

III. Earthquakes in Nepal: The 2011 Sikkim Earthquake

September 2016

Preface

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

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

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

This report is developed from a research conducted by Emily Ying Yang CHAN, Polly Po Yi LEE, Jamie RODAS and Kevin Kei Ching HUNG in 2011 with the support of CCOUC fellows. Ms Rodas

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Executive Summary

Nepal is one of the most disaster-prone countries in Asia. Its topography, geography, political situations, and developmental barriers make it highly vulnerable to disasters. The likelihood of a high impact, calamitous earthquake is very real while its preparedness for such an event has been inadequate. The policies and regulations regarding disaster risk reduction, disaster preparedness and disaster response are weak, which could create uncertainty in a crisis situation.

On 18 September 2011, an earthquake with its epicentre in the adjacent Sikkim state of India struck Nepal to cause extensive structural damage, despite of minor life loss. The earthquake served to highlight the need for enhancing the existing national disaster management system. Although the disaster response for the event was adequate, gaps were revealed within the disaster response framework, which suggests that the response system would not be sufficient in the event of a higher magnitude earthquake.

The purpose of this case study is to document the disaster event and highlight the gaps that were apparent within the disaster response system in Nepal. In addition, it aims to analyse the disaster preparedness efforts of the country. Reporting guidelines from the WHO-EURO and the World Association of Disaster and Emergency Medicine are adopted in this study. Retrospective data reviews and stakeholder correspondence are the main methodology for data collection. Nepal's progress in disaster preparedness is examined through the lens of The Hyogo Framework for Action (HFA).

While Nepal's institutional bodies have committed to increase capacity to achieve disaster preparedness at the local and national levels, the progress has been slow, small scale or incomplete. Moreover, although disaster risk reduction and preparedness agendas have been incorporated into development plans, they were not substantiated in the budget allocations. Nepal's governmental bodies must work quickly to secure the country's proposed disaster response frameworks so as to reduce the human impact of future events. This case study and analysis can be used to guide policy

discussions, identify gaps and formulate actions that will accelerate progress in disaster preparedness following the HFA at national and local levels.

1. Introduction/Material/Methodology

1.1 Introduction

The Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters was the result of a meeting three weeks after the South Asian Tsunami, which killed an estimate of 250,000 people. It is an effort by 168 governments to reduce disaster losses in a 10-year plan agreed at the second World Conference on Disaster Risk Reduction in Kobe (Hyogo). This Nepal case study is to illustrate the intrinsic vulnerabilities that exist in many developing communities around the world and the disaster risk reduction achievements as a result of the government effort in adopting the HFA.

Research on disaster in Nepal should document disaster preparedness and disaster risk reduction, as well as disaster response and post-disaster outcomes. A better understanding of the country's disaster profile would help enhance future preparedness and response and thereby mitigate the adverse human impact of a disaster. This study aims to expand knowledge and understanding of disaster preparedness and response in a country-specific context by examining an earthquake affecting Nepal through the lens of the disaster cycle framework. The disaster cycle refers to the different stages of a disaster, namely: 1) non-disaster/pre-event stage, 2) event/impact stage, 3) emergency relief stage and 4) recovery stage. Characteristics of each stage will be examined and discussed.

1.2 Material

This study draws mainly on secondary sources. Publicly available information for describing the background, disaster preparedness, health crises and critical health events, response and recovery of Nepal with regard to the earthquake was obtained from the following sources: disaster information systems (e.g. the Emergency Events Database (EM-DAT) and Disaster Inventory System (DesInventar)), United Nations agencies dealing with disaster, health and development (e.g. WHO,

UNDP, UNISDR and UNICEF), international organisations (e.g. World Bank), NGOs (e.g. Nepal Red Cross Society), government sources (e.g. Ministry of Home Affairs and Ministry of Health and Populations of Nepal), news media (e.g. Nepali Times), and various disaster-related websites (e.g. PreventionWeb, DPNET and ELDIS) and academic databases (e.g. PubMed and Medline).

Disaster statistics were obtained from disaster databases and cross-checked with government and NGO statistics. Progress reports, government statements, government policy papers, field reports and documents from organisations providing information on disaster preparedness and response were also employed in this study.

1.3 Methodology and a theoretical framework for an earthquake case study

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

I. Public health principles of disaster response

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

The five basic requirements for health include food, health services, information, water and sanitation, as well as shelter and clothing. Usually, the access to these basic needs would be disrupted after a disaster. Compared with other major natural disasters, the short-term consequences of earthquakes include a higher death toll, an overwhelming number of severe injuries requiring extensive medical care, and a relatively small increase in the risk of communicable diseases, while food scarcity or major population displacements are comparatively rare (3). Securing the access to the basic needs is considered the main goal of the emergency relief.

As a global effort in setting the standard for emergency relief, the international Sphere Project hosted by the International Council of Voluntary Agencies (ICVA) in Geneva is “a voluntary initiative that brings a wide range of humanitarian agencies together around a common aim - to improve the quality of humanitarian assistance and the accountability of humanitarian actors to their constituents, donors and affected populations.” The Sphere Handbook, *Humanitarian Charter and Minimum Standards in Humanitarian Response*, provides a level of standard that has been agreed upon by a multitude of front line agencies (4). It contains minimum standards for most aspects of the above five basic requirements for health. For each specific aspect, the Sphere Project has designed distinct indicators to measure whether the minimum standards have been fulfilled.

II. *Definition of health*

Health is a state of complete physical, mental and social well-being instead of the mere absence of disease or infirmity (5). Specifically, public health is defined as “[t]he science and art of preventing disease, prolonging life and promoting health through the organised efforts of society”, according to Sir Donald Acheson (6).

III. *The disaster cycle model*

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

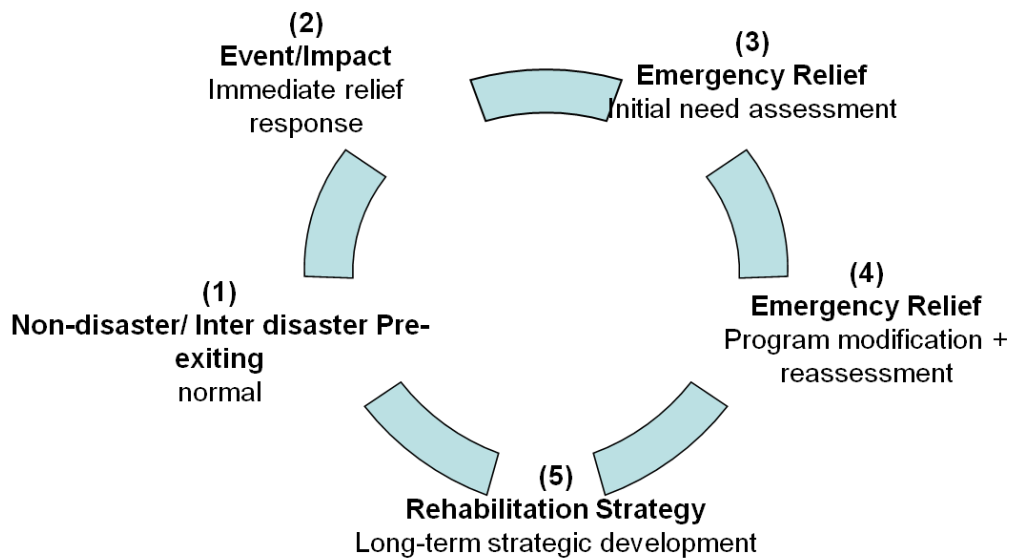


Figure 1 Disaster cycle

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

This case study will focus on the emergency relief - program modification and reassessment stage of the disaster cycle.

2. Pre-Event Status

2.1 Background

Nepal is a small, landlocked South Asian country situated between China and India, sharing almost 3,000 km of land borders with these two countries (See Figure 2 and Figure 3). There are five major regions and 75 districts in the country, with an area of 147,181 sq. km. The terrain in Nepal varies from the flat river plains of the Ganges in the south to the rugged mountain setting in the north at an elevation of 8,850 m (7).

ASIA



Figure 2 Nepal in Asia

Source: Central Intelligence Agency (CIA)



Figure 3 Nepal and its neighbours

Source: Central Intelligence Agency (CIA)

There are three distinct geographical regions in Nepal. The Terai is a fertile area running from east to west in the middle of the country, where most of the agricultural production takes place. Water resources, fertility and flatness permit the cultivation of a variety of crops in this area such as paddy, maize, wheat, sugarcane, vegetables, tobacco and jute. This area lies on an old lake basin, which makes it ripe for fertilisation but also for liquefaction. To the north lies the Himalayan mountain ranges and to the south the plains of the Ganges River. Nepal houses eight of the world's 10 highest peaks, including Mount Everest and Kanchenjunga - the world's highest and third highest.

Kathmandu is the capital and the largest city of Nepal, situated in the centre of the country in the Kathmandu Valley. Kathmandu, along with the nearby cities of Lalitpur and Bhaktapur, form the governmental, cultural and transportation centre of the country. The city is an urban area home to around 1.015 million people in 2014 and covers a significant part of the earthquake-prone valley (7). Due to its location, its steady growth during the last decades and its levels of poverty and marginalisation, the city faces significant earthquake risk.

Despite the richness of its natural resources and opportunities for development, Nepal remains one of the least developed countries. In 2011, only around 56% of households in the country had access to electricity, with a big gap between the urban (93%) and the rural areas (49%) (8). In 2010, only 45.7% of the country's roads were paved, making transportation and accessibility limited (7). Aside from Kathmandu, motor vehicles were sparse. During the period from 2000 to 2005, there were only 5 motor vehicles per 1,000 population in the country (9). Hence, in the event of a disaster, not many motor vehicles would be available for the purposes of transporting the injured and evacuation. People living in remote areas would have a difficult time accessing health services and relocating to safer areas.

Since Nepal retained 54% of its natural habitat, arable land covered only 16% of the total land area in 2011 and permanent crops took up a mere 0.8% (7)(9). Environmental issues include deforestation (due to the overuse of wood for fuel), contaminated water (by human and animal wastes, agricultural runoff and industrial effluents), low priority for wildlife conservation and rising emissions. The misuse of environmental resources can lead to inadequate food availability, reduced assets for income and deteriorated water sources. In the event of a disaster, these resources are important in securing the health status of the affected population. Hence, extra care should be taken to ensure their protection. Nepal has committed to international environmental agreements and is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (10).

Politically, Nepal was an absolute monarchy until 1990, when there were large-scale political reforms after mounting pressure and political movement among the people. The reforms established a multiparty democracy within the framework of a constitutional monarchy, until a Maoist insurgency broke out in 1996. The ensuing 10-year civil war resulted in the dissolution of the cabinet and the parliament and witnessed the resumption of an absolute monarchy. After several weeks of mass protests in 2006, a peace accord was drawn and an interim constitution set forth, ending the decade-long conflict. In 2008, after a nationwide election, Nepal was declared a federal democratic republic and the monarchy was abolished. In April 2008, the Constituent Assembly (CA) was elected as an

interim parliament to draft and promulgate a new constitution. However, the CA was dissolved in May 2012 without completing the formulation of a new constitution. The country's first president was elected in July 2008 by the Constituent Assembly and several coalition governments were formed since then. Under the new constitutional order, many social issues needed attention, and disaster preparedness was still in its infancy (7).

Around the time when the Sikkim Earthquake happened in 2011, Nepal had a population of 27.156 million people (11). With a fertility rate of 2.5 in 2011 (12), the population was expected to grow in the following decade to about 35.6 million by mid-2025, and to a projected 45.974 million by mid-2050. Youths aged 10-24 years old made up about 33% of the population in 2006 (12), while 36.38% of the population were under 15 years old and only 7.51% were over 60 years old in 2011 (11).

The overall maternal mortality ratio in Nepal stood at a high level of 220 per 100,000 live births in 2010, which may be attributable to the low percentage of births attended by skilled health staff at a mere 36% in 2011 (11). The infant mortality rate in the country was also relatively high at 35 infant deaths per 1,000 live births in 2011, and the under-5 mortality rate in the same year was 43 per 1,000 live births (13). The life expectancy at birth in Nepal had seen continuous improvement from 54 years in 1990 to 68 years in 2012, the latter of which is not much lower than the world average of 70 years. There was no large gap between female (69 years) and male (67 years) life expectancy (14). Although communicable diseases remain a main cause of death in Nepal, the negative impact of non-communicable diseases is ever increasing. In 2012, 44% of the mortalities in Nepal were caused by communicable diseases and 42% were caused by non-communicable diseases, while the overall trend for the latter continued to increase (11)(13)(14)(15)(16)(17)(18).

As to the extent of urbanisation, only 18% of Nepalese lived in urban areas in 2013 (19)(20)(21). Within urban areas, 51.2% of the population had access to improved sanitation in 2012, while only 33.7% in rural areas had. These sanitation facilities serve to minimise the exposure to infectious diseases by preventing human, animal and insect contact with excreta. Similarly, having access to safe

water sources is important for the health of a population. Unsafe water supplies and inadequate levels of sanitation and hygiene increase the transmission of diarrhoeal diseases. In Nepal, 90.3% of the urban population and 87.6% of the rural population had access to improved drinking water sources in 2012 (7).

Information	Data
Population	27.156 million (2011)
Population residing in urban area	18% (2013)
Territorial size	147,181 km ²
Population density	189 per km ² (2011)
Life expectancy	68 years (2012)
Literacy rate among adults aged >= 15 years (%)	57.4 (2011)
Maternal mortality rate	220 /100,000 (2010)
Infant mortality rate	35/1,000 (2011)
Hospital bed available	50/10,000 (2006)
Nursing and midwifery personnel available	0.46/1,000 (2004)
Registered physician available	0.209/1,000 (2004)

Figure 4 Statistics on Nepal's population and health services in 2011

Sources:

CIA. The World Factbook: South Asia – Nepal. 2014;[cited 2015 February 6]. Available from: <https://www.cia.gov/library/publications/the-world-factbook/geos/np.html>

World Bank. Data: Population density (people per sq. km of land area). 2014;[cited 2015 February 6]. Available from: <http://data.worldbank.org/indicator/EN.POP.DNST>

World Bank. Data: Urban Development. 2014;[cited 2015 February 5]. Available from: <http://data.worldbank.org/topic/urban-development>

WHO. Global Health Observatory Data Repository: Nepal statistics summary (2002 - present). 2014;[cited 2015 February 3]. Available from: <http://apps.who.int/gho/data/node.country.country-NPL?lang=en>

WHO. Global Health Observatory Data Repository: Probability of dying per 1 000 live births (Nepal). 2014;[cited 2015 February 3]. Available from: <http://apps.who.int/gho/data/view.main.CM1320R?lang=en>

WHO. Global Health Observatory Data Repository: Life expectancy – Data by country (Nepal). 2014;[cited 2015 February 4]. Available from: <http://apps.who.int/gho/data/node.main.688?lang=en>

WHO. Global Health Observatory Data Repository: Nepal: health profile. 2014;[cited 2015 February 5]. Available from: <http://www.who.int/gho/countries/npl.pdf?ua=1>

WHO. Global Health Observatory Data Repository: Essential health technologies – Data by country (Nepal). 2014;[cited 2015 February 6]. Available from: <http://apps.who.int/gho/data/view.main.1860>

WHO. Global Health Observatory Data Repository: Literacy rate among adults – Data by country (Nepal). 2014;[cited 2015 February 6]. Available from: <http://apps.who.int/gho/data/view.main.2100>

WHO. Global Health Observatory Data Repository: Density per 1000 – Data by country (Nepal). 2014;[cited 2015 February 6]. Available from: <http://apps.who.int/gho/data/view.main.92100>

To create a robust profile of health needs following a crisis event, a community's baseline disease pattern is relevant. Figure 5 below shows the causes of death for children under 5 in the country in 2008. Like their counterparts in most developing countries, Nepali children often face diarrhoeal diseases and are vulnerable to death by dehydration. Another prevalent cause of under-5 mortality in Nepal is birth asphyxiation (22).

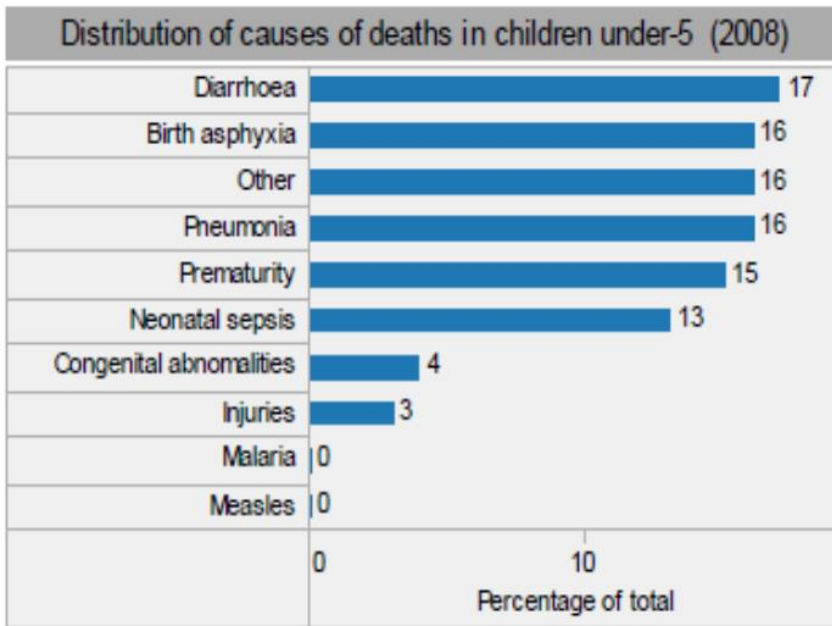


Figure 5 Distribution of causes of deaths among children under-5 in Nepal (2008)

I. Non-communicable diseases (NCDs)

Nepal faces a double burden of disease. Apart from being threatened by many communicable diseases, Nepal is also increasingly plagued by non-communicable diseases. Chronic NCDs accounted for 42% (235,000) of all deaths in Nepal in 2002 and nearly 50% in 2011 (23). The management of NCDs is often overlooked during disasters. However, given its high prevalence, it should be given a high priority during disaster preparedness planning. The chart below shows the proportion of NCDs among mortalities in the country in 2010.

Proportional mortality (% of total deaths, all ages)*

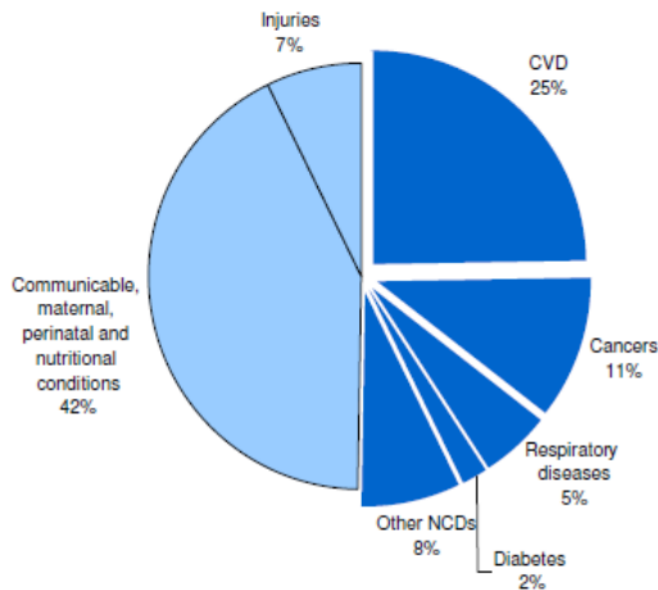


Figure 6 Proportional mortality in Nepal (2010)

Source: WHO NCD country profile 2011 (23)

Using solid fuels such as wood, charcoal and crops is associated with increased mortality from pneumonia and other acute lower respiratory diseases among children, as well as increased mortality from chronic obstructive pulmonary disease and lung cancer (where coal is used) among adults. In Nepal, 91% of the rural population and 35% of the urban population use solid fuels for cooking and other purposes.

NCDs are often overlooked post disaster. However, recent studies have shown that the management of chronic illnesses and NCDs make up a large proportion of health needs immediately post disaster (24). In addition, a lack of management of chronic conditions may have serious effects on the long-term health of the community.

II. Vaccination and infectious diseases

Nepal's immunisation system has been relatively stable and provided adequate coverage. In 2010, 82% of the relevant population have been vaccinated against DTP (diphtheria, tetanus and pertussis (or whooping cough)), 82% vaccinated against hepatitis, 3.86% vaccinated against measles and 83% vaccinated against polio (25). In addition, 87.5% of the children were estimated to have received vitamin A supplements. However, coverage for avoidable diseases was still inadequate, as suggested by the number of reported vaccine preventable cases in 2010.

During a disaster, the risk of disease outbreaks is heightened. Although severe epidemics are rarely a concern during an earthquake, the ensuing displacement of people could result in a huge number of disaster victims living in overcrowded quarters, which provides an environment conducive to the spread of communicable diseases. Hence, measures like measles immunisation could become a priority intervention. Due to the massive destruction of infrastructure and the related susceptibility to injuries, tetanus can also become an acute issue. A vaccine coverage profile will help identify any gaps in preventable disease management post-disaster.

<u>Diphtheria</u>	146
<u>Hib meningitis</u>	2
<u>Japanese encephalitis</u>	183
<u>Measles</u>	190
<u>Mumps</u>	29,022
<u>Pertussis</u>	2,293
<u>Polio</u>	6
<u>Rubella</u>	510
<u>Rubella (CRS)</u>	-
<u>Tetanus (neonatal)</u>	13

<u>Tetanus (total)</u>	547
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Figure 7 Number of reported cases of vaccine preventable infectious diseases in Nepal, 2010 (26)

As to the non-vaccine-preventable infectious diseases in Nepal, the incidence of tuberculosis (TB) dropped from 240/100,000 people in 2009 to 163/100,000 in 2010 (27). The proportion of new smear-positive TB cases registered under the Nepal national TB control programme who successfully completed treatment was 89% in 2008 (28). Notified cases of malaria was 103/100,000 people in 2008, while there might be underestimation due to incompleteness in the reporting systems, patients seeking treatment in the private sector and self-medicating.

III. Nutrition

Nutritional status during normal times is a benchmark against which the nutritional needs of a community post disaster can be estimated. The baseline rate of malnutrition or nutritional deficiencies can help plan for the action needed for food security post disaster. Promoting breastfeeding post disaster is also an important public health initiative to keep infants healthy and avoid an increased incidence of diarrhoeal diseases among infants resulting from poor quality or unavailability of water.

The proportion of new Nepali mothers who feed their children less than six months of age exclusively with breast milk was decreasing steadily from about 74% in 1996 to about 53% in 2006, perhaps due to the increasing availability of formula powders and other feeding options and the increasing demand for women to join the labour market. Nepali women were not providing the adequate recommended nutrition for their babies by weaning early.



Figure 8 Trends of breastfeeding prevalence among women in Nepal from 1996-2006

Source: <http://apps.who.int/nutrition/landscape/report.aspx?iso=NPL&rid=1620&goButton=Go>

The International Food Policy Research Institute calculates a comprehensive measure of hunger called the Global Hunger Index (GHI) by combining three equally weighted indicators of undernourishment, child underweight and child mortality (29). Each country is rated on a 100-point scale with zero being the best score (i.e. no hunger) and 100 being the worst. Nepal's GHI of 19.9 in 2011 is an improvement from its previous GHI of 27.1 in 1990, mainly attributed to the sharp decrease in child mortality from 14.2% in 1990, to 4.8% in 2011 (Figure 9).

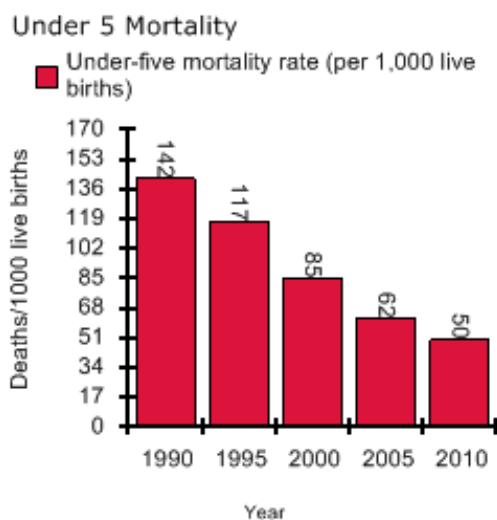


Figure 9 Trend of under-5 mortality in Nepal from 1990-2010

Source: <http://apps.who.int/nutrition/landscape/report.aspx?iso=NPL&rid=1620&goButton=Go>

Maintaining sound nutritional status among the population is important following a disaster. Food distribution should be a priority and the uninterrupted breastfeeding of infants should be promoted.

IV. *Service delivery*

This section presents data on the resources in the health system, including healthcare workers, infrastructure and medical services.

The availability of an adequate healthcare workforce can be a strong indicator of whether the population can have access to healthcare and whether their health needs are being met. The size of the workforce could also determine the available local capacity during a disaster and determine how much external assistance is needed.

Physicians		Nursing and Midwifery personnel		Dentistry personnel		Pharmaceutical personnel	
No.	Density (per 10,000 population)	No.	Density (per 10,000 population)	No.	Density (per 10,000 population)	No.	Density (per 10,000 population)
5,384	2.1	11,825	4.6	359	0.1	358	0.1

Figure 10 Health workforce indicators, Nepal, 2000-2010 (WHO health indicators)

Public health professionals contribute to the healthcare system by providing preventative services, as well as being complementary to clinical services. The availability of public health workers is an important indicator of the population's emphasis on prevention and health promotion. After a disaster, public health workers can help implement public health initiatives such as sanitation, hygiene,

nutrition and rehabilitation programmes. They can also be instrumental in aiding to rebuild a health-promoting community.

A country's healthcare infrastructure is an important determinant of health that indicates access to care and availability of services. The density of hospital beds can be used to indicate the availability of inpatient services. During and after a disaster, the healthcare system may be partially or totally crippled. Hospital and healthcare centres may collapse and services be disrupted. Combined with a sudden surge of disaster victims, the healthcare system would need to be ready and cognizant of their capacity.

Environment and public health workers		Community health workers	
No.	Density (per 10,000 population)	No.	Density (per 10,000 population)
172	0.1	16,206	6.3

Figure 11 Health Facilities & Health Human Resources under the Ministry of Health and Population (MoHP)

Health facility under MoHP	Number
Total Health Institutions under MoHP	4,396
Hospitals(Central, Regional, Sub-regional, Zonal and District)	94
Health Center	5
Primary Health Center (PHC)	201
Health Post	699
Sub-Health Post	3,104
Ayurvedic Health Institution	293

Total Hospital beds	6,944
Health manpower under MoHP	
Doctors	1,457
Nurse	11,637
Paramedic/Health Assistant	7,491
Village Health Worker	3,190
MCHW	3,985
Ayurvedic Physician	394
Baidhya	360
Health Volunteers	
Female Community Health Volunteer including Trained Traditional Birth Attendants	63,326
Hospital beds (per 10,000 population)	50

Figure 12 Health infrastructure indicators, Nepal, 2000-2010

Sources:

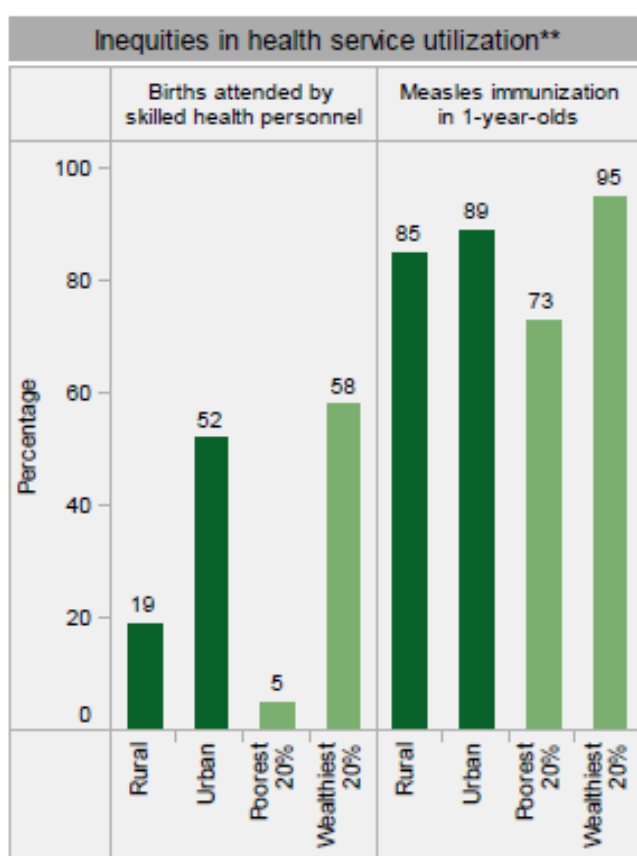
MoHP (2008)

WHO Baseline Country Survey on Medical Devices conducted in 2010

In general, health service provision has been steadily improving in the last 50 years in Nepal; however there remain some unfair and avoidable differences between the rural and urban populations in health outcomes. For example, births attended by physicians in the urban areas are more than double of those in the rural areas. In addition, the wealthiest 20% of the nation is 10 times more likely to have access to a skilled attendant at birth than others. Children under-5 living in the rural areas are two times more likely to die before their 5th birthday than children in the urban areas. The poorest 20% are also two times more likely to die before their 5th birthday than the wealthiest 20%.

In the event of a disaster, these inequities can have a grave impact on the chances of survival in the rural areas since being remote and inaccessible would be likely to keep them dependent on local available resources and their pre-event health status would be a key determinant of their resilience.

The following figures show inequities between the rural and the urban populations. As mentioned above, contributing factors to existing inequities may include a lack of access to care due to the remoteness of the rural areas and a lack of health professionals in remote areas.



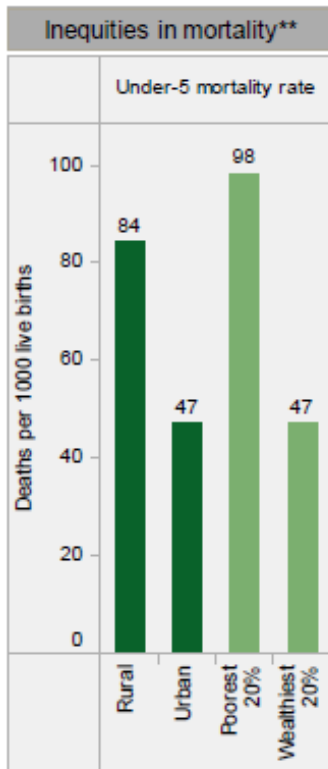


Figure 13 Inequities in health outcomes and health provision illustrated by health service utilization and mortality indicators, 2009 (WHO 2010)

V. Health expenditure

The out-of-pocket expenditure is any direct payment by a household to health practitioners and suppliers of goods and services whose primary intent is to contribute to the restoration or enhancement of the health status of people. A high out-of-pocket expenditure may indicate a lack of public health expenditure from the government.

Nepal's total expenditure on health was 5.1% of the gross national product in 2008 (WHO global health observatory). The private expenditure on health was 62.3% of the total expenditure on health in 2008. In low-income households, an unexpected health problem may worsen people's poverty status.

2.2 Preparedness

The importance of disaster preparedness is evident in Nepal. Policies, programmes, and action plans have been used to prevent or decrease the impact of a disaster on the population, or to increase the ability of the community to withstand a disaster. Having a long history of natural hazards has left the government of Nepal cognizant to the risks they face, but the volatile political situation has also made it difficult to strengthen the disaster preparedness to an adequate level.

The government has formulated various disaster preparedness plans during the last 30 years starting with the landmark National Calamity Relief Act in 1982. It was followed by the National Action Plan in 1996, which defined the disaster management system in its organizational structure of central, regional, district and local levels.

I. Health Sector

The Disaster Health Working Group (DHWG), founded in 1993, is the body responsible for coordination of emergency preparedness and disaster response at the national level within the health sector. The responsibility of this group is to implement, and evaluate health sector emergency-related activities. In 2003, the DHWG was institutionalized and has since been recognized within the government system.

The Ministry of Health and Populations (MoHP) has established Rapid Response Teams (RRTs), whose responsibilities would be to coordinate with the District Committees (who report to the Ministry of Home Affairs) as first level responders. However, although training is on-going for the RRTs, it is unclear how many RRTs have completed training and how effective their training has been.

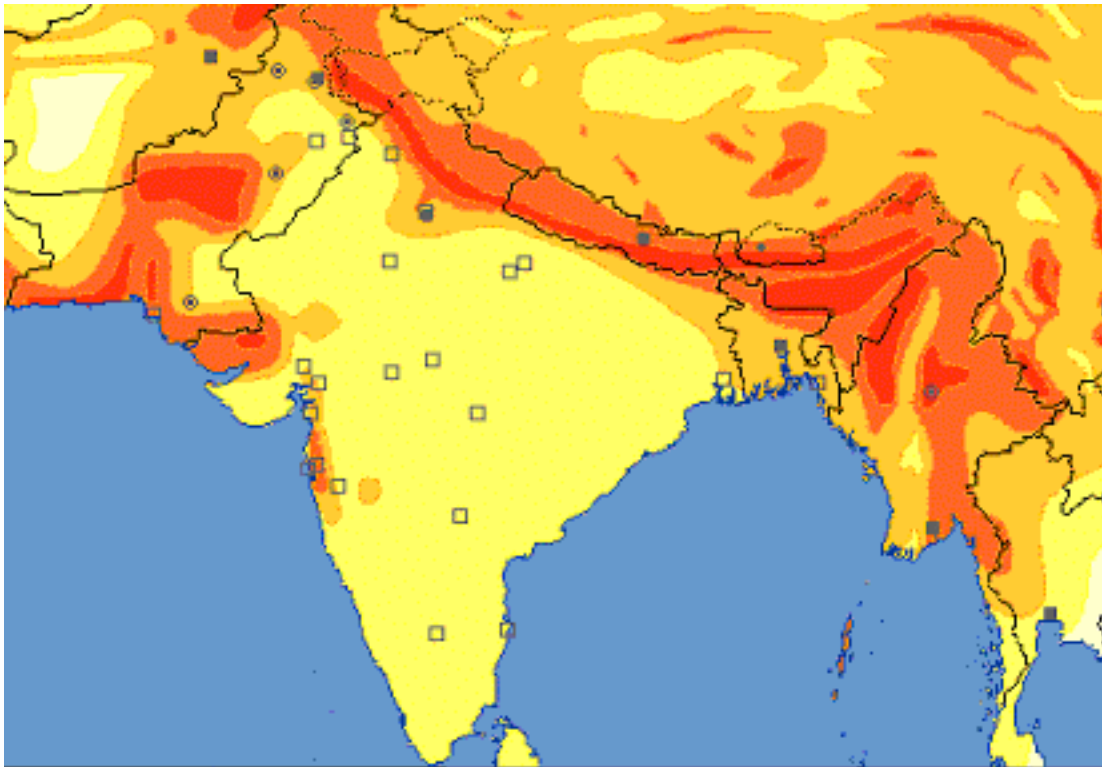
II. National Policy Framework

The Natural Calamity (or Disaster) Relief Act, was the first structured policy in Nepal dealing with disaster management. The Act was drafted in 1982 and amended in 1989 and 1992. The Act provided authority to the committees at different levels (central, regional, local) to set up disaster aid funds for relief operations. This was a landmark act and the beginning of cooperation of government bodies at

all levels, making disasters a priority. (For further details see Appendix I: Nepal National Policy framework).

2.3 Hazard

In Nepal, a variety of natural hazards affect the millions of people who live there. Among the most frequent ones are floods, landslides, and fires. Epidemics, droughts and avalanches also occur frequently but more importantly, earthquakes are a major hazard. Earthquakes have been occurring at different intervals of time throughout the history of Nepal affecting many lives. Since Nepal is located on an active seismic belt, earthquakes are a major potential hazard. The plates beneath Nepal are active and continuously moved by the shifting of the Indian tectonic plate towards and below the Eurasian tectonic plate. Every year, thousands of earthquakes occur in this area but area usually of minimal force and damage. A major earthquake can help release the pent up energy that the plate movement stores up and a mapping of the seismic hazards in Nepal reveal a telling reality; a catastrophic earthquake in Nepal is inevitable.



Seismic Zone	Modified Mercalli Intensity	Peak ground acceleration (%g)
Zone = 0	MMI = V	< 3
Zone = 1	MMI = VI	3 - 10
Zone = 2	MMI = VII	10 - 20
Zone = 3	MMI = VIII	20 - 35
Zone = 4	MMI = IX	> 35

Figure 14 Seismic Hazard Map of Nepal

Source: Munich re (2001)

As the seismic map shows, Nepal falls within a high earthquake intensity belt. The seismic hazard zones divide the country into three zones stretched out in northwest-southeast direction. The central valleys are highly exposed to earthquakes and this where a large proportion of the population is concentrated. The flat plains of Terai in the south and the Kathmandu Valley show the highest level of susceptibility to liquefaction due to fine sand and high water table. Liquefaction is the process by which sediment is transformed into a substance that acts like a liquid. Liquefaction changes the firm consistency of the soil from firm to semi-liquid, losing its ability to support structures. Seismic waves are amplified, and the level of destruction is increased. The mountainous centre and hilly areas of the country are vulnerable to earthquake induced landslides. The past few decades have seen a few small-medium scale earthquakes in Nepal.

Deaths	Injury	People affected	Buildings destroyed	Buildings damaged	Livestock death	Reported Direct Loss (Million NPs)
813	6,842	4,539	33,710	63	2,257	22.8337

Figure 15 Disaster Losses in Nepal during 1971 – 2006 (37 Years)

Although the numbers shown in the graph have not been catastrophic, deaths per event, extent of damage, and intensity of damage from earthquakes are much larger than other disasters such as floods, landslides, or epidemics in Nepal. Even the medium intensity earthquake of 1988 (a magnitude of 6.9 (M_w)) caused the death of 721 people and a loss of 5 billion Nepali Rupees as reported by official estimates.

2.4 Risk

A study conducted by the United Nations Development Programme in 2004 ranked Nepal the 11th most at risk country in the world, in terms of relative vulnerability to earthquakes. In another report, the World Bank concluded that the country is extremely vulnerable to natural disasters including earthquakes. Kathmandu Valley fairs poor in all risk assessments, not only in regards to casualties but also the highest per capita risk.

The health effects of earthquakes largely depends on the population density of the area, the amount of people occupying the buildings, the type of infrastructure in the area, the time of occurrences, and on immediate response efforts. The nature of injuries can be in a wide spectrum, requiring simple procedure or intensive curative and surgical care. Patients who manage to survive blunt trauma and crush injuries, a common occurrence during earthquakes, can suffer from complications afterwards. This poses a great burden on the health system at a time when the local and regional medical response capacities are very likely to have been disrupted.

During an earthquake, medical facilities, roads, and bridges are often destroyed and medical chain supplies are interrupted. After the initial morbidity toll from instant death, the second mortality peak occurs a few hours after the earthquake, when serious traumas and fractures cause death. Finally, a third peak follows within days to weeks following a quake, as people with organ failure or infection succumb to their injuries. The severity of pre-existing chronic diseases can also cause a higher chance of morbidity. Post-traumatic stress and mental health problems are common, along with depression and anxiety. Public health problems such as overcrowding of makeshift shelters and health facilities can lead to infectious disease outbreaks. Although dead bodies do not pose an immediate health concern, removing dead bodies becomes a priority for psychological, moral and ethical reasons.

The Bihar/Nepal earthquake was the most devastating earthquake of the last century to hit Nepal. It measured a magnitude of 8.0 (M_w), with an epicentre about 240km away from Kathmandu. Most of the destruction occurred in Kathmandu Valley and along the plains bordering Northern India. The number of reported casualties was 8,519, and the estimated number of houses that were damaged reached more than 80,000. A total of 12,397 houses were completely destroyed. In 1988, another magnitude 6.9 (M_w) tremor struck in eastern Nepal killing 700 people, injuring 6,500, and destroying an estimated 22,000 houses.

Earthquakes of high magnitude do not occur frequently in Nepal, and are therefore not reflected in recent statistics. However, in the event of an earthquake, according to experts, the damage will be calamitous. The Global Earthquake Safety Initiative estimates that Kathmandu is exposed to the greatest earthquake risk per capita among 21 megacities around the world (2001). A major earthquake is estimated to occur every 75 years in Nepal according to seismic records. National Society for Earthquake Technology in Nepal estimates that if an magnitude 8 or higher earthquake was to strike Kathmandu, somewhere between 40,000-200,000 people could die, another 90,000-200,000 would be injured, 1.5 million people would be left homeless, and 60% of homes would be damaged beyond repair. Furthermore, communication networks would be cut off and electricity shut off. The Kathmandu Valley Earthquake Risk Management Project (KVERMP) also estimated that six out of

ten buildings would collapse, about 95 percent of water supply pipes might explode and 50 percent of bridges and 10 percent of roads could collapse in the Kathmandu valley area. The large death toll would mainly be due to building collapse, weak medical capacity, and insufficient preparedness.

Earthquakes continue to be a common occurrence, jostling the country, on average 3 times per month. However, an earthquake of the 1934 magnitude is expected to hit Nepal every 75 years or so. By estimation, this means that the next catastrophic earthquake is overdue to hit Nepal.

Date, Year / Time	Location	Magnitude
December 19, 2011 / 03:20	Taplejung	4.6
December 15, 2011 / 02:05	Taplejung	4.9
December 2, 2011 / 05:17	Sarsin, Rasuwa	4.2
November 23, 2011 / 00:26	Dailekh	4.2
November 19, 2011 / 00:06	Dolakha	4.1
November 13, 2011 / 05:45	Gorkha district	5.0
October 1, 2011 / 10:11	Humla district, 20 km north of Simikot	4.7
September 18, 2011 / 18:25	Sikkim/Nepal border	6.9
August 29, 2011 / 07:51	Udayapuradhi, Udayapur	5.0
August 22, 2011 / 20:36	Lahachowk, Kaski district	4.0
August 15, 2011 / 22:33	Bijulikot of Ramechhap	5.0
July 15, 2011/ 19:59	Sankhuwasava District	4.5
June 3, 2011	Kanchanjunga area, Taplejung	5.2

Figure 16 Recent earthquakes in Nepal

Source: KVERMP (2011)

2.5 Vulnerability

Vulnerability can be measured in different categories related to the conditions in which people live. It is a measure by which to gauge the likelihood of suffering harm and damages in case of an occurrence, in this case, of an earthquake. The Kathmandu valley and other urban centers are particularly vulnerable to earthquakes due to increasing population growth, poverty, lack of safe urban planning, insufficient enforcement of building codes, and weak political situation.

I. Infrastructure

Urbanization has been rapidly increasing in the Kathmandu valley over the past decade. This trend has led to many issues that make the area vulnerable, including overpopulation and rapid construction of unsafe/unregulated buildings to accommodate the population. Rapid construction with disregard to appropriate materials and design cause structural vulnerabilities that even under normal conditions are inadequate for living in. The few existing building codes are rarely enforced. Only one airport exists in Nepal and the three major access roads that run through the country would likely be destroyed in the event of an earthquake, limiting, if not preventing access to the disaster struck areas.

A decade has passed since the last structural assessment of health facilities was conducted by the World Health Organization (WHO) and the government of Nepal. The 2002 assessment explored the ability of the health facilities to withstand a major earthquake. It was found that 13 out of 14 of the hospitals in the Kathmandu Valley are at risk of destruction in the event of an 8.1 magnitude earthquake.

An ongoing program of the National Society for Earthquake Technology Nepal (NSET) has, since 2000, been assessing the seismic vulnerability of residential and commercial buildings in Kathmandu. However expert services are lacking and there is a huge gap in the availability of adequately trained organizations for assessments. To date, a mere 40 buildings have been assessed since the beginning of the program more than a decade ago. This progress is too slow for and is not sufficient to reduce the infrastructural vulnerability.

Another program of NSET in collaboration with partner organizations such as UNICEF, the Global Fund for Children, GeoHazards International, World Bank, and various other international and national bodies, is the School Earthquake Safety Program. This program also aims to conduct further vulnerability assessments after a 1998 assessment shocked the nation by reporting that an estimated 60% of schools were labeled highly vulnerable and risky (30). The programs' ultimate objective is to reduce the vulnerability through retrofitting of existing buildings and the safe construction of new buildings. However, progress has been slow, with only 42 schools having been retrofitted so far. The program simultaneously trains masons on the construction of earthquake resistant buildings and so is increasing the capacity of masons in vulnerable communities to build safely, but progress is slow.

The water supply and its necessary infrastructure can also be at risk during a major earthquake. A program called Seismic Vulnerability Assessment of the Drinking Water Supply System in Kathmandu Valley was undertaken by NSET with support from UNICEF in 2002. As Using hypothetical situations, and a Geographical Information System (GIS), possible network system and routes of damage were found, and based on these, suggestions were given for optimum restoration of the water supply for distribution of emergency water in case of an earthquake. The program was a success but is now out-dated. A new assessment is necessary.

II. *Poverty*

The Human Development Index (HDI) is a composite measure averaging achievement in three basic dimensions of human development: a long and healthy life, knowledge, and a decent standard of living. Nepal's HDI is 0.458. This puts the country at a rank of 157 out of 187 countries, and is classified as low human development.

A better measure of poverty is the Multidimensional Poverty Index (MPI). The MPI is a composite measure that reflects the percentage of households that experience overlapping deprivations in three dimensions-educations, health, and living conditions (31). The overall MPI for Nepal is 0.350 ranking it very low in the international scale at 157 out of 187 countries, below Myanmar and Nigeria. In

addition, 54% is the average percentage of deprivation experienced by the population and a total of 64.7% of the population is MPI poor.

Nepal is constantly ranked as one of the least developed countries in the world. Being a disaster prone country, the cycle of under-development and poverty is exacerbated with every event. Disasters can create immediate poverty through the loss of lives, livelihoods, and assets, but also, poverty can exacerbate the consequences of disaster by increasing vulnerability. Currently, Nepal faces a huge vulnerability to disasters due to the sheer amount of people facing everyday poverty, and the lack of financial resources to strengthen the progress of human development.

III. Political situation

The political conflict of the last couple of decades has also increased Nepal's vulnerability. The displacement of a large proportion of the population due to fighting has added to the deterioration of livelihoods already burdened by poverty. Conflict and displacement has also restricted people's access to information sources and community.

Post-conflict reconstruction is slow and the vulnerabilities associated with migrated/displaced populations, underdeveloped policies and a lack of budget for disaster preparedness, continue to plague the country. The concentrations of people that migrated to urban areas due to the conflict after losing their livelihoods added to the burden of urban degradation, rapid building of unsafe structures, and overcrowding that was discussed earlier as well as further worsened poverty levels. No exact figures exist regarding the number of people who were displaced, but estimates suggest up to 200,000. Even minor hazard events can evolve into recurring disasters which wear away the successful, increasing economic developmental gains in affected communities.

IV. Lack of disaster preparedness

Disaster preparedness has been improving steadily in Nepal in the last few years as evidenced by the growing number of organizations in the disaster preparedness and disaster mitigation sector. However,

information dissemination has been insufficient at the community level. A lack of information in some communities has contributed to a fatalistic and complacent mentality in regards to disaster preparedness. The relationship between hazard, risk, and vulnerability should be in the public conscience so that disaster preparedness directives can make an impact at the local level.

2.6 Resilience

2.6.1 Absorbing capacity

A number of projects address the issue of infrastructure and attempt to reduce the current vulnerabilities posed by unsafe buildings, and to mitigate damage in the event of an earthquake. The Department of Urban Development and Building Construction (DUDBC) with assistance especially from the UNDP/Earthquake Risk Reduction and Recovery Project (ERRRP) and National Society for Earthquake Technology – Nepal (NSET) has a number of on-going projects mainly focusing on the retrofitting of public schools, hospitals and other public buildings for earthquake resilience. Local authorities and those in the building trades have also held public education seminars on the earthquake risk from collapsing buildings and have provided training to enable correct implementation of the National Building Codes. The Department of Urban development and Building Construction along with NSET and the UNDP have developed and provided training on guidelines in the National Building Codes intended for owners and builders to use to build safer buildings.

The Ministry of Physical Planning and Works has executed a system of land pooling by which landowners who wish to build new urban developments in the Kathmandu Valley can forfeit a small portion of their land to use for proper roads, or open space. These measures can help to expand access for emergency vehicles, enhance evacuation, and reduce the hazard of tightly built collapsing buildings.

2.6.2 Buffering capacity

Nepali society's capacity to cope with the damage of a major earthquake is low. Disaster preparedness and early warning systems and response have been focused on flooding events until recently.

2.6.3 *Response capacity*

The Ministry of Health and Population (MoHP) has established Rapid Response Teams (RRTs) whose responsibilities are to coordinate with the District Committees (who report to the Ministry of Home Affairs) as first level responders. The Emergency Operation Center, whose function is to act as a central unit for dealing with emergency response, and to coordinate different clusters and agencies, coordinates all MoHA communications to the different level agencies. In the event of an earthquake, the local level rapid response teams will be an integral component of the disaster response. The Central Natural Disaster Relief Committee (CDRC) will coordinate local, regional, and district response and decide on the level of international assistance needed. The Regional Natural Disaster Relief Committee (RDRC) is comprised of related government agencies and security agencies (law and order, emergency response and development institutions) along with voluntary organizations such as the Red Cross. It is responsible for supporting and monitoring the activities implemented by the District Disaster Relief Committees (DDRCs). All 75 districts of Nepal have a District Natural Disaster Relief Committee DDRC. These are responsible for disaster management at the local level, such as disbursement of funds during emergencies, and rescue and transport of the injured to hospitals.

3. Health Crisis and Critical Health Events

3.1 Primary event

On September 18th, 2011, at 6:11pm Indian Standard time, a sudden onset earthquake measuring a magnitude of 6.9 (M_w) struck near the Nepal/India border in Sikkim province, lasting for 30-40 seconds. The earthquake was felt across India, Nepal, Bhutan, Bangladesh and southern China. The epicentre of the earthquake was estimated to be between 19.7 to 20.7km deep and 272 km (169miles) east of Kathmandu in Nepal on the Alpine-Himalayan seismic belt. The earthquake was associated with tectonic activity along the Main Boundary Thrust and the Main Central Thrust, two well-known faults in the Himalayas. The Sikkim earthquake was the biggest earthquake that Nepal has experienced in 78 years. Fifteen districts were affected with loss of property and damage to

infrastructure. The affected districts were in the eastern region, three were in the Kathmandu valley, and some in the western and central Nepal. The tremor was felt across 26 districts in total (23). The mobile communication network coverage was jammed during the first few days and a landslide triggered by the earthquake blocked a section of the Mechi highway, blocking the way to some of the affected areas.

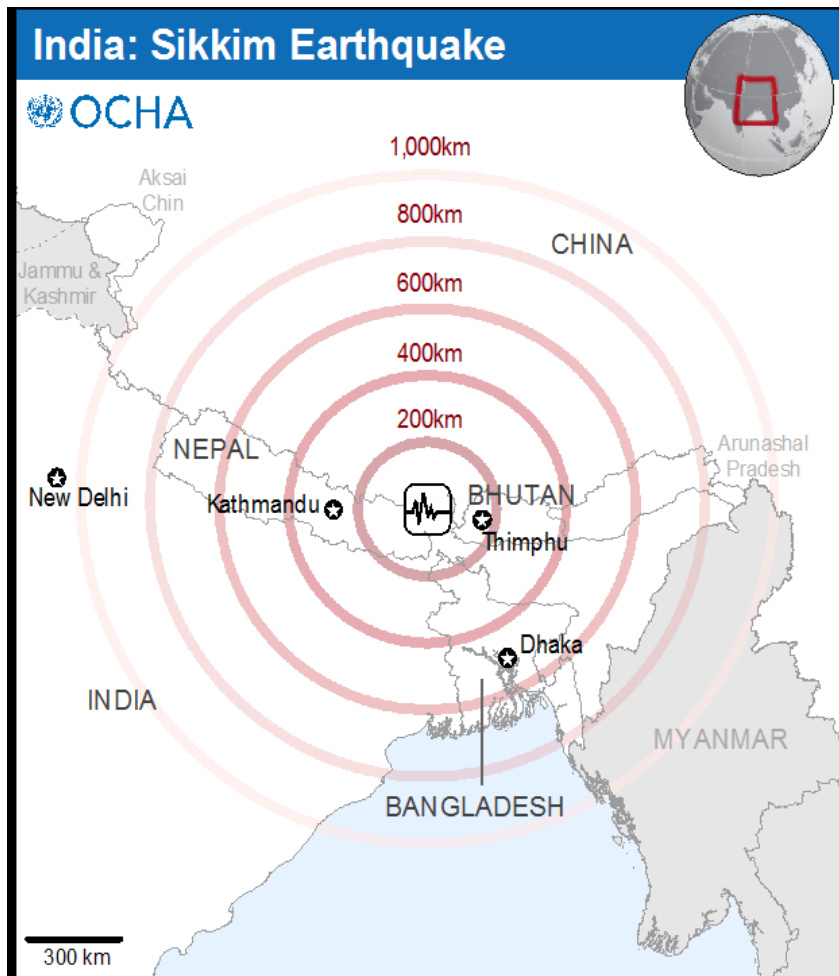


Figure 17 Epicentre and areas affected by the Sikkim earthquake, September 18, 2011 (32)

3.2 Secondary events

Three aftershocks were felt measuring magnitudes of 5.7, 5.1, and 4.6 (M_w). A landslide triggered by the earthquake blocked a section of the Mechi highway, blocking the way to some of the affected areas.

4. Damage & Consequences of Damage

4.1 Damage and disturbances (Human)

Death estimates in Nepal vary between organizations. Presently, the agreed upon mortality count is 6-7 people (Red Cross Society Nepal, 2011), (WHO, 2011). Three people died in Kathmandu in an embassy building when it collapsed. A total of 88 people were reported to be severely injured. Reports from the affected districts suggest a total of 19,813 families were affected and 7,882 displaced.(33)(34)

4.2 Damage and disturbances (environment)

Presently, 7,746 houses are reported to be completely destroyed and 12,104 partially destroyed. In addition, 24 schools and health post buildings in four districts are reported to be damaged.(33)

5. Responses

5.1 Relief responses

A cabinet meeting was held immediately (15 minutes) after the earthquake followed by a Central Natural Disaster Relief Committee (CNDRC) meeting. The National Emergency Operating Centre was immediately activated, relief response was initiated and instructions were sent to all district authorities and the District Disaster Response teams (DDRT) to carry out search and rescue operations and assessments along with security personnel including the police and military. The Ministry of Home Affairs (MoHA) coordinated and communicated with all of the effected districts. Assessments were conducted mainly through the NRCS and the IFRC.

The CNDRC was in charge of identifying and assessing needs for shelter and food for displaced families. A relief kit of 7kg of rice per head, kitchen utensils, and tarpaulins were distributed. Displaces families whose house was destroyed were provided with NPR 5,000 by the district teams. Another NPR 5,000-15,000 was promised by the central level government if needed. For families whose house was completely destroyed, NPR 25,000 per family was allocated and NPR 125,000 for

families who lost a family member. Presently the government has distributed an estimated NPR 25,277,000 to 5,296 families.

Nepal has endorsed the cluster approach for disaster response since the Koshi river flood disaster in 2008. The National Strategy on Disaster Risk Management identifies clusters and sectors that can feasibly be activated after a disaster to provide humanitarian response.

The operational arrangements adopted include coordinating with national and local authorities, civil society and actors. There are currently ten clusters operating at the central level. Based on the districts' capacities, districts have different numbers of clusters. (See appendix 3 for cluster responses).

5.2 Recovery responses

All of the responding clusters continued to develop recovery strategies following the initial relief stage.

The child protection cluster committed to review the training manual on child protection in emergencies and is developing a training package to be available as part of the Protection Cluster training packages. In addition, the education cluster continued to meet and conduct further assessments. Save the Children and UNICEF mutually decided to support the District Education Offices to build Temporary Learning Centers (TLCs) in areas where schools were unusable. A total of 687 TLCs are planned to be built.

The nutritional cluster reviewed the response for any gaps and to assess coordination between national and district levels and organized a training regarding Nutrition in Emergencies. Other key issues discussed were the updating of initial rapid assessment tools for earthquakes, and a revision of the cluster contingency plan. Furthermore, The WASH cluster presented "Emergency WASH Preparedness and Response" workshop using lessons learnt from the event.

The Regional Disaster Preparedness and Response (DPR) Monitoring Committee has commenced the monitoring process regarding the formation and application of disaster preparedness and response plans throughout the country. Districts will need to report the progress of their preparedness and response plans and they will be documented. The Regional Disaster Response Committees (RDRCs) for monitoring the progress provide support to the districts in need. A total of 62 districts out of 75 have completed their disaster preparedness and response plans.

6. Development

The government has devised a recovery plan to carry out reconstruction of damaged buildings. The Ministry of Physical Planning and Works is coordinating in order to carry out reconstruction works of buildings. There is a commitment to provide contributions to individual families, schools, health service centers and government authorities. The contributions are tentative, and only in the planning phase, but would be as follows:

- NPR. 100,000 for houses that are fully damaged and NPR. 50,000 for houses that are partially damaged.
- NPR. 1,000,000 for schools which are fully damaged and NPR. 500,000 for schools which are partially destroyed.
- NPR. 500,000 for health centers which are fully damaged and NPR. 200,000 for health centers that are partially damaged.
- NPR. 1,000,000 for buildings that are fully damaged and NPR. 500,000 for buildings that are partially damaged.

The government of Nepal has also expressed a commitment to making the national building code obligatory. Under the building code, there would be updated and effective regulatory provisions for the construction of multi-storey building in the urban areas. Regulation would include:

- a) Building systematic cities along the main highways to improve access during emergencies.
- b) Ensuring sustainable and systematic urban development plans are formulated
- c) Promoting a functional coordination among the actors related to housing and urban

development

- d) Enhancing the institutional capacity of local bodies and central government for conducting necessary research in this sector, and strengthening the regulatory system
- e) Providing mason training for local masons

7. Discussion

Unlike the Millennium Development Goals, the Hyogo framework does not set any target but identifies three strategic goals and five priority areas for action. The goals include integrating DRR into development policies, planning and programmes; develop institutions, mechanisms and capacities at all levels to contribute to building resilience to hazards; systematically incorporate DRR in emergency preparedness, response and recovery programmes. It was felt that Nepal's current situation is still far from the goals set from the Hyogo framework. In the following discussion session, the reasons and barriers shall be further examined.

Nepal's response to the September 18th Sikkim earthquake was considered satisfactory. The cluster system, a widely recognized and efficient disaster response mechanism was activated immediately after the earthquake. Nepal's commitment to providing compensation for lost homes and for providing free health care was also commendable. However, the Sikkim earthquake is in no way representative of the response that would be feasible in the event of a major earthquake the scale of the 1934 earthquake.

The political situation in Nepal is weak and after decades of political transition and governance, is still in its interim period. The outcome of this interim process is that the process of regulatory structure is slow and sometimes inefficient. The implementation of new policy is also slow. In addition to the transitioning structure of the federal system, a decade of the absence of district and local elections has left this process weak. Since community disaster reduction measures depend on an effective governing process, formal community participation is also stunted. Yet, despite the difficulty that comes with transition, the government of Nepal has adopted a new National Strategy for Disaster Risk

Management and is in the last stage of implementing a new Disaster Management Act. The Act is planned so that new coordinating mechanisms at the district and local levels will be implemented for disaster management.

Due to Nepal's other developmental problems, vulnerability to disaster runs high. For example, as discussed above, poverty exacerbates the risk of earthquakes becoming an unmanageable disaster. For this reason, any new disaster management plan must be comprehensive in that it takes into account all factors including social, environmental, and political issues. An effective new strategy needs to address some of the regulatory factors that will make a major earthquake a catastrophe. Development goals that are currently a priority in Nepal (i.e. poverty reduction) should be integrated with disaster management goals. Thereafter, the challenge will be to implement this comprehensive style of strategy at the district and local level.

The new Disaster Management Act will be integrated with the previous National Strategy for Disaster Risk Management which has already been widely accepted at the district level and what remains is to integrate it into the communities. Other initiatives like the retrofitting of schools, hospitals, and buildings are also on-going positive steps towards establishing good disaster risk reduction and disaster preparedness. Recognizing that building codes are an integral component of disaster risk reduction, training provided to builders via the Mandatory Rules of Thumb is also an important step forward. However, an impediment to building code implementation is that the responsibility lies not within the National government but at the local levels, making enforcement ambiguous. Community acceptance of the building codes is crucial in their implementation. Since local authorities are not elected, the process of regulation is weakened and so a change of governance, attitudes, and information sharing is important. At the local levels where the presence of a government structure is vague, many communities are showing resilience in regards to other hazards such as flooding; therefore the building blocks for building community resilience to earthquakes can naturally follow.

In terms of land planning, the voluntary land use scheme is an improvement from unregulated and largely ignored land use and planning. The land use scheme will help to guide urban development away from high risk zones and to ensure that space is available for emergency access roads, evacuation routes, and other infrastructure. Without such a measure, uncontrolled, unsafe construction will continue to be replicated.

Good governance and an updated disaster management act will help Nepal strive forwards in its disaster reduction goals. Implementation of regulations and laws that deal with the built environment can help to reduce the number of hazards that continue to create such a high risk for the Nepalese people. The Sikkim earthquake response on the 18th of September was sufficient for a small scale earthquake but not indicative of a future response to large-scale disaster events. Disaster management must lie, not in the highest level of governance but in the local capacity since the greatest disaster damage will be in the communities where immediate response will depend on the local people. Using this yardstick, Nepal is not ready for a major earthquake. Community disaster response initiatives are slow to be recognized, applied, and funded. The cluster approach is an effective tool, but even then, agencies involved cannot reach the affected zones immediately following an event. The response for the Sikkim earthquake highlighted that inter-agency cooperation can be effective but that more coordination is needed and that community capacity needs to be strengthened.

8. Lessons Identified and Actions Recommended

According to the priority actions of the Hyogo framework and taking into the reports of agencies involved in the disaster response of the Sikkim earthquake in Nepal, lessons learnt are as follows:

I. Ensure that DRR is a national and local priority, with a strong institutional basis for implementation.

It is important that there is “a national legal and institutional framework” that focuses on risk reduction and identifies “who does what”, and involves all main stakeholders to prevent, mitigate and prepare against the impact of hazards at a regional, national and local level”.

The compensation, relocation, and displacement process of affected civilians is not fully clear. Although the government provided monetary compensation, and working agencies (i.e. the Red Cross Society of Nepal) provided essential relief items, resources for reallocation are scarce. In the event of an earthquake, reallocation and displacement are major concerns, and therefore will need to be considered a priority in the planning of the new Act. In addition, there is no current regulation addressing the right to be relocated from high risk lands and no compensation for relocating as a measure of disaster preparedness.

Official reporting of disaster events is messy and uncoordinated. Reliable sources such as government agencies, humanitarian agencies (i.e. OCHA), and national agencies (i.e. Red Cross Society of Nepal), all reported different figures of casualties, injuries, and infrastructure damage. No consensus was reached until months after the earthquake on the number of deaths and monetary cost. The lack of efficient reporting can be a major barrier to the efficient and effective allocation of resources and should also be considered a priority in the disaster management act.

II. Use knowledge, innovation and education to build a culture of safety and resilience at all levels

It was found that communities are not as involved as they should be in the risk reduction, disaster management process. Although the National Strategy has emphasized greater focus on community participation, implementation is at the early stage. More focus should be given to the disaster education of women and children at the local level, information flow between emergency operation centers and communities, community consultation, and community organizations. Currently, there are many community disaster reduction initiatives but they are usually short term and small scale albeit successful.

III. Strengthen disaster preparedness at all levels

Community empowerment is low. Existing laws do not emphasize the right of citizens in regards to risk reduction and disaster. The new Disaster Management Act should take this into account and

translate this priority into a legal right. This would help communities feel protected and acknowledged, providing them with self-empowerment and trust in the system.

9. Conclusions

Nepal is a small, vulnerable, disaster prone country in Asia. The risk of a catastrophic earthquake runs high and a transient political environment keeps disaster policy implementation slow. Disaster response in Nepal is efficient on a small-scale level. An organized strategy is in place for the development of disaster management priorities but it is still fragmented and uncoordinated. A scaled up attempt to improve development of disaster management and the new Disaster Management Act will be a driving force for future capacity. So far it seems that community- based projects are active but not driven by the law as much as by need and importance. In the absence of legally mandated programs however, these projects will remain at the micro-level. It is hoped that the new Disaster Management Act will address these pressing issues.

10. References

1. Kulling P, Birnbaum M, Murray V, Rockenschaub G. Guidelines for reports on health crises and critical health events. *Prehospital disaster Med Off J Natl Assoc EMS Physicians World Assoc Emerg Disaster Med Assoc with Acute Care Found.* 2010;25(4):377–83.
2. Paul B. Responding to disasters. In: *Oxford Handbook of Public Health Practice.* 2nd ed. Oxford University Press, USA; 2006. p. 383–5.
3. Pan American Health Organization. *Emergency Health Management After Natural Disaster.* Washington, DC: Office of Emergency Preparedness and Disaster Relief Coordination; 1981.
4. The Sphere Project. Humanitarian charter and minimum standards in humanitarian response [Internet]. The Sphere Project. 2011. 402 p. Available from: <http://www.spherehandbook.org>
5. World Health Organization. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York. In: *Official Records of the World Health Organization.* 1946. p. 100.
6. Acheson D. *Public health in England: the report of the Committee of Inquiry into the Future Development to the Public Health Function.* Her Majesty's Stationery Office. London, England; 1988.
7. Central Intelligence Agency. *The world factbook: South Asia - Nepal* [Internet]. 2014. Available from: <https://www.cia.gov/library/publications/the-world-factbook/geos/np.html>
8. Wilkinson D, Acharya S, Devkota B, Rana P, Uprety A. *Evaluation of UNFPA's sixth country programme in Nepal (2008-2012): report prepared for UNFPA Nepal.* 2011.
9. United Nations' Population Fund (UNFPA) Nepal. *Key Indicators for Nepal.* 2015.
10. Government of Nepal. Ministry of Environment. *Strengthening national capacity on climate change – Terms of reference: preparation of the climate change strategy and framework for climate change fund.* 2010.
11. WHO. *Global Health Observatory Data Repository: Nepal statistics summary.* 2014.
12. United Nations' Population Fund (UNFPA). *Nepal indicators: Demographic highlights.* 2011;
13. WHO. *Global Health Observatory Data Repository: probability of dying per 1 000 live births (Nepal).* 2014.
14. WHO. *Global Health Observatory Data Repository: life expectancy – data by country (Nepal).* 2014.
15. WHO. *Global Health Observatory Data Repository: Nepal: health profile.* 2014.
16. WHO. *Global Health Observatory Data Repository: essential health technologies – data by country (Nepal).* 2014.
17. WHO. *Global Health Observatory Data Repository: literacy rate among adults – data by country (Nepal)* [Internet]. 2014. Available from: <http://apps.who.int/gho/data/view.main.680?lang=en>
18. WHO. *Global Health Observatory Data Repository: density per 1000 – data by country*

- (Nepal). 2014.
19. World Bank. Data: population density (people per sq. km of land area). 2015.
 20. World Bank. Data: urban development. 2014.
 21. World Bank. Data: arable land. 2014.
 22. WHO. Nepal: WHO statistical profile. 2010.
 23. WHO. Noncommunicable diseases country profiles - Nepal. 2011.
 24. Hung KK, Lam EC, Chan EY, Graham C a. Disease pattern and chronic illness in rural China: the Hong Kong Red Cross basic health clinic after 2008 Sichuan earthquake. *Emerg Med Australas* [Internet]. 2013;25(3):252–9. Available from: <http://doi.wiley.com/10.1111/1742-6723.12080>
 25. WHO, UNICEF. Estimates of immunization coverage: 2010 revision – Nepal. 2010;
 26. WHO. Nepal: immunization profile. 2011;
 27. WHO. Nepal: urban health profile. 2009;
 28. WHO Global Health Observatory. Nepal: tuberculosis profile. 2010;
 29. International Food Policy Research Institute. 2011 Global Hunger Index: the challenge of hunger: taming price spikes and excessive food price volatility. 2011.
 30. Apikul C. The School Earthquake Safety Program in Kathmandu Valley: building safer communities through schools [Internet]. 1998. Available from: http://www.preventionweb.net/files/11099_41.pdf
 31. Oxford Poverty & Human Development Initiative (OPHI). Multidimensional Poverty [Internet]. Available from: <http://www.ophi.org.uk/research/multidimensional-poverty/>
 32. United Nations Office for the Coordination of Humanitarian Affairs (OCHA). Sikkim earthquake: India. 2011.
 33. International Federation of Red Cross and Red Crescent Societies. Disaster relief emergency fund (DREF): Nepal: earthquake [Internet]. 2012. Available from: <http://reliefweb.int/sites/reliefweb.int/files/resources/MDRNP005dref4.pdf>
 34. United Nations Office for the Coordination of Humanitarian Affairs (OCHA). Sikkim earthquake: India (Situation Report No. 3) [Internet]. 2011. Available from: [http://reliefweb.int/sites/reliefweb.int/files/resources/Sikkim India EQ sitrep, no. 3, 23 Sept 2011.pdf](http://reliefweb.int/sites/reliefweb.int/files/resources/Sikkim%20India%20EQ%20sitrep,%20no.%203,%2023%20Sept%202011.pdf)

11. Appendices

Appendix I: Nepal National Policy framework

Preparedness Plan

In response to the UN call for global disaster risk reduction, the Government of Nepal formed a national committee under the authority of the Minister for Home Affairs. The committee was composed of academics, experts, administrators, and security personnel. It has drawn up a National Action Plan on Disaster Management in Nepal (1996) covering disaster preparedness, response, mitigation, and reconstruction, which was disseminated to all levels of government. The plan consisted of four sections: disaster preparedness, disaster response, disaster reconstruction and rehabilitation, and disaster mitigation. The committee first adopted the Yokohama Strategy set forth in 1994.

Following the Hyogo Framework for Action (HFA) in 2005, Nepal developed and implemented the National Strategy for Disaster Risk Management (NSDRM) in 2009, with commitment of the Government of Nepal for protection, growth, and promotion of national heritages and physical infrastructures. The five priorities were recommended in the implementation process: (1) prioritizing disaster risk reduction at both the national and local levels; (2) strengthening assessment, identification, monitoring, and early warning system on potential disaster; (3) development of safety and disaster resilient culture at all levels; (4) minimizing existing risk factors; and (5) strengthening disaster preparedness for effective response. In 2011, the MoHA issued the Guidance Note on Disaster Preparedness and Response Planning (DPR Plan 2011) to provide a conceptual framework for disaster preparedness planning in all 75 districts of the country. By 2014, the NSDRM was in the process of being incorporated in a new Disaster Management Act, which is meant to establish a National Disaster Management Authority (NDMA) and new coordinating mechanisms at all levels and to shift further focus of disaster plans from response and relief to preparedness, mitigation, and the strengthening of institutions and community participation.

Since the adoption of the above mentioned policies and the international call for disaster risk reduction and mitigation, Nepal has seen an integration of disaster risk considerations into sustainable development policies, planning and programming at all levels of government. The emphasis of these policies is on disaster prevention, mitigation, preparedness, and vulnerability reduction.

Nepal also created the Nepal Risk Reduction Consortium (NRRC) in 2011 to implement key elements of the NSDRM, with priorities in school and hospital safety, emergency preparedness and response, flood risk management in the Koshi River Basin, community based disaster risk reduction, and policy and institutional support for disaster risk management. The consortium is comprised of the Asian Development Bank, International Federation of the Red Cross, UNDP, UNISDR, OCHA, and the World Bank. Together these agencies have been working together to create Flagship programs that ranged from retrofitting 900 school buildings and a dozen large hospitals in the Kathmandu Valley to community preparedness in 1,000 of Nepal's 4,000 Village Development Committees. In addition, the programs focused on capacity building for the search and rescue force, and sensitive land use planning in the Kathmandu Valley.

Organization

The Ministry of Home Affairs (MoHA) is the main agency responsible for hazard management and the implementation of emergency preparedness and disaster management policies. MoHA coordinates with international agencies and relevant stakeholders to develop, strengthen and enhance the institutional capacity for implementing disaster risk reduction activities in the country. MoHA also carries out rescue and relief efforts through the Disaster Management districts.

The Minister of Home Affairs heads a committee called the Central Disaster Relief Committee (CDRC). The committee is made up of representatives and secretaries from many ministries including the Minister of Health and Populations (MOHP), the Minister of Planning and Physical Works, the Nepal army, Nepal police, ministers from the Department of Mines and Geology, Red Cross Society, and various others. Following a disaster, the Department of Mines and Geology has the capacity to

disseminate information about an earthquake within half an hour of its occurrence, initiating a meeting of the CDRC to address the needs of the affected population and to coordinate rehabilitation efforts.

Appendix II: National Strategies for Disaster Risk Management, 2009

Government of Nepal Ministry of Home Affairs. National Strategies for Disaster Risk Management 2009 [Internet]. 2009. Available from: <http://un.org.np/sites/default/files/report/2010-08-06-nsdrm-in-eng-2009.pdf>

The Local Self-Governance Act 1999 initiated a decentralization process that delegated more authority, resources, and responsibilities to the local bodies. This means that local bodies are responsible for collecting tax, the construction and maintenance of villages, and disaster mitigation. By 2011, 66 out of 75 districts in the country have adopted a district disaster preparedness plan. However, lack of budget allocations has been a barrier to the implementation of their plans.

Local-level plans are also engaged to organize prevention works along with non-governmental organizations such as the Red Cross Society of Nepal. At the district level, the District Disaster Relief Committees (DDRCs) are the agencies that coordinate relief support locally through the provision of medical support, and the distribution of essential supplies. Community-based disaster risk reduction committees have been established and encouraged to register as community-based organizations at the district level upon completion of their start-up projects so that they may have access to government assistance for disaster preparedness measures, and be able to participate in local government disaster risk reduction processes. Each district is further subdivided into Village Development Committees with local community participation.

The Disaster Preparedness Network (DP-Net) is an association of individual organizations in Nepal, which are concerned with disaster management. DP-Net matches the effort of these agencies to inform and prepare communities to deal effectively with disasters. The service is meant to be mutually beneficial, for both agencies and the public.

Appendix III: Cluster responses for 2011 Nepal Sikkim earthquake

Health

Assessment teams were deployed immediately post-earthquake. The MOHP coordinated with the WHO led Health cluster for health cluster needs assessments. The government of Nepal instructed all health institutions to provide free health service to people affected by the earthquake as communicated by the CNDCR. According to the information collected, 26 health facilities were completely destroyed and 38 were partially damaged.

By December 2011, District Health Offices in Doti, Achham, Darchula, Bajhang and Bajura districts with support from the United Nations Population Fund (UNFPA) had prepared new contingency plans.

Water, Sanitation, and Hygiene

After an initial rapid assessment, the WASH cluster concluded that no immediate humanitarian WASH response was needed at the community level. The WASH cluster distributed some WASH supplies to meet the immediate needs of displaced families. The WASH cluster members also committed to provide technical support for the installation of WASH facilities in schools as required.

Shelter and Non-Food Relief Items

The Nepal Red Cross Society (NRCS) conducted assessments immediately after the earthquake and distributed non-food relief items to the displaced families. The NRCS distributed, 2,189 non-food relief item sets, 3,149 Tarpaulins and 709 blankets and continued surveillance of changing needs with the changing season.

Nutrition

The nutrition cluster conducted a rapid assessment of the food security situation and found that there was not a health and food scarcity problem.

Education Cluster

A rapid assessment found that many school buildings were damaged in the earthquake and that there was a need for reconstruction. In 13 districts, 128 schools were found to need urgent action as they were fully destroyed and 547 schools were partially damaged.

Protection Cluster

The Protection Cluster responded to the earthquake by conducting a rapid protection assessment of the situation. The Child Protection cluster led by UNICEF undertook rapid assessment missions to eastern districts, where some children feared a return to school, fearing that the buildings might collapse. The psychosocial support working group under the Protection Cluster developed a list of service providers in the districts that could be contacted to provide assistance. UNICEF prepared and delivered public messages to be aired through the FM radio that emphasized the protection of children and post-event psychological issues.

12. Keywords

2011 Sikkim Earthquake; crisis event management; crisis management; critical health event; disaster; disaster cycle model; Disaster Case Studies Series; disaster management; disaster response; earthquake; emergency; emergency medical service(s); health crisis; preparedness; public health evaluation; Sikkim earthquake

13. Abbreviations

CDRC	Central Disaster Relief Committee
CNDRC	Central Natural Disaster Relief Committee
DDRC	District Disaster Relief Committee
DHWG	Disaster Health Working Group
DPNET	Disaster Preparedness Network Nepal
DPR	Disaster Preparedness and Response
DRR	Disaster Risk Reduction
DUDBC	Department of Urban Development and Building Construction
ELDIS	Electronic Development and Environment Information System
EM-DAT	Emergency Events Database
ERRRP	Earthquake Risk Reduction and Recovery Project
GIS	Geographical Information System
HDI	Human Development Index
HFA	Hyogo Framework for Action
IFRC	International Federation of Red Cross and Red Crescent Societies
KVERMP	Kathmandu Valley Earthquake Risk Management Project
MoHA	Ministry of Home Affairs
MoHP	Ministry of Health and Populations

MPI	Multidimensional Poverty Index
NDMA	National Disaster Management Authority
NGO	Non-governmental Organization
NPR	Nepalese Rupee
NRCS	Nepal Red Cross Society
NRRC	Nepal Risk Reduction Consortium
NSDRM	National Strategy for Disaster Risk Management
NSET	National Society for Earthquake Technology Nepal
OCHA	United Nations Office of Humanitarian Affairs
OPHI	Oxford Poverty & Human Development Initiative
PRB	Population Reference Bureau
RDRC	Regional Disaster Relief Committee
RRT	Rapid Response Team
TLC	Temporary Learning Centre
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
UNICEF	United Nations International Children's Emergency Fund
UNISDR	United Nations International Strategy for Disaster Reduction
WASH	Water, Sanitation and Hygiene
WB	World Bank
WHO	World Health Organization
WHO-EURO	WHO Regional Office for Europe