Epidemics, Diseases, and Health Emergencies in the Aftermath of Natural Disasters in the Philippines

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ABSTRACT

Objectives. The study aimed to present the data on the frequency and severity of natural disasters in the Philippines, the common diseases in affected communities after a natural disaster, the immediate health effects after a natural disaster and the preceding environmental risk factors, as well as evaluation scheme for pre- and post- disaster management in the Philippines.

Methods. Data were gathered from local and international agencies dealing with epidemics, diseases and health emergencies related to natural disasters. Critical analysis was done in order to come up with an evaluation scheme on both ex ante risk reduction, and ex post disaster response.

Results. The study showed that there are immediate adverse health effects of natural disasters. Drought brings about protein malnutrition; earthquakes can cause crush injuries; and fires can cause poor air quality. The study showed that the most common communicable diseases arising from disasters and emergencies include diarrhea, acute respiratory infection, measles, and malaria. In the international scene, cholera, diarrhea, hepatitis A and E, measles, meningitis, tetanus, diarrhea, leptospirosis, acute respiratory syndrome, coccidiomycosis, and malaria were reported to be the major epidemics after certain types of natural disaster.

Conclusion and Recommendations. There are several recommendations proposed in this study for disaster management such as integration of permanent LGU disaster risk management, better coordination among agencies involved in disaster management, strengthened vertical and horizontal integration of disaster risk reduction plans, creation of an overall framework that integrates environmental issues with disaster management strategies, documentation, evaluation and replication of successful local disaster prevention and management strategies, and coordination with health units, and economic development units. The Philippines is challenged to come up with and implement a comprehensive disaster preparedness and mitigation measures for disasters and epidemics.

Key Words: natural disasters, epidemics, health emergencies, diseases in the aftermath of disaster

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Introduction

Many scientists and researchers have attributed natural disasters to global climate change. Kahn[1] noted that the frequency and severity of natural disasters can be caused, augmented, and amplified by climate change. The Economics of Climate Adaptation (ECA)[2] also showed that climate change is directly associated with the intensity of natural hazards. Of the world's natural disasters, 75% happened in the years 1970-1977 and occurred in Asia and the Pacific Region. Countries located in this area include the Philippines, Vietnam, Cambodia, and other Pacific Island countries. The Philippines is located in the middle of the most active earthquake zone in the world, the Pacific Ring of Fire. It is estimated that an average of 22 typhoons and storms from the Pacific Ocean pass over the Philippine archipelago annually.[3]

Philippine Agencies Tasked to Respond to Natural Disasters

Philippine Disaster Management Program

The National Disaster Risk Reduction and Management Council (NDRRMC) formerly known as National Disaster Coordinating Council (NDCC) is the main agency responsible for preparing and responding to emergency situations in the country. It was created during the Marcos regime in 1978 under Presidential Decree No. 1566. Its function was to "advise the President on the status of preparedness programs, disaster operations and rehabilitation efforts undertaken by the government and private sectors." During the time of the Macapagal-Arroyo administration, NDCC was renamed and reorganized as the National Disaster Risk Reduction and Management Council (NDRRMC) under Republic Act No. 10121. NDRRMC is also tasked to "develop a National Disaster Risk Reduction and

Management Framework, which shall provide for comprehensive, all-hazards, multi-sectoral, inter-agency and community-based approach to disaster risk reduction and management."[4]

Disaster Management Institutional Arrangements

The Office of Civil Defense is the "operating arm" of the NDRRMC.[5] The NDRRMC works through its local networks such as the regional and local disaster coordinating councils (DCCs).[6] It is composed of 80 Provincial Disaster Coordinating Councils, 113 City Disaster Coordinating Councils, 1,496 Municipal Disaster Coordinating Councils, and 41,956 Barangay Disaster Coordinating Councils, and 17 Regional Disaster Coordinating Councils).[5] (Figure 1)

Framework for Disaster Management

The Philippine Disaster Management System, lead by NDRRMC engages four strategies for consequence management. These are: 1) mitigation to reduce the actual and potential impact of a hazard; 2) preparedness, consisting of contingency plans or pre-disaster programs; 3) response provided to the victims of disaster; and 4) rehabilitation for the restoration of affected communities including livelihood, infrastructures, and basic necessities.[7] See Figure 2 for the Disaster Management Framework, and Disaster Operations Flow.

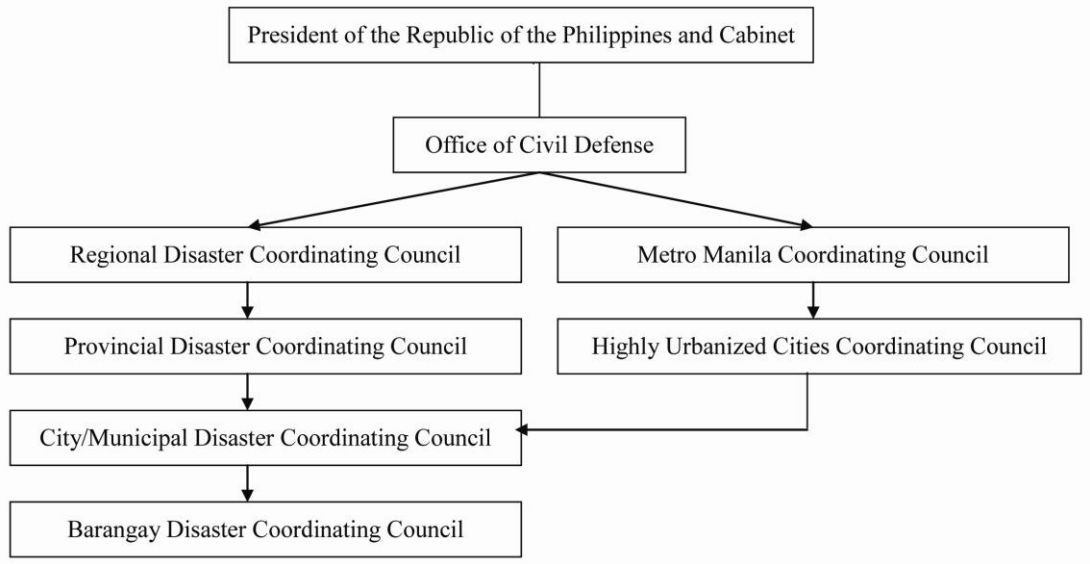
This study presents the frequency and severity of natural disasters in the Philippines and the attendant epidemics after a type of natural disaster. The study attempted to answer the following questions: 1) What are the factors that affect/contribute to the frequency and severity of the occurrence of natural disasters in the Philippines? 2) What are the common diseases in affected communities after a natural disaster? 3) What are the immediate health effects after a natural disaster and the preceding environmental risk factors? 4) What are the epidemics that have plagued the country in the past years? 5) What is the current structure of disaster response and management in the Philippines, and its effectiveness?

Methods

The study looked into natural disasters covering various types—biological, hydro-meteorological, and geophysical—in the Philippines. Data included profiling of types of diseases and health emergencies in the aftermath of natural disasters. Both local and international data were examined. The data used in this study was gathered from the records of Emergency Events Database (EM-DAT) of the Office of US Foreign Disaster Assistance/Centre for Research on the Epidemiology of Disasters (OFDA/CRED) International Disasters Database, the Independent Evaluation Group (IEG) of the World Bank, the United Nations International Strategy for Disaster Reduction Secretariat (UNISDR) and the National Disaster Risk Reduction and Management Council (NDRRMC), formerly known as National Disaster Coordinating Council (NDCC). An extensive review of literature on natural disasters in the Philippines and related studies was performed to complete this study.

Results

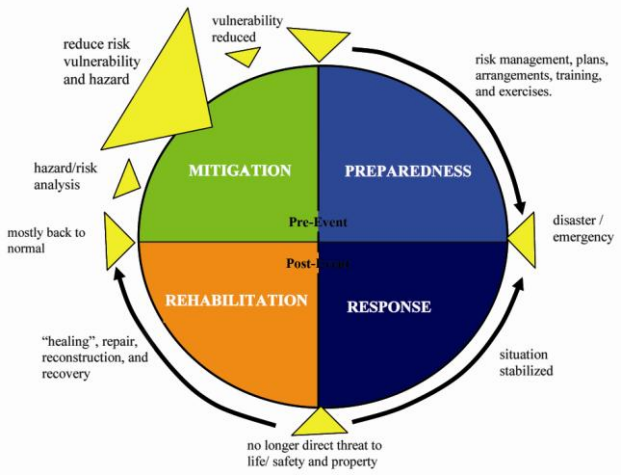
The Philippines, having frequently seen earthquakes, floods, landslides, typhoons, and volcanic eruptions, is included by the International Red Cross and Crescent



Adapted from World Bank and NDCC, 2004[6]

Figure 1. Diagram of Institutional Arrangements of Disaster Management

Societies as one of the disaster-prone countries of the world. Being an archipelago, it is susceptible to tsunamis and typhoons.[3] It is located along the typhoon belt of the North Pacific Basin and is thus at risk of typhoons and the El Nino phenomenon.[8]



Adapted from: Co, 2010[8]

Figure 2. Disaster Management Framework

Disaster Statistics: Philippine Setting

The Philippines is fourth among countries that are most exposed to multiple hazards due to natural disasters. The risk exposure to disaster covers 22.3% of total area, and 36.4% percent of population (Table 1).

Table 1. Countries Most Exposed to Multiple Hazards (based on *IEG)

Country	Percent of Total Area Exposed	Percent of Population Exposed	Maximum Number of Hazards
1. Taiwan, China	73.1	73.1	4
2. Costa Rica	36.8	41.1	4
3. Vanuatu	28.8	20.5	3
4. Philippines	22.3	36.4	5
5. Guatemala	21.3	40.8	5
6. Ecuador	13.9	23.9	5
7. Chile	12.9	54.0	4
8. Japan	10.5	15.3	4
9. Vietnam	8.2	5.1	3
10.Solomon Islands	7.0	4.9	3

Note: Three or more hazards (top 10 based on land area)
**IEG stands for Independent Evaluation Group of the World Bank.*
Adapted from World Bank, 2005[9]

The Philippines is also at risk and susceptible to various natural disasters. Based on the Modeled Number of People Present in Hazard Zones, established by the United Nations International Strategy for Disaster Reduction Secretariat (UNISDR) on its 2009 Global Assessment Report on disaster risk reduction, the Philippines ranked second out of the 89 countries for the risk of cyclone. It is second out of the 153 countries for the risk of earthquake. It is fourth out of the 162 countries for the risk of landslide, eighth for the risk of flood. It is fifth out of 265 countries for the risk of tsunami (Table 2).

Table 2. Risk Assessment Rankings of the Philippines to Natural Disasters

Natural Disasters	Rankings of the Philippines
Cyclone	2nd (out of 89 countries)
Drought	33rd (out of 184 countries)
Flood	8th (out of 162 countries)
Landslide	4th (out of 162 countries)
Earthquake	2nd (out of 153 countries)
Tsunami	5th (out of 265 countries)

Source: United Nations International Strategy for Disaster Reduction Secretariat (UNISDR). 2009. ISDR 2009 Global assessment report on disaster risk reduction: Risk and Poverty in a Changing Climate, United Nations, Geneva.[10]

Table 3. Natural Disasters that have Occurred in the Philippines from 1900 to 2011

General Type of Disaster	Specific Type of Disaster	No. of Events	No. of People Killed	No. of People Affected	Cost of Damage (000 US$)
Drought	Drought	8	8	6,553,207	64,453
Earthquake (seismic activity)	Earthquake (ground shaking)	22	9,580	2,223,269	519,575
	Tsunami	1	32	-	-
Epidemics	Bacterial Infectious Diseases	3	43	327	-
	Parasitic Infectious Diseases	1	50	666	-
	Viral Infectious Diseases	9	594	42,436	-
	Unspecified	1	1	664	-
Flood	Flash flood	29	1,021	4,005,975	786,085
	General flood	35	446	3,882,981	92,868
	Storm surge/coastal flood	11	149	125,931	2,617
	Unspecified	33	1,440	7,680,373	351,857
Insect infestation	Unspecified	2	-	200	925
Mass movement dry	Landslide	2	311	-	-
	Rockfall	1	50	-	-
Mass movement wet	Avalanche	1	6	1,200	-
	Landslide	24	2,044	312,596	33,281
	Subsidence	1	287	2,838	-
Storm	Local storm	4	9	24,704	5
	Tropical cyclone	255	36,456	104,538,071	6,569,775
	Unspecified	26	812	3,110,501	112,274
Volcano	Volcanic eruption	23	2,996	1,700,976	231,961
Wildfire	Forest fire	1	2	300	-

Source: EM-DAT: The OFDA/CRED International Disaster Database. UCL - Brussels, Belgium. Available from http://www.em-dat.net.[11]

Several natural disasters have plagued the Philippines. Table 3 summarizes the natural disasters that have occurred in the Philippines from 1990 to 2011. In terms of fatalities and health emergencies, storms, floods and earthquakes were most prevalent. Ground shaking was more frequent than tsunami in the country. Viral infectious diseases caused more deaths than bacterial and parasitic infectious diseases.

Epidemics as Type of Natural Disaster

Natural disasters are classified into three types—biological, geophysical, and hydro-meteorological. Epidemics and insect infestations are examples of biological disasters. At present, the various groups of epidemics are bacterial infectious diseases (cholera and meningococcal disease), viral infectious diseases (acute diarrheal syndrome, acute respiratory syndrome or SARS, dengue/dengue hemorrhagic fever, and influenza), and parasitic infectious diseases.

Geophysical disasters include earthquakes, tsunamis, and volcanic eruptions. Hydro-meteorological disasters include floods and tidal waves, storms and typhoons, landslides and avalanches, and droughts, forest fires, or extreme rains due to extremes in temperature and climate. [10]

Table 4 provides the list of epidemics in the Philippines from 1900 to 2011. Dengue caused the highest number of deaths recorded, at 737, and affected the highest number of people with 123, 939 cases.

Table 4. List of Epidemics Reported in the Philippines: 2000-2010

Year	Epidemic Type	Specifics	Number of People Killed	Number of People Affected
2010	Viral Infectious Disease	Dengue	737	123,939
2004-2005	Bacterial Infectious Diseases	Meningococcal Disease	32	98
2003	Viral Infectious Disease	Acute respiratory Syndrome (SARS)	2	12
2000	Viral infectious Disease	Acute diarrheal syndrome	1	664

Source of data: EM-DAT: The OFDA/CRED International Disaster Database. UCL - Brussels, Belgium. Available from http://www.em-dat.net. [11]

Table 5 presents the top five natural disasters causing massive numbers of health emergencies and fatalities. Earthquakes caused the most number of deaths, while storms caused the most number of people affected. Flooding was the most devastating economically. The top natural disasters that have frequently occurred from 1900 to 2011 in the Philippines include earthquakes, floods, and storms.

Outbreak of Diseases by type of Disaster

Natural disasters have immediate adverse health effects. Drought brings about protein malnutrition, earthquakes can cause crush injuries, and fires can cause poor air quality. Acute respiratory disease syndrome has also been associated with volcanic eruptions (Table 6).

Table 5. Top Five Events that Caused the Highest Number of People Killed, Highest Number of People Affected, and the Highest Amount of Economic Damages in the Philippines in 1900 to 2011.

Ranking of Events	Frequency
By Number of People Killed	***Number of People Killed***
1. Earthquake (Aug. 16, 1976)	6,000
2. Storm (Nov. 5, 1991)	5,956
3. Earthquake (July 16, 1990)	2,412
4. Storm (Nov. 29, 2004)	1,619
5. Storm (Oct. 13, 1970)	1,551
By Number of People Affected	***Number of People Affected***
1. Storm (Nov. 12, 1990)	6,159,569
2. Storm (Sept. 24, 2009)	4,901,763
3. Storm (June 21, 2008)	4,785,460
4. Storm (Sept. 29, 2009)	4,478,491
5. Storm (Oct. 21, 1998)	3,902,424
By Amount of Economic Damages	***Amount of Economic Damages (000 US$)***
1. Flood (Sept. 4, 1995)	700,300
2. Storm (Sept. 29, 2009)	585,379
3. Storm (Nov.12, 1990)	388,500
4. Earthquake (July 16, 1990)	369,600
5. Storm (June 21, 2008)	284,694

Source: EM-DAT : The OFDA/CRED International Disaster Database. UCL - Brussels, Belgium. Available from http://www.em-dat.net. [11]

Table 6. Immediate Health Effects of Natural Disaster

Type of Natural Disaster	Immediate Health effects
Drought	Protein malnutrition (kwashiorkor) or calorie malnutrition (marasmus); Xeropthalmia (lack of vitamin A) and child blindness
Earthquake	Crush injuries due to falling objects
Fires	Poor air quality (build up of smoke and pollutants in the air that leads to respiratory problems); burn injuries
Floods	Drowning; diarrheal diseases; respiratory infections; dermatitis; and snake bites.
Heat Waves	Hyperthermic illnesses; heat stroke
Hurricanes, Typhoons, Cyclones	Crush injuries such as superficial lacerations, trauma incidents
Tornadoes	Crush injuries due to collapsing structures; fractures, penetrating trauma, lacerations, abrasions (due to fine particles of soil, mud, sand that strike the body at very high speed) and other soft tissue injuries
Volcanoes	Acute respiratory distress syndrome, pulmonary edema, irritant conjunctivitis, joint pain, muscle weakness, and cutaneous bullae due to toxic volcanic gases (i.e., carbon dioxide, carbon monoxide, and sulfuric acid) emitted into the atmosphere; burns due to steam coming from the volcano's vent; crush injuries, severe internal bleeding, multiple organ dysfunction syndrome and asphyxiation due to mudslides and pyroclastic flows
Winter Storms	Frostbite

Source: March, 2002[13] *and DCPP, 2007*[14]

Watson et al.[12] reported that outbreaks of diseases after flooding have been prevalent. A high risk of outbreak of disease is seen more in large-scale population displacement than in small-scale population displacement.[12]

In the international scene, cholera, diarrhea, hepatitis A and E, measles, meningitis, tetanus, diarrhea, leptospirosis, acute respiratory syndrome, coccidiomycosis, and malaria were reported to be the major epidemics to erupt after a type of natural disaster (Table 7). Flooding was the most frequently reported natural disaster that caused epidemics.

International Data on Epidemics

At the international level, bacterial infectious diseases killed the most number of people, followed by parasitic and viral infectious diseases. Although Africa recorded the highest mean number of events pertaining to bacterial infectious diseases, Asia had the most number of people killed per event. As a whole, Asia recorded the highest mean number of people killed in all the three groups of epidemics. Table 8 shows the average number of people killed per event due to epidemics from 1900 to 2011.

Cases of Natural Disasters and Epidemics in the Philippines

The Philippines has seen several natural disasters. The Payatas Tragedy that happened on July 12, 2000, was regarded as one of the most terrible disasters. A 50-foot mountain of garbage collapsed on houses, in the middle of heavy rains, and killed garbage scavengers and residents of the Payatas dumpsite.[3] The Mt. Pinatubo eruption in June 1991 resulted in the loss of thousands of lives and homes in the provinces of Pampanga, Tarlac and Zambales.[3] Residents in the community who were eventually displaced by the eruption of Mt. Pinatubo experienced an outbreak of measles.[16] The flashflood in Ormoc City in Leyte that occurred on November 5, 1991, caused 3,000 deaths and destroyed 50,000 homes. The Cherry Hills landslide in Antipolo City killed 58 people and buried hundreds of houses under the rubble.[3] The great earthquake in Baguio, Dagupan, and Cabanatuan on July 16, 1990, recorded at a magnitude of 7.7, killed 1,700 people and injured 3,000 others. The El Niño Phenomenon in 1998 affected 985,000 people in Mindanao. The drought caused PhP 8.3 billion worth of agricultural damages. In Marinduque, a mine tailing tragedy that happened on March 24, 1996, caused

Table 7 . Epidemics after a Natural Disaster in Different Countries

Country	Natural Disaster (Cause of Epidemics)	Environmental Risk Factors	Epidemics	Total Number of Cases
Bangladesh	Flood	Water contamination	Cholera	>17,000 cases
West Bengal	Flood	Water contamination	Cholera	>16,000 cases
Mozambique	Flood	Water contamination	Diarrhea	-
Indonesia	Flood	Water contamination	Diarrhea	-
Pakistan	Earthquake	Water contamination	Diarrhea; Hepatitis E, Measles, Meningitis; Tetanus	>750 cases of diarrhea; 1,200 cases of acute jaundice, >400 clinical cases of measles
US	Hurricane	Water contamination	Diarrhea; Hepatitis A and E	-
Taiwan	Typhoon	Contact of the skin and mucous membranes with water, damp vegetation, or mud contaminated with rodent urine	Leptospirosis	-
Philippines	Volcanic Eruption (Mt. Pinatubo)	Crowded evacuation centers	Measles	>18,000 cases
Aceh	Tsunami		Measles; meningitis; tetanus	35 cases of measles; 106 cases of tetanus including 20 deaths
Nicaragua	Hurricane		Acute Respiratory Infection	-
Costa Rica	Earthquake	Changes of habitat that favors breeding of vectors	Malaria	-
Southern California	Earthquake	Exposure to increased levels of airborne dust	Coccidiomycosis	-

Source: Watson et.al., 2007[12] and WHO, 2006[15]

Table 8. Average Number of People Killed (per event) due to Epidemics by Continent: 1900-2011

Continent	Bacterial Infectious Diseases		Parasitic Infectious Diseases		Viral Infectious Diseases		Unspecified	
	No. of Events	Average No. of People Killed per Event	No. of Events	Average No. of People Killed per Event	No. of Events	Average No. of People Killed per Event	No. of Events	Average No. of People Killed per Event
Africa	489	458	20	236	140	167	73	2,837
Americas	46	199	6	17	81	647	8	1,087
Asia	115	49,345	20	264	140	5,990	54	184
Europe	16	22	3	16	24	3	6	416,667
Oceania	5	34	-	-	13	541	-	-

Source: EM-DAT: The OFDA/CRED International Disaster Database. UCL - Brussels, Belgium. Available from http://www.em-dat.net.[11]

about 1.6 million cubic meters of copper mine waste spillage into the Boac River and other nearby rivers. This affected 20,700 people, and destroyed many aquatic resources and mangroves.[6]

Table 9 presents case studies on these natural disasters, and the various responses to these casualties.

Discussion

Factors associated with natural disasters and epidemics

There are various factors that make countries vulnerable to disasters. These are geographic location, population changes, population demography, urbanization, and climate change.

Due to its geographic location, the Philippines is highly susceptible to natural disasters. The most frequent natural disasters in the Philippines include earthquakes, floods, tropical cyclones, and volcanic eruptions. Every year, the country experiences an average of 887 earthquakes, most of which are damaging. There are about 220 volcanoes in the Philippines, 22 of which are active. Having a tropical climate, the country is affected by monsoon winds. An average of three typhoons strike the country per month.[6]

Population change is also another factor to consider in the occurrence of natural disasters. As population increases, land-use patterns change. Migration and urbanization can cause environmental degradation. In 2001, the urban population of the country was 59% of the total population. This is expected to rise to 75% by 2030.

Population demography coupled with poor land-use planning also leads to environmental degradation. Heavy rainfall and typhoons can result in heavy run-offs flashfloods, landslides and droughts. Flooding in Baguio City has been attributed to deforestation. In the upland

Table 9. Case Studies on Natural Disasters and Corresponding Health and Safety Risks

Disaster	Health and Safety Risks	Emergency Response
Payatas Tragedy Quezon City, 2000	Due to heavy rains brought about by typhoons Ditang and Edeng, a 50-foot slope of garbage collapsed, burying hundreds of houses and families. At least 288 people were killed. Survivors were evacuated to the Lupang Pangako evacuation center. Due to constrained space, and inadequate sanitation and hygiene, there was an outbreak of waterborne diseases. Many children died.	Relief and emergency measures were provided by agencies like the Homeless People's Federation Philippines, Inc (HPFP), volunteer leaders, local community organizations, and Vincentian Missionaries Social Development Foundation, Inc. (VMSDFI). 300 families were relocated to Rizal Province, and later returned back to their provinces through the Balik-Probinsya program. Homeless Peoples Federation Philippines, Inc. (HPFPI) initiated a longer term resettlement project for the waste-picking communities.
Landslide in Brgy. Guinsaungon Southern Leyte, 2006	A landslide triggered by a 2.6-magnitude earthquake buried the entire barangay. Barangay Guinsaungon was announced by the Mines and Geophysical Bureau as "ground zero" since the whole population was severely affected. The casualty included displacement of 18,862 people, death of 154 people, not including 968 individuals who were reported missing; 3,272 people were evacuated. Due to limited space and lack of health and hygiene facilities, ailments such as sore eyes, flu, fever, and cough became prevalent.	NGOs provided supply of goods and medicines. The LGU provided a portable toilet (portalet). HPFPI worked on relocation and reconstruction through the community and the LGU.
Mount Mayon mudflow and flashflood Albay Provinces, 2006	Two successive typhoons, Milenyo and Reming, in the Bicol region caused flashfloods and mudslides from Mt. Mayon. This killed 208 people[8,17]	The government declared a permanent 6-kilometer danger zone around Mt. Mayon since its slope is composed of ashes and volcanic rocks. Rigorous information campaigns on hazard and risk factors of the area were done. Part of the mitigation activity was a program on safe land acquisition with the guidance of weather and geohazard institutes such as MGB, PAGASA, and Manila Observatory.[8]
Flashflood in Iloilo City Iloilo City, 2008	Typhoon Frank caused massive flooding in the city of Iloilo with 152 of its 180 barangays flooded and 261,355 individuals affected.	5,640 people were moved to 57 evacuation centers. The NGOs, LGUs, and private sectors provided relief goods and medical assistance to the victims in the evacuation centers. A resettlement area was provided by the city government. Education campaigns and social mobilization were reportedly conducted by the HPFPI, Iloilo City Urban Poor Network (ICUPN), and the Iloilo City Urban Poor Affairs Office (ICUPAO) to the typhoon victims urging them not to return to their old houses due to the magnitude of the risk.[8]
Flashflood in Angeles City Pampanga, 2006	Typhoon Florita caused a massive flash flood in the city of Angeles. 1,161 people were reportedly affected, and 138 houses partially/totally washed out.	Affected families were settled in public buildings and schools[17]

communities of Panay, serious droughts have been experienced since the 1980s due to deforestation.[6]

Rapid urbanization, along with insufficient allocation of areas for residential development results in the proliferation of hazard-prone areas such as squatters' areas.[6] Munich Re[18] noted that the increasing population and increasing number of infrastructure built in hazard-prone areas increase the number of people exposed to natural hazards.

The increasing frequency and magnitude of natural disasters is also closely associated with climate change.[19] The Intergovernmental Panel on Climate Change[20] underscored that climate change affects the average temperature, sea level, and the amount and timing of precipitation. This leads to extreme weather patterns causing floods, cyclones, and heat waves.

Natural disasters are costly. For instance, in the Mount Pinatubo eruption, the cost of damage to crops, infrastructure, and personal property was estimated to be at least PHP 10.1 billion (USD 374 million).[6]

Disease outbreaks in the aftermath of natural disasters

The increasing risk of outbreaks of disease and epidemics in the aftermath of natural disasters can be due to several factors such as mass population movement from the zone of danger, overcrowding in evacuation centers, inadequacies of health services and sanitary facilities, shortages in safe food, safe water, and food supplies, and disruption of infrastructures like water pipes and electricity. For instance, in Haiti, an outbreak of cholera was reported after the earthquake, affecting 112,330 people, and eventually causing the death of 2,478 patients.[21]

In disaster areas, malnutrition due to shortage in food as well as an increased risk for communicable diseases can arise. These diseases are further spread by lack of water supply and poor sanitation conditions. Health facilities and other infrastructures can also be damaged by disasters. This increases the burden of illnesses. In the Honduras, the hurricane that struck the country in 1998 damaged/destroyed 23 hospitals and 123 health centers.[15]

Adequacy of response and effectiveness of disaster management in the Philippines

In terms of responses to natural disasters, the local government and certain civil societies have been readily available to cater to the immediate needs of the people and the community. In the Payatas tragedy, for instance, the Homeless People's Federation Philippines facilitated the relocation of about 300 families to Rizal Province. In the landslide in Brgy. Guinsaungon in Southern Leyte, the local government rebuilt infrastructure. However, there are still many gaps and lapses in terms of emergency responses and disaster preparedness. The authors recommend the following:

1.0. Integration of permanent LGU disaster risk management.

A permanent structure of disaster risk management can be effected at the local government unit level in two ways: creation of new LGU disaster risk management bodies, or the integration of disaster risk management responsibilities into the duties of existing LGU offices. Once this is established, logistical support should be given including capability-building among key officials and employees. There should be an explicit disaster response financing strategy. This effort should be complemented by a tracking system to monitor expenditures on both ex ante risk reduction and ex post disaster response.

2.0 Better coordination among agencies involved in disaster management.

At present, the National Disaster Risk Reduction and Management Council (NDRRMC) is composed of 80 Provincial Disaster Coordinating Councils, 113 City Disaster Coordinating Councils, 1,496 Municipal Disaster Coordinating Councils, and 41,956 Barangay Disaster Coordinating Councils, and 17 Regional Disaster Coordinating Councils.[5] However, there has not been a clear organizational and functional point for coordination, accountability, responsibility sharing, or even post-disaster assessment efforts by these various agencies. There is a need to develop a long-term disaster risk management strategy incorporating individual sectoral strategies that could be combined or delineated, with monitoring and evaluation indicators. A specific unit within each line agencies should also have a particular risk reduction focal point that coordinates with the same body in other agencies.

3.0 Strengthened vertical and horizontal integration of disaster risk reduction plans.

In the flashfloods in Iloilo in 2008, the LGU, NGOs and private sectors provided assistance to the victims in the evacuation centers. The LGU provided a resettlement area. The private sector provided education campaigns and social mobilization to the typhoon victims urging them not to return to their old houses due to the magnitude of the risk.[8] However, these efforts seemed to be independently done by each agency without pre- and post-assessment of coordinated strategies. There should be horizontal integration among various agencies as well as clear command structure evident in an explicit vertical integration between different levels of government units.

4.0 Creation of an overall framework that integrates environmental issues with disaster management strategies.

An integral part of the emergency and disaster management plan, especially in the area of prevention of disasters, is to work closely with programs that are geared towards environmental protection and sustainability. For

instance, there should be strict implementation of land-use regulations and building codes in subdivisions, as well as the necessary judicial measures for enforcement. Climate change is another risk factor for disasters. Disaster risk management should go hand in hand with climate change adaptation programs at all levels—institutional, policy and research coordination. Resources should be allotted to integrate the two issues into the national and local planning processes.

5.0. Documentation, evaluation and replication of successful local disaster prevention and management strategies.

A comprehensive assessment of local efforts at disaster prevention and management should be performed in order to identify the strengths and weaknesses of these efforts. The documentation process is essential in this endeavor. All local units should have a documentation process and evaluation plan strategy. Successful ones should be replicated and disseminated to other local government units. Local mainstreaming activities should be carried out in various localities that are prone to disasters.

6.0 Coordination with health units.

As shown in the study above, natural disasters have immediate health effects. Drought brings about protein malnutrition, fires can cause poor air quality leading to respiratory disease syndrome, and cholera outbreaks can affect families due to unsanitary environment. There is therefore a need to establish a more defined coordination plan with the Department of Health and other local health units during and after disasters. The capacity of hospitals and health units to accommodate injured and ill persons in the aftermath of a disaster should be enhanced, including the availability of medicines and rehabilitation facilities.

7.0 Coordination with economic development units.

In the aftermath of a disaster as shown in the above results, natural disasters are costly. In the Mt. Pinatubo eruption, the cost of damage to crops, infrastructure, and personal property was at least PHP 10.1 billion (USD 374 million).[6] Mechanisms should be made readily available at the national and local levels aimed at building livelihood and infrastructures. Technical capabilities can be coordinated through the institutional assistance of the National Economic and Development Authority (NEDA).

8.0 National platform for disaster risk reduction.

Strong national leadership and policy stance are needed for disaster risk reduction. The Philippines can learn from the disaster management strategies of other countries. For instance, in the United States of America, an agency called the Subcommittee on Disaster Reduction (SDR) deals with catastrophic and non-catastrophic hazards, both local and international, and whether natural or technological in origin.[22] This agency is responsible for the facilitation and promotion of natural and technological disaster strategies. Canada also formulated the Emergency Management Framework that functions to prevent, mitigate, and respond to disasters. This framework covers the principles of emergency management, the governance mechanisms, and the coordination instruments, and all are wholly integrated. China had organized the group called China National Committee for International Disaster Reduction (CNCIDR) that is integral mainly to reducing the impact of various disasters on the national economic and social development. The Italian National Platform for Disaster Risk Reduction in Italy is responsible for promoting all activities of the society that can reduce human, social, and economic losses resulting from natural disasters. These are strategies toward economic rehabilitation and integration. The German Committee for Disaster Reduction (DKKV), designated by the German Government, was established to serve as an information center for all related national and international disaster reduction issues. The Spanish Committee for the International Decade for Natural Disaster Reduction (IDNDR) (Royal Decree 1301/1990) engages in information dissemination on disaster risk prevention and mitigation. These are strategies for massive education campaign at the national level.[22]

The above are just few countries that have established and declared their national platform for disaster risk reduction. Other countries have not yet established their own national platform or are still in the process of doing so. A national platform for disaster risk reduction is defined as a "nationally owned and nationally led forum or committee for advocacy, coordination, analysis and advice on disaster risk reduction."[22]

Conclusion

This study presented the data on the frequency and severity of natural disasters that have occurred in the Philippines. The factors that affected the frequency and severity of occurrences of natural disasters in the Philippines were also discussed in this study, including climate change, geographic location of the country, and land-use patterns.

The study showed that the most common communicable diseases arising from disasters and emergencies include diarrhea, acute respiratory infection, measles and malaria. These diseases are aggravated by malnutrition. Internationally, cholera, diarrhea, hepatitis A and E, measles, meningitis, tetanus, diarrhea, leptospirosis, acute respiratory syndrome, coccidiomycosis, and malaria were reported to be the major epidemics erupting after a type of natural disaster.

The government has been spending billions of pesos due to these hazards. About 2% of the Philippine GNP was spent due to disasters each year.[23] Natural disasters can

inhibit the economic development of the nation due to reallocation of funds wherever there is need for finance relief and reconstruction assistance. There are mitigation and preparedness programs implemented by government agencies and private entities such as the NGOs to prevent or alleviate the adverse effect of disasters.[3] However, Co[8] showed the inadequacies of the disaster risk management system in the country. He noted that disaster structures and systems should not only be composed of government people but also those from the private sectors, civil society and community associations. The NDRRMC is composed mostly of government employees. Thus, the capacities for risk-reduction of the NDRRMC members as well as the LGUs are not expansive. Poor coordination of efforts from multi-lateral donor institutions and civil societies was also observed. The government also was noted to lack programs for a community-driven rehabilitation and reconstruction effort, and community awareness on disaster risk and risk-reduction activities.[8]

The Philippine government is therefore challenged to implement disaster management measures that would effectively reduce the adverse effects and potential losses due to natural disasters.

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