly above the normal high tide mark with very dangerous flooding, damaging waves and strong currents.

Widespread heavy rain and further flooding are likely in western parts of the Pilbara Gascoyne over the next few days.

Details of Severe Tropical Cyclone Monty at midnight WST.  
Location of centre : within 20 kilometres of Latitude 20.1 South Longitude 115.2 East.  
Recent movement : southwest at 10 kilometres per hour.  
Central Pressure : 935 hPa.  
Maximum wind gusts : 250 kilometres per hour.  
Severity Category : 4

FESA-State Emergency Service advises of the following community alerts:

RED ALERT: People in communities at Barrow Island should move to shelter.

YELLOW ALERT: People in or near the communities of Mardie, Onslow, Fortescue Roadhouse, Pannawonica and Nanutarra should commence action in readiness for the cyclone's arrival.

BLUE ALERT: People in or near the communities of Roebourne, Wickham, Karratha, Dampier and Exmouth should be taking precautions.

The next advice will be issued at 1 am WST.

Cyclone advices and State Emergency Service Community Alerts are available by dialling 1300 659 210

A map showing the track of the cyclone is available at: <http://www.bom.gov.au/weather/wa/cyclone>

Figure 4: Organization Structure of Flood and Typhoon Control System of Vietnam

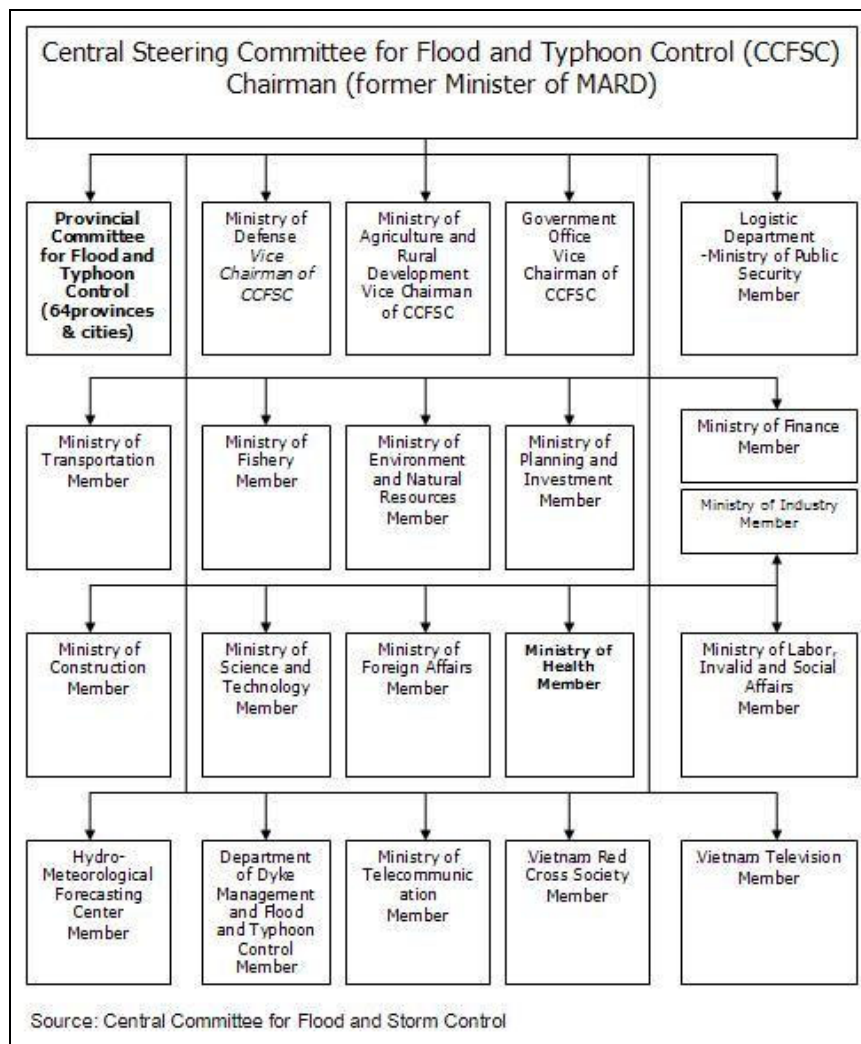


Figure 5: Relationship between the Health Sector Disaster Management system and the General Disaster Management system

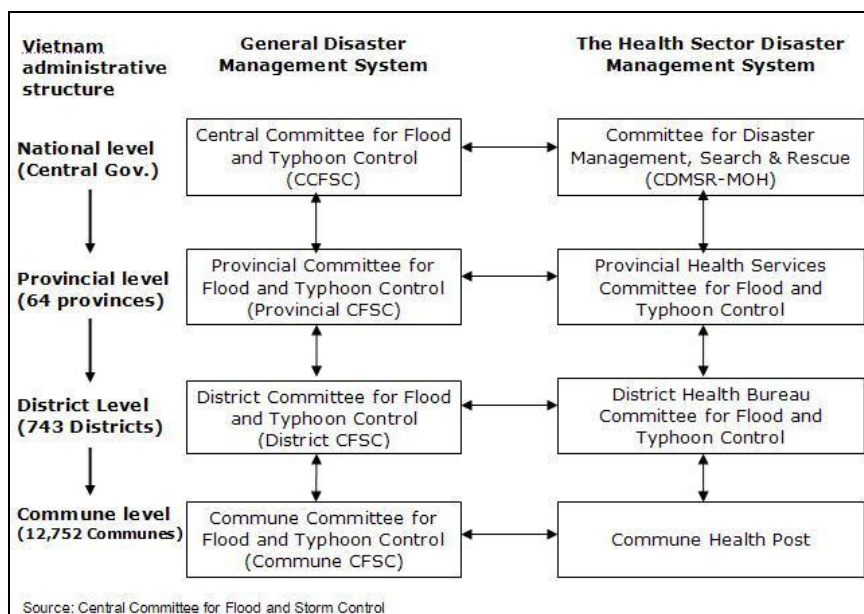


Figure 6: Structure of the Ministry of Health, Vietnam

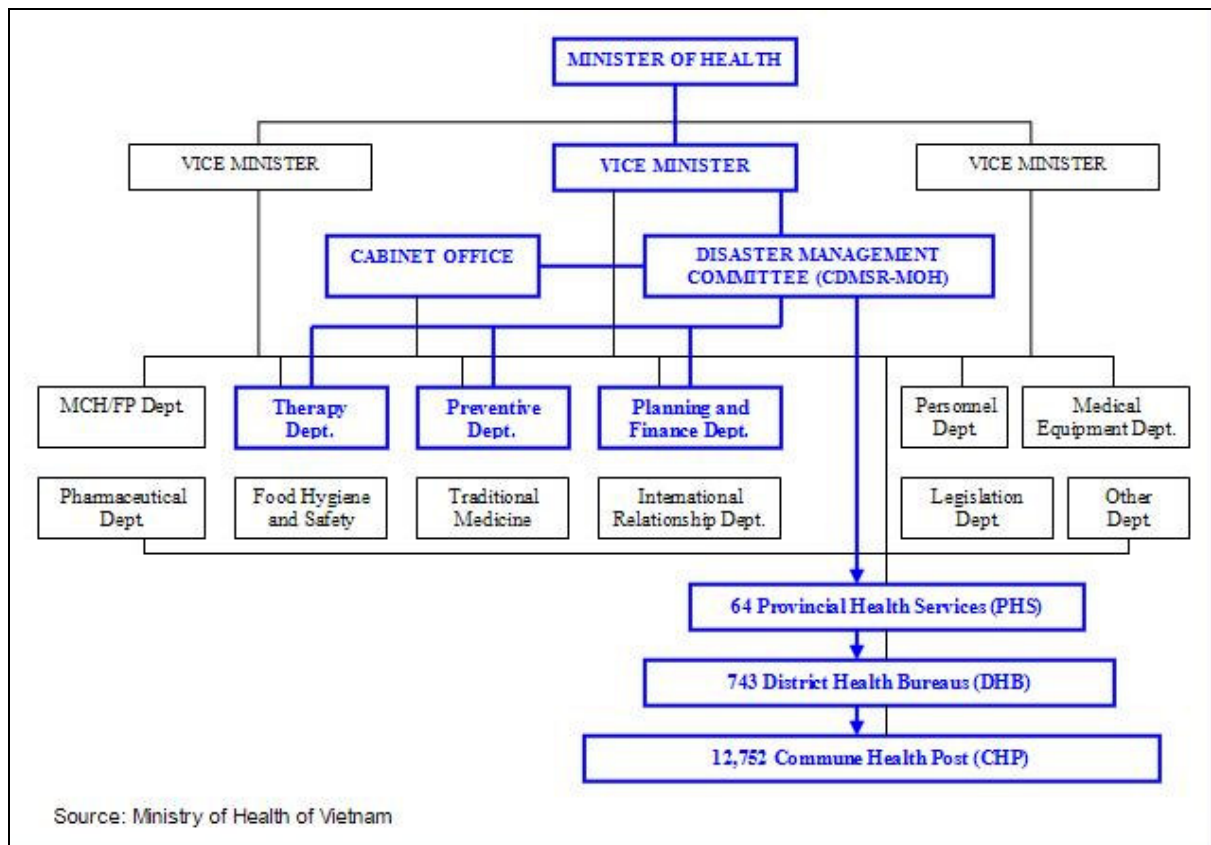


Figure 7: Impacts of disaster and response of Health sector

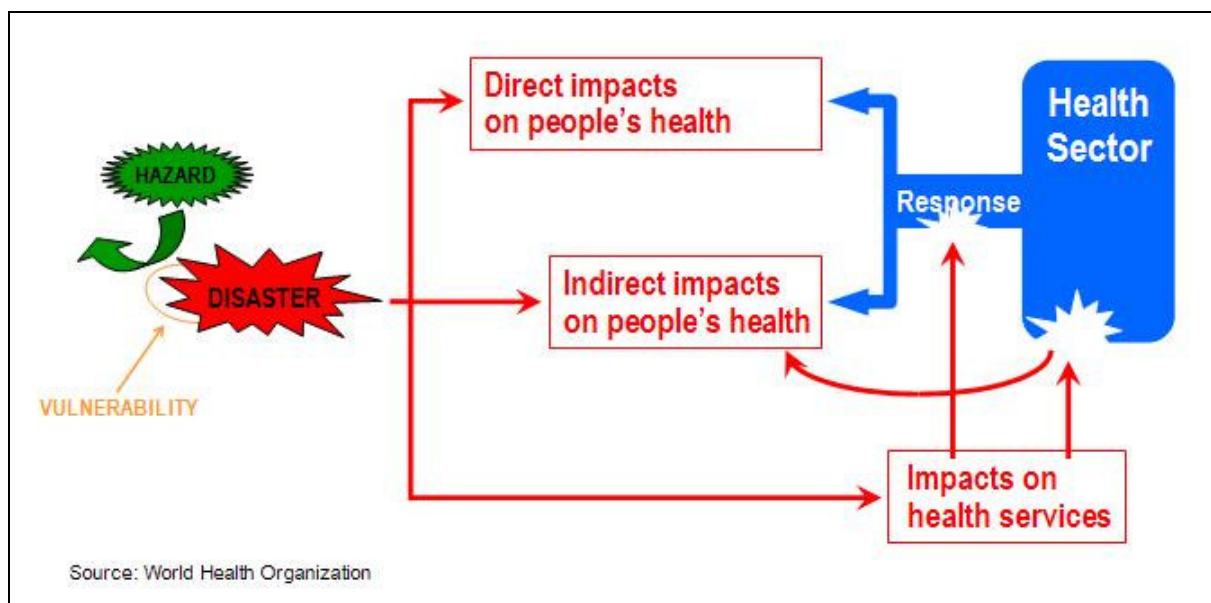


Figure 8: Structure of Disaster Coordinating Councils in the Philippines

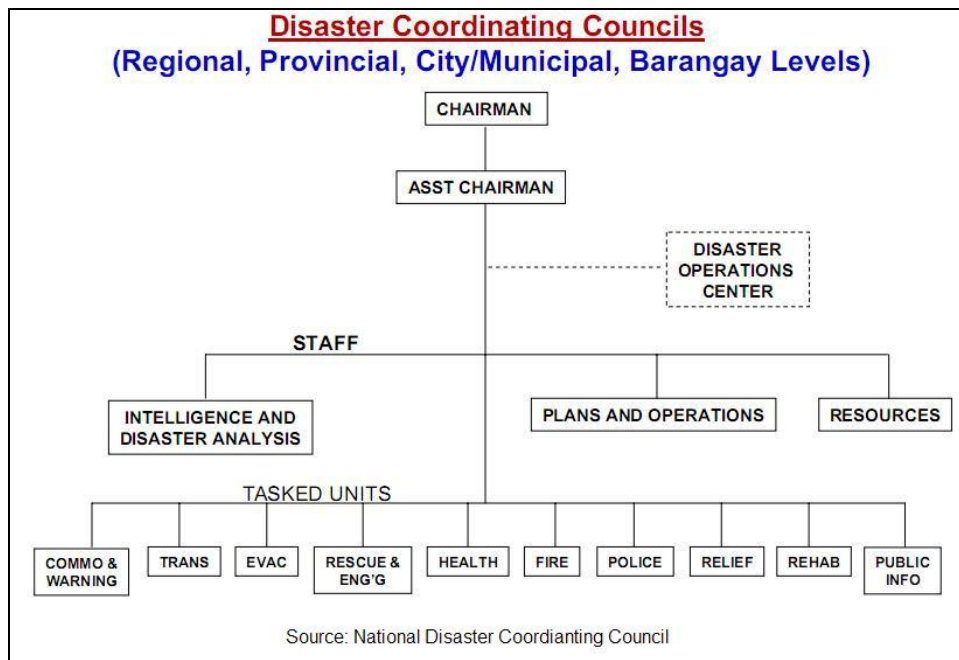


Figure 9: Structure of National Emergency Management Organization of Saint Lucia

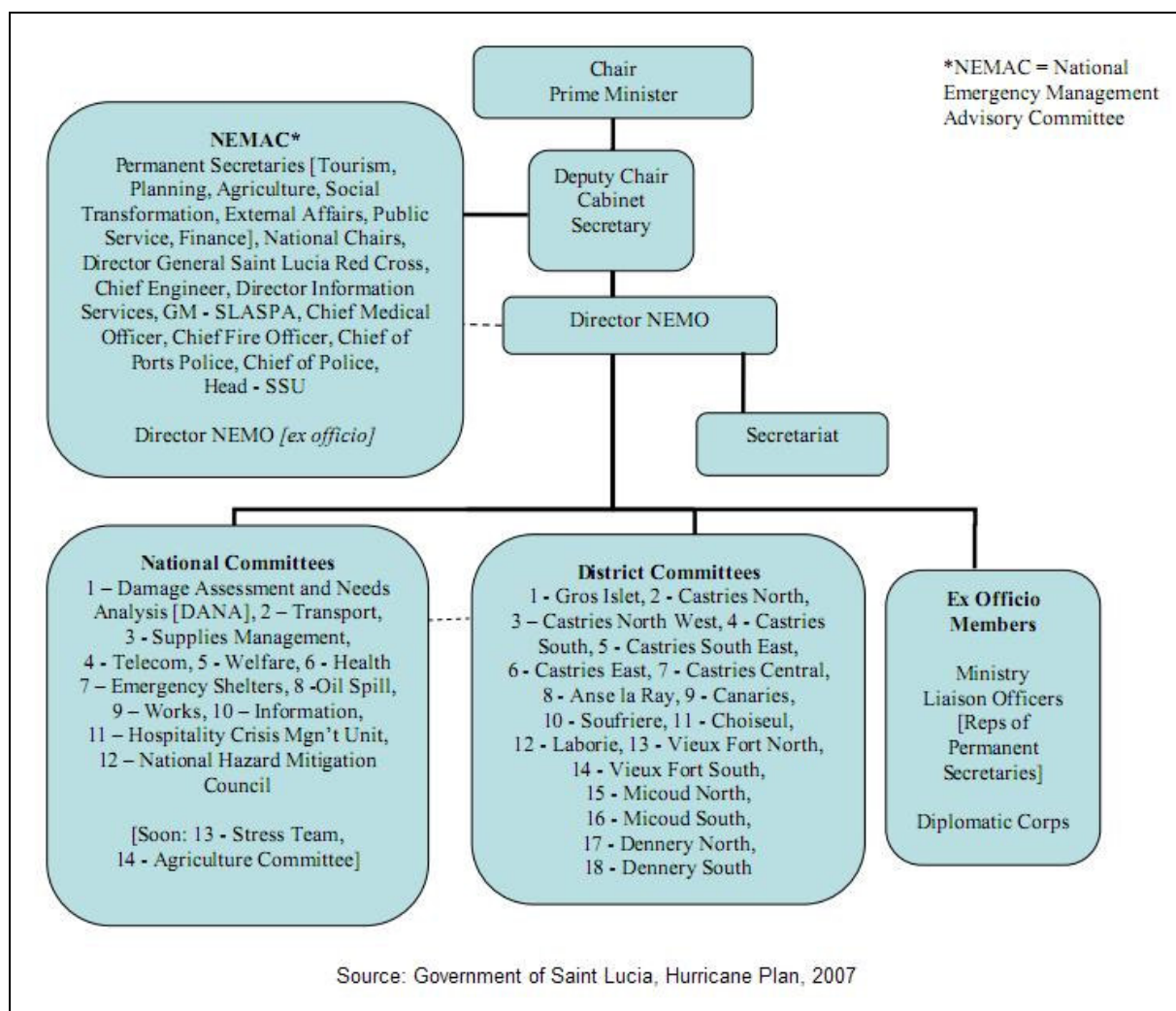


Figure 10: Structure of Emergency Response in Saint Lucia

