Research Report

IRIDeS Fact-finding and Relationship-building Mission to Nepal

International Research Institute of Disaster Science
Tohoku University
Sendai, Japan

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TOHOKU UNIVERSITY

IRIDeS

IRIDeS Fact-Finding and relationship-building mission to Nepal

IRIDeS Task Force Team

Hazard and Risk Evaluation Research Division:

Prof. F. Imamura, Prof. S. Koshimura, Dr. J. D. Bricker, Dr. E. Mas

Human and Social Response Research Division:

Prof. M. Okumura, Dr. R. Das, Dr. E. A. Maly

Regional and Urban Reconstruction Research Division:

Dr. S. Moriguchi, Dr. C. J. Yi

Disaster Medical Science Division:

Prof. S. Egawa (Team Leader), Prof. H. Tomita, Emeritus Prof. T. Hattori, Dr. H. Chagan-Yasutan, Dr. H. Sasaki

Disaster Information Management and Public Collaboration Division:

Dr. A. Sakurai

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- Mr. Edmondo Perrone, Cluster coordinator/World Food Program
- Mr. Surendra Babu Dhakal, World Vision Internationa
- Mr. Prafulla Pradhan, UNHabitat
- Mr. Vijaya P. Singh, Assistant Country Director, UNDP Nepal Office
- Mr. Rajesh Sharma, Programme Specialist UNDP Bangkok Regional Hub

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- Dr. Vinshu Dangol, Tribuvan University
- Dr. Nagendra Raj Sitoula Tribhuvan University Institute of Engineering, Center for Disaster Studies
- Dr. Basanta Raj Adhikari, Tribhuvan University Institute of Engineering, Center for Disaster Studies
- Dr. Prem Neth Maskey, Tribhuvan University, Institute of Engineering Department of Civil Engineering
- Dr. Saroj Prasad Odja, Head, Department of Psychiatry, TU-IOM
- Prof. Dr. Sangita Bhandary, Vice Chancellor, Patan Academy of Health Science
- Mr. Macha B. Shakya, Medical Librarian/Training Liason Officer, Patan Academy of Health Science
- Dr. Basant Pant, Chairman, Annapurna Neurological Institute and Allied Science
- Dr. Tulshi B. Shrestha
- Dr. Hiroshi Yagi, Yamagata University
- Prof. Yasushi Takeuchi, Tohoku Institute of Technology
- Mr. Masahiko Murata and Mr. Sotaro Tsuboi, Disaster Reduction and Human Renovation Institution
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- Mr. Jeevan Shrestha, Japanese Language Instuctor, Sankhu
- Ms. Midori Sakamoto, Advisor, Japanese Language Teachers Association
- Yogendra Chitrakar, Engineer, Guheshwori Wastewater Treatment Plant

- Mr. Shinya Machida-Counselor, Embassy of Japan in Nepal
- Mr. Makoto Ooyama, First Secretary, Embassy of Japan in Nepal
- Mr. Hiroyasu Tonokawa, Senior Representative, JICA Nepal Office
- Mr. Yukio Tanaka, Representative, JICA Nepal Office
- Ms. Aika Tomimatsu, JICA Nepal Office
- Mr. Kozo Nagami, JICA Tohoku Office and JICA Nepal Office
- Mr. Tatsuya Murase, Director, JICA Tohoku Office
- Mr. Satoshi Fujii JICA Tohoku Office
- Ms. Midori Kamata, JICA Tohoku Office

Contents

Dr. Fumihiko Imamura

Director of IRIDeS,
Tohoku University

1 Message from IRIDeS for reconstruction and future safety in Nepal

One month after the 3rd UN World Conference on Disaster Risk Reduction was held in Sendai to discuss issues of disaster mitigation with participants from around the world, we were so shocked by the news from Nepal about the earthquake and resulting damage. Soon after, we decided to collect information/data toward the support of people in the affected area, by starting discussions within IRIDeS and making contact with other people and organizations related to Nepal.

Having experienced the catastrophic disaster in 2011, Tohoku University founded the International Research Institute of Disaster Science (IRIDeS). Together with collaborating organizations from many countries and with broad areas of specializations, IRIDeS conducts leading edge research on natural disaster science and disaster mitigation. Based on the lessons from the 2011 Great East Japan (Tohoku) Earthquake and tsunami disaster, IRIDeS aims to become a world center for the study of disasters and disaster mitigation, learning from and building upon past lessons in disaster management from Japan and around the world. This is why IRIDeS contributes to on-going recovery/reconstruction efforts in affected areas, including Nepal and other countries, conducting action-oriented research and pursuing effective disaster management to build sustainable and resilient societies. IRIDeS innovates based on past disaster management paradigms after catastrophic natural disasters in Japan and other countries, to become a cornerstone of disaster mitigation management and sciences.

2 Executive Summary

Author: Shinichi Egawa

Immediately after the Nepal Gorkha Earthquake occurred on Apr. 24, 2015, IRIDeS began to assess the damage of the earthquake and to organize emergency survey team(s) for fact finding and network building missions. This mission is the inherent mechanism of IRIDeS because it aims to create a new academia of disaster mitigation, building on and applying lessons from the 2011 Great East Japan Earthquake and Tsunami and the findings of leading edge research into our societies.

Disaster risk is calculated by the following equation:

Risk = (Hazard exposure x Vulnerability) / Capacity

Disaster risk reduction (DRR) is achieved by decreasing hazard exposure or vulnerability and increasing capacity. Apparently most of the human damage in Nepal could be attributed to building vulnerability. But because of geoscientific knowledge, people and the Government of Nepal were already aware of the possibility of earthquakes and vulnerability of the buildings far before the earthquake attacked this time. The DRR process is the total outcome of the policy, culture, economy and health of society and the damage from disaster reflects the condition of DRR.

The aim of our fact-finding mission was to clarify preparedness before the disaster and to assess the resilience of society in the disaster cycle--response, recovery, reconstruction and preparedness.

In March 2015, the Sendai Framework for Disaster Risk Reduction (SFDRR) was adopted by 187 member states to improve disaster resilience. The four Priorities for Action in the SFDRR include:

1. Understanding disaster risk;
2. Strengthening disaster risk governance to manage disaster risk;
3. Investing in disaster risk reduction for resilience;
4. Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.

In this context, IRIDeS focused on understanding risk perception and management of people in Nepal by visiting Government offices, hospitals, infrastructure and logistic facilities along with agencies involved in relief including the Embassy of Japan, Japan International Cooperation Agency (JICA) and UN agencies.

On May 1, IRIDeS organized a symposium in Sendai, Japan to share the information from various researchers and organizations to capture the outline of disaster.

IRIDeS Director Prof. Fumihiko Imamura visited Nepal on May 25 to join the Build Back Better Reconstruction Seminar in Nepal organized by the Government of Nepal and JICA to share the knowledge of the Great East Japan Earthquake. Prof. Imamura introduced IRIDeS to partners in Nepal, including the Center for Disaster Science, Institute of Engineering, Tribhuvan University and JICA Nepal Office, who helped the successive teams a lot.

Remote sensing of hazard and damage and its multilayered information gave us a better outline of the disaster to prepare before visiting the area. We also tried to collect as much information as possible and visited JICA Tohoku Office for assistance with transportation and communication as well as finding counterparts in Nepal. Emeritus Prof. Toshio Hattori in the Division of Disaster Infectious Disease has a research network about tuberculosis and introduced Dr. Basu Pandey, Director of Division of Leprosy Control in Ministry of Health and Population (MoHP), who kindly coordinated the major part of our mission. We appreciate his help very much.

From Jul. 24 to Jul. 30, the main multidisciplinary team, which consisted of three medical doctors, a nurse, a health researcher, a transportation engineer, and a hazard scientist, visited the abovementioned agencies in Nepal.

From Sep. 3 to Sep. 6, 2015, Prof. Hiroaki Tomita visited Tribhuvan University and investigated the mental health aspects of the disaster. The mental health service in Nepal before the earthquake was quite limited due to the limited number of facilities and physicians, but interventions to support the mental health of affected people were carried out through projective allocation of mental health services in a certain area. He also promoted networking between the Institute of Medicine, Tribhuvan University (IOM-TU) and IRIDeS.

Nepal endorsed a permanent constitution on Sep. 17, 2015 after eight years of in which there was only an interim constitution, following years of conflict. The adoption of the permanent constitution, however, created a complicated political situation.

In Dec. 2015, Prof. Aiko Sakurai and the second large team visited Nepal focusing on disaster education and reconstruction. At that moment, Nepal was still facing difficulties related to logistical needs including foods, fuel and medicine due to issues related to the political situation.

These varied and multidisciplinary emergency survey teams found not only the facts that people in Nepal faced, but also the background of their resilience through natural, health and social science.

We deeply appreciate the help of counterparts in Nepal and all agencies kindly providing information and help for our missions. We are hoping that this report inspires the knowledge of scientists and the hope of people in Nepal.

3 Summary of the Nepal Earthquake

Author: Shuji Moriguchi

3.1 Main Shock

Nepal is located between the India plate and the Eurasia tectonic plate. The India plate is subducting down into the Eurasia plate with velocity of 5-6 cm/year. The April 2015 Nepal Earthquake occurred as a result of fault motion induced by the plate movement. The Mw7.8 earthquake occurred at 11:56 (NST, Nepal Standard Time) on 2015 April 25. As shown in Fig. 3.1, the epicenter (28.231°N 84.731°E) is located in the Gorkha area, about 80 km northwest of Kathmandu. Fig 3.2 shows a map of seismic intensity provided by USGS (United States Geological Survey). Ground motion propagated across a wide area, and the earthquake caused serious damages in several regions in Nepal including Kathmandu. The earthquake's epicenter and damaged area are in the central Himalaya region. The region was called a "central seismic gap", and was well known as an area with high risk of large earthquakes. Fig. 3.3 shows the positional relation of the central seismic gap and large earthquakes that have occurred since the end of the nineteenth century.

Fig. 3.1 The epicenter of the earthquake (Source: USGS, 2015a)
http://earthquake.usgs.gov/earthquakes/eventpage/us20002926#general_map

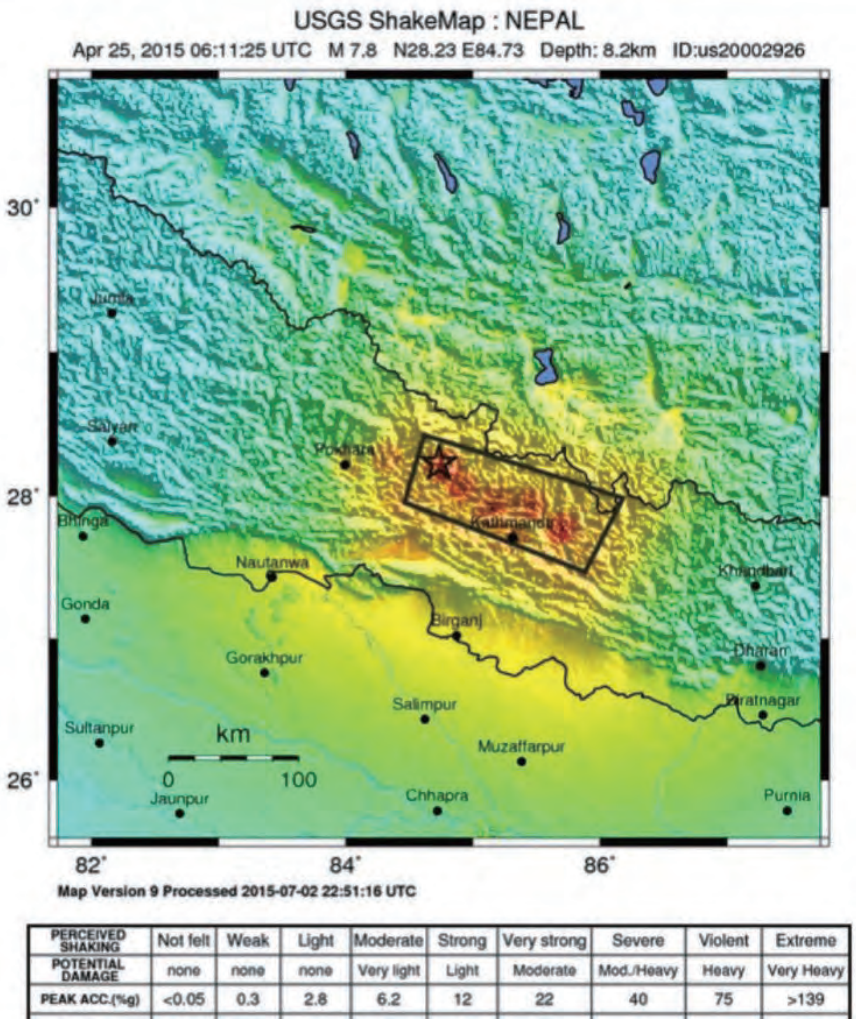

Fig. 3.2 The epicenter of the earthquake (Source: USGS, 2015b)

http://earthquake.usgs.gov/earthquakes/eventpage/us20002926#impact_shakemap

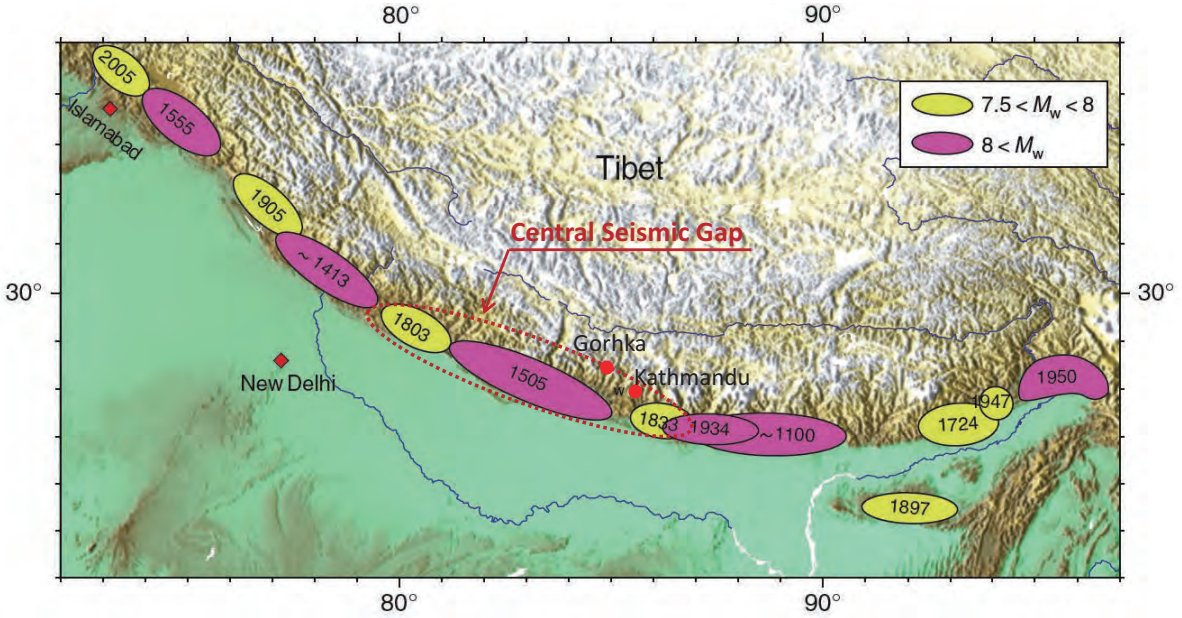

Fig. 3.3 The epicenter of the earthquake (Source: Avouac, 2007)

3.2 Aftershocks

Because information about aftershocks is important for analyzing the initial response and the reconstruction process, information is summarized in this section. Adhikari et al. (2015) reported about the aftershocks using data recorded by the Nepal seismological network. Fig. 3.4 shows a distribution map of the aftershocks. Some information about earthquakes that occurred in the past is also included in the map. There are two red stars on the map. One indicates the epicenter of the main shock and the other indicates the largest aftershock which occurred on May 12, 2015. Other aftershocks that occurred within 45 days following the main shock are shown by red dots. Yellow dots show seismic events recorded during the twenty years preceding the main shock. As shown in the map, aftershocks mainly occurred around Gorkha (epicenter) and Kathmandu. It is also understood from the map that most aftershocks occurred intensively in the area southeast of Kathmandu.

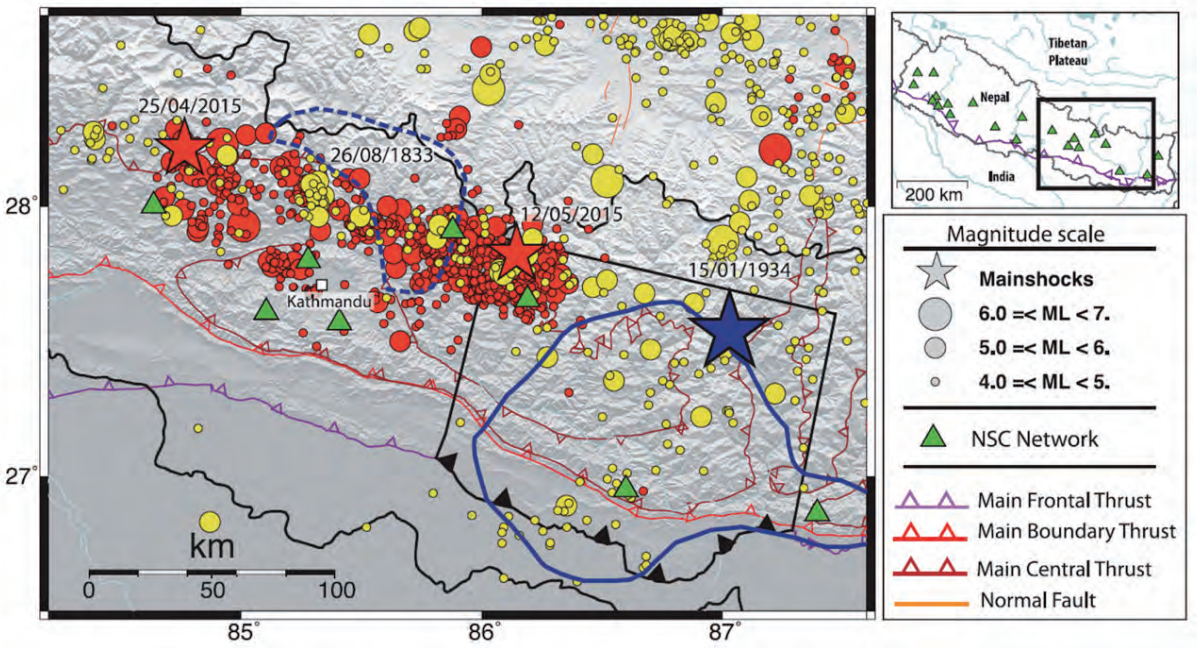

Fig. 3.4 Principal aftershocks (Source: Adhikari et al., 2015)

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USGS. (2015b). UGGS Shakemap: Nepal. http://earthquake.usgs.gov/earthquakes/eventpage/us20002926#impact_shakemap. Accessed Feb. 10, 2015.

4 Initial damage mapping by satellite images

Authors: Erick Mas, Hideomi Gokon, Bruno Adriano, Yanbing Bai, and Shunichi Koshimura

4.1 Background

On April 25, 2015, a magnitude Mw7.8 earthquake occurred in Nepal with a maximum Mercalli Intensity of IX (Violent). Within the first hours and days of such a huge disaster it is critical to gather information related to damage and casualties in the area. This information will contribute to effective resource allocation and rapid relief to remote areas. In this event, Nepal reported nearly 9,000 people killed and other countries such as India, China and Bangladesh suffered losses of approximately 130, 27 and 4 people respectively. When a disaster of this scale impacts a wide area, gathering information about damage and casualties becomes a challenge for disaster responders. In order to tackle these problems, remote sensing technologies aid the disaster response stage by analyzing aerial and satellite images that cover wide areas. Therefore, what the human eye of survey teams and first responders could miss from the ground, an overview of the area from above might identify. Moreover, using aerial and satellite imagery, the extent of the impact can be easily understood when mapping the information observed by sensors. Thus, for decades, aerial and satellite imagery has been used to assess the extent and level of damage in areas with limited access and need for support and quick emergency response (Koshimura et al., 2010, Wegscheider et al., 2013, Adriano et al., 2014, Gokon and Koshimura, 2015).

Multiple methods to handle image data and identify the building damage characteristics have been developed throughout the years. A fast and simple method, possibly one of the most accurate methods when using very-high-resolution (VHR) imagery (Wegscheider et al., 2013), is the visual and manual interpretation technique. In this, a pre-event and post-event set of optical images is acquired and analyzed focusing on the changes observed building by building and classifying these user interpreted changes within levels of expected damage. From the manual visual interpretation, damage mapping products can be obtained (Koshimura et al., 2009, Mas et al., 2015). A limitation of the optical satellite image is that cloudy weather conditions might restrict the observation of the ground. Thus, to avoid such limitation, different sensors that are not restricted by weather conditions are used. The Synthetic Aperture Radar (SAR) sensor is capable of *sensing* the ground with disregard of the clouds or rain. However, visual interpretation is difficult for the user due to the format of the image acquired, where colors and shapes of objects are not easily identified. Thus, image-processing techniques are used to evaluate the changes between pre- and post-event images of SAR origin (Adriano et al., 2014, and Gokon and Koshimura, 2015).

4.2 Objective

This section aims to share part of the mapping efforts conducted by the Laboratory of Remote Sensing and Geoinformatics for Disaster Management (ReGID) from the International Research Institute of Disaster Science (IRIDeS) of Tohoku University in the days following the Nepal Earthquake. We focused on two activities:

1. Gathering spatial information to produce thematic maps and situational reports to be used by first responders and survey teams.
2. Using available satellite imagery to assess the level of damage in multiple areas using visual manual interpretation and automatic methods of damage estimation with SAR images.

4.3 Geospatial and satellite imagery data

A major challenge for remote sensing in disaster management is the availability of satellite imagery of the post-event situation. However, several efforts regionally and globally are being promoted by different nations to address this necessity. For instance, the International Charter[1], which started in the year 2000, provides a unified system of space data acquisition for disaster relief through collaboration of different aerospace agencies in the world. Within this framework, the Japan Aerospace Exploration Agency (JAXA) has been a member since 2005. Similarly, Sentinel Asia[2] is a voluntary initiative to support disaster management activity in the Asia-Pacific region by applying the WEB-GIS technology and remote sensing technologies using earth observation satellite data. Tohoku University and IRIDeS has been a member of this initiative since 2014. Thus, in this event, the images acquired were provided through the JAXA and Sentinel Asia collaboration.

The details of the optical images used are as follows:

(1) Pre-event Image

Acquisition Date: November 13, 2014

Data Source: Google Earth

(2) Post-event Image

Acquisition Date: May 3, 2015 (Ten days after the earthquake)

Data Source: Google Earth (also provided by Google CrisisMap[3])

The details of the SAR images used are as follows:

(1) Pre-event Image

ALOS-2/PALSAR-2

Acquisition Date: February 21, 2015

Data Source: JAXA

(2) Post-event Image

ALOS-2/PALSAR-2

Acquisition Date: April 26, 2015 (One day after the earthquake)

Data Source: JAXA

In the case of geospatial data, such as basic urban information, there are some platforms available for sharing and using voluntary and official-based geo-referenced products. For instance, the Humanitarian Data Exchange (HDX)[4] project is an open platform for sharing data. From here, humanitarian data is accessible for analysis. The case of the Nepal Earthquake can be found in this link: https://data.hdx.rwlabs.org/group/nepal-earthquake.

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1 https://www.disasterscharter.org

2 https://sentinel.tksc.jaxa.jp

3 https://google.org/crisismap/2015-nepal-earthquake

4 https://data.hdx.rwlabs.org

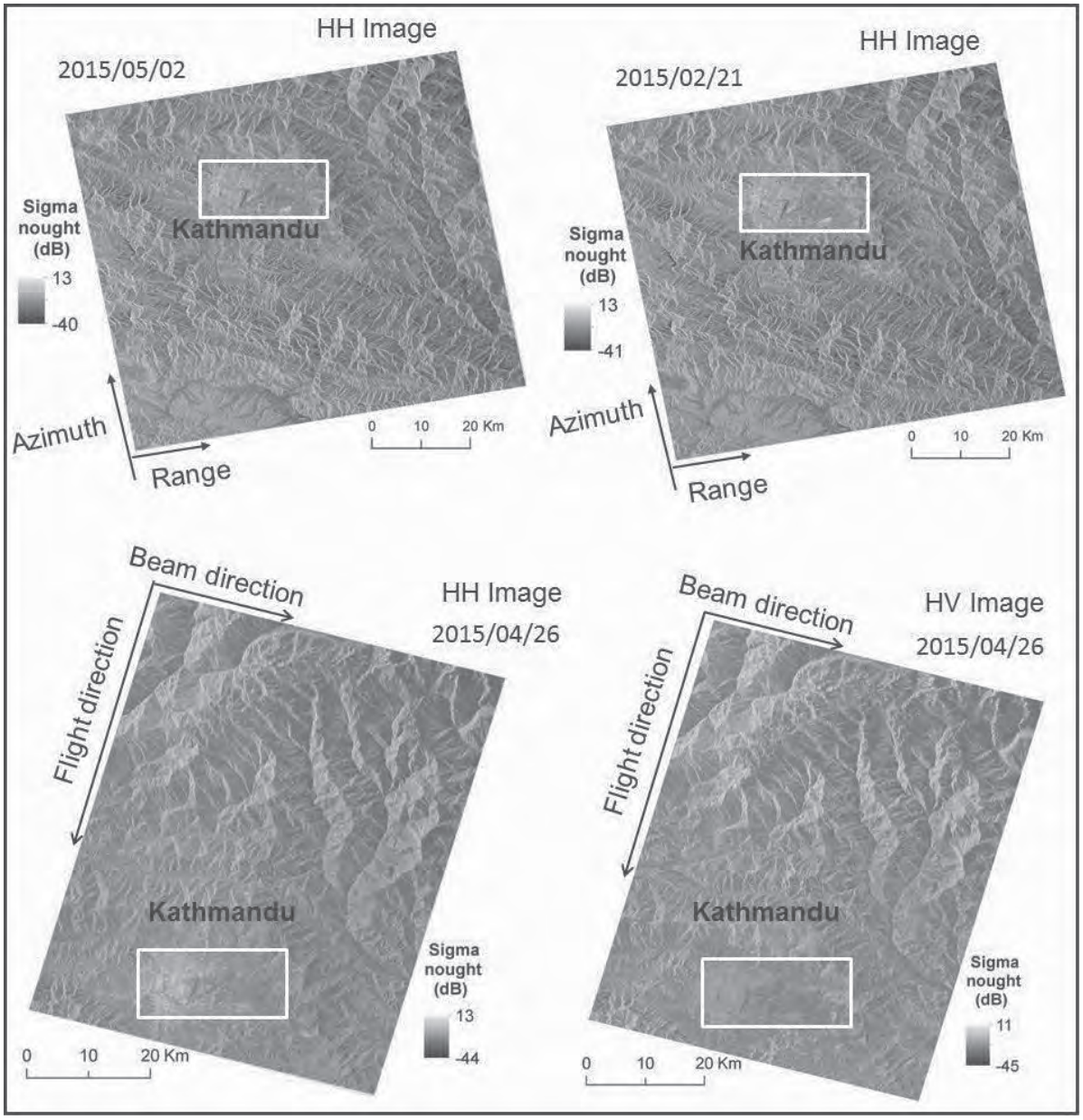

Fig. 4.1. Synthetic Aperture Radar (SAR) imagery used for damage estimation within the Kathmandu area in Nepal. HH and HV intensity images are shown for the pre- and post-event acquisitions.

4.4 Methodology

Two methods for damage assessment were applied after images were available for analysis: (1) Damage Estimation using Multitemporal ALOS-2/PALSAR-2 satellite imagery; and (2) Damage Estimation using visually interpreted optical images.

4.4.1 Damage Estimation using Multitemporal ALOS-2/PALSAR-2 satellite imagery

Due to the rapid acquisition of SAR data, in this case, first we applied methods developed at ReGID for automatic damage estimation using SAR images (Gokon et al., 2015). This method is based on the relationship between the building damage ratio and the mean value of the correlation coefficient of pre- and post-event pixel values on L-band SAR data. First, pre-processing was applied including calibration, speckle noise filtering, and co-registration. Next, change detection of pre- and post-event ALOS-2/PALSAR-2 data was conducted by calculating the correlation coefficient. Then, the built-up areas were identified by making envelopes around the building footprint data obtained from the Open Street Map through the HDX platform described above. Next, the object-oriented image processing was applied to the correlation coefficient image within the built-up areas, to estimate the local homogeneities

in terms of building damage. Finally, the damage ratio in terms of collapsed buildings was estimated by applying the damage function proposed by Gokon and Koshimura (2015), that shows the relationship of the mean values of correlation coefficient and damage probability of destroyed buildings. Here, as a first response effort, damage ratio in buildings is estimated based on changes between pre- and post-event images with respect to the intensity of radio wave pulses transmitted by the radar and bounced back by the objects in the ground. The changes on these levels of intensity are classified within a 0.0 to 1.0 numeric scale to represent non-damage (0.0 value) and high-damage (1.0 value) expectations. Finally, highly damage areas can be identified to prioritize relief actions.

4.4.2 Damage Estimation using visually interpreted optical images

Optical images were available several days after the event; thus, the manual and visual interpretation of damage could be conducted only after the first week since the earthquake had occurred. Google Earth images with medium resolution are available online and can be used as pre-event data. Post-event image acquisition depends on the timing of the satellite position with respect to the area to be acquired. Therefore, if the satellite has already passed through this area when the earthquake had occurred, then it needs to complete its cycling orbit to be able to acquire a new image under similar conditions to the previous one. This, plus other required image pre-processing and institutional permissions for publication are the basic reasons of *delays* for gathering satellite images. To conduct manual visual interpretation, first, the damage classification levels should be decided. In this case, due to the resolution available within the images, and the extensive urban area combined with the need for rapid estimation, it was decided to use only two levels of damage interpretation: (a) undamaged and (b) damaged. The criteria to identify which buildings were damaged and which were not is shown in Fig 4.2. The classifications from D-A to D-E denotes the criteria to identify and classify buildings as "damaged", while "undamaged" structures were the other structures that do not fit any of the five criteria described before. Furthermore, in the right side of the figure, a follow-up criterion to consider structures as undamaged was the U-A interpretation, where emergency relief camps or tents were identified and the areas surrounding these camps are expected to be low or undamaged to ensure safety of evacuees.

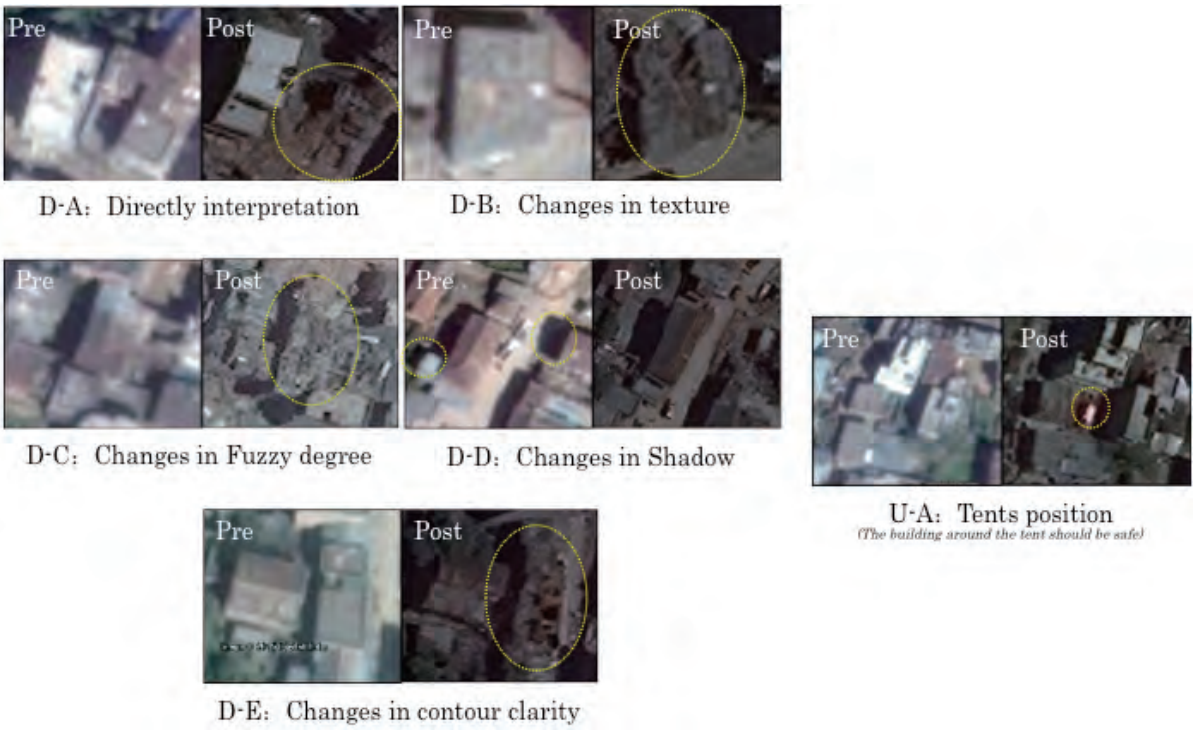

Fig. 4.2. Criteria to identify damage levels. On the left, "damaged" structures were identified by direct visual interpretation, changes in texture, fuzziness, shadow or contour. "Undamaged" structures were others that do not fit on any of the previous criteria, plus the criterion shown on the right where evacuees' tents or camps were identified and surrounding structures were assumed safe.

4.5 Results and Discussion

Results of analysis and interpretation of satellite images are shown in Fig. 4.3 and Fig. 4.4. The SAR image analysis shows areas of high damage ratio clustered to the west and southeast of the Kathmandu area. Through this method it was possible to identify high damage distribution in Nepal, but also a highly scattered behavior of damage.

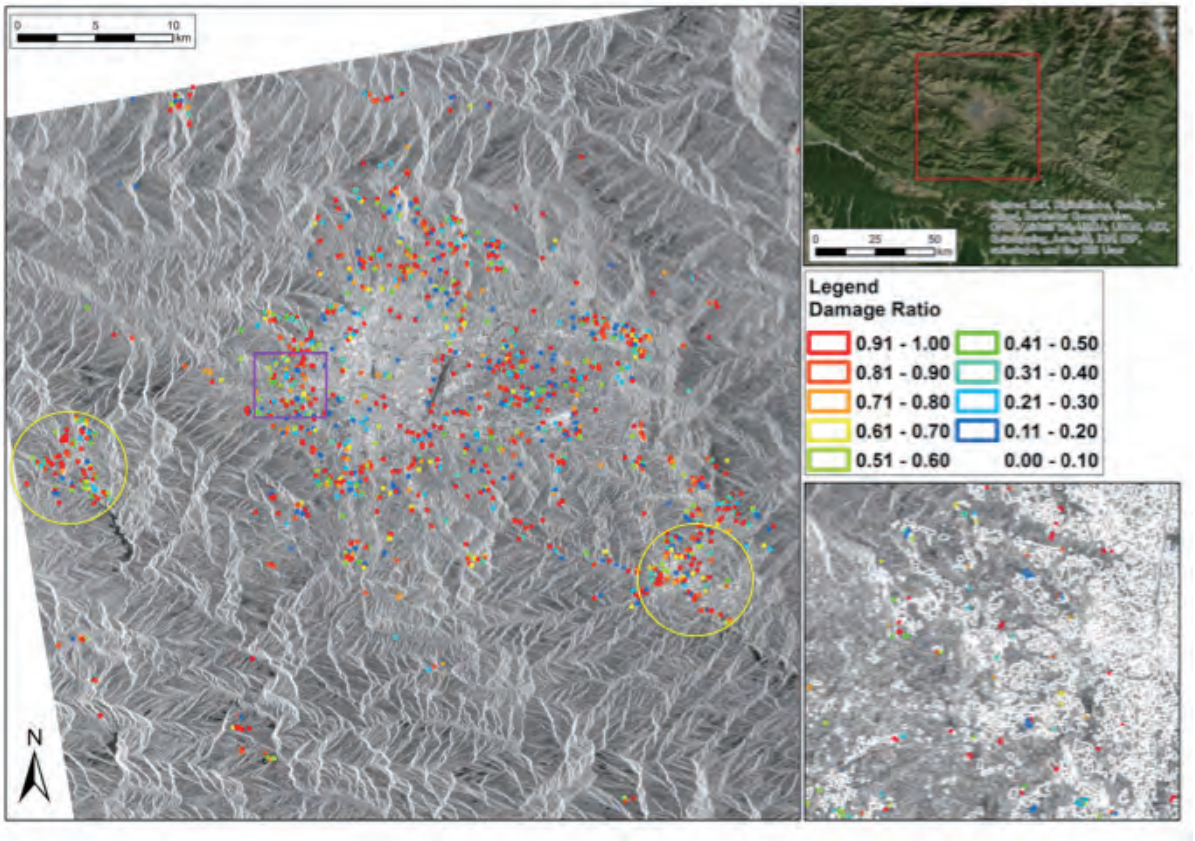

Fig. 4.3. Result of the analysis of SAR images for damage estimation. The legend shows the damage ratio level from 0.0 (undamaged) to 1.0 (damaged). The square and circle insets mark areas where damage clusters with high damage ratio are seen. These are areas where high building damage can be expected.

On the other hand, through the manual visual interpretation method, it was confirmed that approximately 68% of the total buildings observed in the area were damaged in the case of Sankhu, northeast of Kathmandu. Similar efforts of damage interpretation using high-resolution optical images conducted on following days and months may be found in the Sentinel Asia archive related to this event.

4.6 Conclusion

In the case of the April 25, 2015 Nepal Gorkha Earthquake, Synthetic Aperture Radar satellite images were rapidly available through the Sentinel Asia initiative. With SAR images, damage estimation was conducted using L-band SAR data obtained from the ALOS-2/PALSAR-2 sensor. Damage estimation processing time is very short provided all pre-processing steps have been accomplished when the image is used. Days after the event, optical images through Google Earth and Digital Globe were available and used to visually interpret the damage building by building producing damage maps useful for disaster relief and recovery.

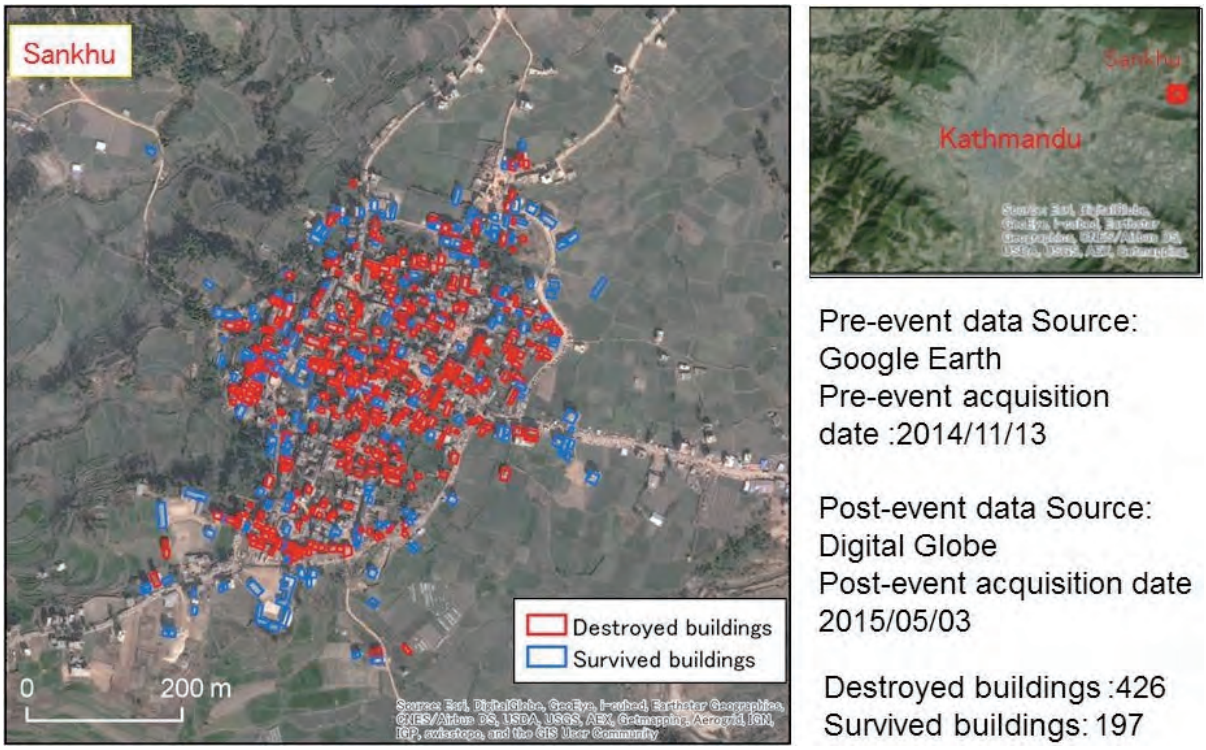

Fig. 4.4. Manual visual interpretation result within the area of Sankhu, northeast of Kathmandu in Nepal. Damaged and Undamaged classification was conducted for the whole urbanized village area. From all the identified structures in the area, 68% were classified as damaged.

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Acknowledgments and Contributors:

JAXA, Sentinel ASIA, IRIDeS-Tohoku University, ICUS-University of Tokyo

5 IRIDeS Fact-Finding mission

5.1 Structural and Water Resources Assessment

Author: Jeremy D. Bricker

5.1.1 Background and aims

Nepal's buildings and infrastructure suffered heavy damage during the 2015 earthquakes. The aim of this assessment is to determine which types of building structures and water infrastructure suffered damage, and which types survived intact. This should aid future construction decisions in this earthquake-prone country.

5.1.2 Methods

Assessment of structures and water infrastructure was conducted by both on-site field visits and meetings with government, academic, NGO, and international aid organization personnel who are familiar with the issues.

5.1.3 Structures

The effect of the earthquakes on buildings in Nepal was investigated by meeting the following experts:

- Dr. Nagendra Raj Sitoula and Dr. Basanta Raj Adhikari, Tribhuvan University, Institute of Engineering, Disaster Research Center
- Dr. Prem Neth Maskey, Professor at Tribhuvan University, Institute of Engineering, Department of Civil Engineering
- Jeevan Shrestha, volunteer guide in the town of Sankhu
- Vijaya P. Singh, UNDP
- Hiroyasu Tonokawa and Yukio Tanaka, JICA

Building construction in the Kathmandu Valley has long been dominated by brick masonry. The reason for this is Kathmandu's location on an old lakebed, giving it a predominance of clay, the major material used in production of bricks. Most of the older structures in the Kathmandu Valley and its surroundings consist of fired-brick construction, while some older buildings also incorporate adobe bricks (Fig. 5.1.1). Further afield in the hills and mountains, where stone is readily available, random rubble (uncut stone) masonry buildings are common (Fig. 5.1.2). Some brick and stone buildings have been renovated with wooden frames for increased strength. Throughout the country, newer buildings make use of reinforced concrete or steel load-bearing frames in combination with brick shear walls (Figs. 5.1.3, 5.1.4, and 5.1.5), as required by the building code.

A cultural preference for 1st floor shops contributes to buildings' weakness against seismic motion, as these 1st floor shops are often soft stories, with little shear resistance. Another cultural preference is for increasing floor plan area for upper stories, leading to building asymmetry, another cause of weakness during quakes (Fig. 5.1.6).

Due to the lack of a licensing system in construction, anyone may build a house in Nepal. This makes enforcement of building codes difficult. In order to spread the knowledge of earthquake-resistant house construction techniques, JICA is conducting an education program to increase local knowledge about safe building methods while incorporating local materials (Fig. 5.1.7).

Earthquake retrofit programs have been in place for many years now, and slowly progress per the availability of funds and willpower. Fig. 5.1.8 shows the old building of Patan Hospital in Kathmandu, which had not yet undergone a seismic retrofit. The new building, which had been retrofit, did not see heavy damage. Another challenge to building retrofitting is the desire to preserve historic structures. Fig. 5.1.9 shows the original building of Tribhuven University's Pulchowk Campus. This building has an

all-brick construction, and is now too dangerous to utilize. The university is currently searching for a way to retrofit it, but has minimal resources with which to finance the project.

As retrofitting is often too expensive to undertake, simple maintenance together with periodic replacement of worn structural components can strengthen buildings against earthquakes. Many of the structures which collapsed during the quakes had not been renovated since the 1934 earthquake or earlier, leading to gradual weakening of the bricks from which they were built and gradual rotting of wooden support frames. Some old buildings had not even been rebuilt to replace old mud mortar with modern cement mortar. Old buildings also experience rotting of timber beams used to support upper floors and roofs, as these beams also rot with time. Some buildings had been renovated to replace wooden floor diaphragms and roofs with reinforced concrete diaphragms, as these are stronger than wooden diaphragms. However, Fig. 5.1.10 shows a temple with a reinforced concrete roof but all-brick columns that collapsed. One example of an all-brick building which survived the quake after renovation without retrofit is the 55 Window Palace and Pagoda in Bhaktapur Durbar Square. Another type of renovation which would strengthen buildings in the countryside is replacement of random rubble walls with square-cut stone masonry, as the friction between properly cut stones provides much more resistance to seismic motion than random rubble (Fig. 5.1.2) does. Replacement of brick masonry with concrete masonry would also strengthen structures, even in lieu of proper rebar reinforcement.

Immediately after the quake, one of the biggest problems was that people were afraid their buildings were damaged badly and would soon collapse, and so took refuge outdoors in public areas. This could have lead to a public health crisis, so it was imperative to inspect buildings quickly, to reassure the majority of the populace that their buildings were still safe to inhabit. To do this, Tribhuvan University Institute of Engineers, UNDP, and the Nepal Engineers' Association mobilized and trained practicing engineers and students for inspection of homes in the weeks after the quake.

Fig. 5.1.1. Sankhu town. Older homes were built of both fired bricks and adobe bricks. Adobe was the most poorly performing building material during the quakes.

Fig. 5.1.2. Sankhu town. Random rubble masonry was also present, and very weak.

Fig. 5.1.3. House with RC frame and brick shear walls under construction next to Patan Hospital.

Fig. 5.1.4. Sankhu town. In general, homes of all-brick construction collapsed, but most buildings of RC frame with brick shear wall construction survived.

Fig. 5.1.5. Sankhu town. An RC frame building with brick shear walls in the background. In the foreground, an all-brick building had been attached to the RC building's face, but the all-brick building collapsed in the quake. There were many examples of this situation in Sankhu.

Fig. 5.1.6. Sankhu town. Example of typical soft story and asymmetric construction.

Fig. 5.1.7. JICA demonstration project at Tribhuvan University, Institute of Engineering, showing RC frame construction with brick shear walls. Posters explain the construction techniques.

Fig. 5.1.8. Patan hospital old building with damage to brick walls. Concrete masonry frame intact. This building will be repaired and retrofit. The new RC frame hospital building next door was not damaged.

Fig. 5.1.9. Historic brick masonry building at Tribhuvan University, Pulchowk Campus. Damaged by quake and now closed, but faculty are searching for an affordable way to repair and retrofit.

Fig. 5.1.10. Sankhu town. Temple with RC roof slab but brick columns. Columns collapsed.

5.1.4 Water supply and wastewater

The state of water supply and wastewater in Nepal, as well as the effect of the earthquakes on this infrastructure, was investigated by meeting the following experts:

- Yogendra Chitrakar, engineer at the Guheshwori Wastewater Treatment Plant
- Dr. Nagendra Raj Sitoula and Dr. Basanta Raj Adhikari, Tribhuvan University, Institute of Engineering, Disaster Research Center
- Dr. Prem Neth Maskey, Professor at Tribhuvan University, Institute of Engineering, Department of Civil Engineering
- Jeevan Shrestha, volunteer guide in the town of Sankhu
- Vijaya P. Singh, UNDP
- Hiroyasu Tonokawa and Yukio Tanaka, JICA

5.1.4.1 Water supply

The Kathmandu Valley Water Supply Company (KUKL) is a government-owned company responsible for supplying water to the distribution system in the valley. The distribution system was built in the 1930s and 1940s, funded by the UK during the Raja system in Nepal. Almost all proper buildings in the valley are connected to the system. Water sources for the system are natural springs in the hills surrounding the valley and groundwater wells from the deep (uncontaminated) aquifer. Before entering the system, water is pretreated with sedimentation/flocculation, sand filtration, and chlorination. It is drinkable at this time, but becomes contaminated within the distribution system due to Inflow and Infiltration (I&I) of wastewater and rainfall runoff. Water supply and wastewater pipes run very near each other and are very old and leaky. The water supply system suffers from intermittency in pressure and volume, allowing I&I to occur unchecked. Most private wells are from the shallow aquifer, which, due to contamination with wastewater, has a high concentration of ammonia, as well as naturally occurring iron. Some wells are deep, and are contaminated with iron only. Due to the intermittency of the water supply, about 30% of water used in the valley comes from private wells. An example of a private well user is Patan Hospital, which treats its water after extraction (Fig. 5.1.11).

In order to improve both water supply quality and quantity in the Kathmandu Valley, the Melamchi water tunnel is under construction, funded by the Asian Development Bank (ADB). However, this still won't meet the city's water demand, because it was designed 20 years ago based on population growth estimates at the time. In the 2000s, population increased dramatically due to an influx of people from the countryside fleeing the fighting between the old government and the communist rebels. Therefore, the city will need to further develop its water supply infrastructure. In addition to the water tunnel, the project entails replacing the water distribution system (and wastewater collection system) with new pipes, to reduce I&I.

Just outside the Kathmandu Valley, in the hill town of Sankhu, water supply comes from multiple shallow wells throughout the town (Fig. 5.1.12 and Fig. 5.1.13). Townspeople claim this water is safe to drink without boiling or filtering, but this claim appears to be in doubt, leading at least one NGO to set up a filtration system for one well (Fig. 5.1.14).

The earthquakes did not cause catastrophic damage to the water supply system in either Kathmandu or Sankhu, but rather further stressed an already old and insufficient system. Fig. 5.1.15 shows makeshift repairs to a water pipe left leaky after the quake, while Fig. 5.1.16 shows a break in a water supply pipe (soon to be repaired). Despite the scattered damage due to the quakes, cholera, which is seen each year during the monsoon season, did not appear this year. This is attributed to heightened awareness amongst the people to boil and/or disinfect their water in the wake of the quakes.

Fig. 5.1.11. Water filter and water tanks on the top level of Patan Hospital. Patan Hospital uses an on-site well for drinking water. Treated chemically. Government water also is treated on site. Two different water systems: drinking water and grey water. Engineers monitor water quality.

Fig. 5.1.12. Sankhu town. Water supply is from wells. People typically don't boil or filter before drinking.

Fig. 5.1.13. One of the wells in Sankhu town.

Fig. 5.1.14. Sankhu town. Filter installed by NGO beside well.

Fig. 5.1.15. Sankhu town. Leaking water supply pipe taped up with pipe wrap.

Fig. 5.1.16. Sankhu town. Ruptured water supply pipe beside wastewater pipe or septic tank

5.1.4.2 Wastewater

As with the water supply distribution system, the wastewater collection (sewer) system in Kathmandu was built during the 1930s-1940s. Almost all the proper buildings in Kathmandu are connected to the collection system, helping to reduce the spread of disease that comes along with open field defecation, cesspools, and open channel sewers. However, lack of sufficient wastewater treatment facilities means that most of these sewers discharge directly into the Bagmati River and its tributaries. This presents a health risk for river users downstream. Contamination of river water as well as exfiltration of raw wastewater from the leaky old sewer system are also responsible for contaminating the valley's shallow aquifer with ammonia, posing a health risk to those who use shallow wells for drinking water.

Only 1 operating wastewater treatment plant (WWTP) exists in Nepal. This is the Guheshwori WWTP (Fig. 5.1.17) on the Bagmati River, near the airport in the northern part of the valley. It was built in 2002 by the central government, and is operated and maintained by the central government. The treatment train consists of grit removal, primary clarification, aeration for sludge, and secondary clarification. There is no disinfection. After secondary clarification, the effluent enters a tunnel about 1km long under the nearby temple, then discharges to the Bagmati River downstream of the temple. The effluent tunnel is important because at the temple site, the river is used for traditional bathing and prayers. Water quality is sampled at the WWTP influent, aeration flume, and effluent stages, and is usually worse than the upstream river water quality. Sludge from the clarifiers is dried in the sun on site, and then hauled away by farmers.

Due to the quakes, the WWTP's aeration flume sustained damage to its partition walls (Fig. 5.1.18). This reduced the residence time in the flume slightly, and caused minimal short circuiting of the flume, but has had only minimal effect on effluent water quality. Minor damage was also sustained by the secondary clarifier, but this was repaired 2 to 3 days after the quake. The quake did not cause power loss or interruption of service, but the quake has spurred WWTP staff to consider the purchase of a backup generator, and also the creation of an emergency plan in case of disaster.

Though the Guheshwori WWTP allows effective treatment of a small portion of the city's wastewater, it lacks the capacity to treat all the wastewater in the Kathmandu Valley. The Asian Development Bank (ADB) is planning to fund construction of an expanded plant on the same site, in order to handle a larger flowrate with a modern treatment train including disinfection. ADB is also planning to fund similar modern WWTP's at other sites on the Bagmati River downstream. Together with the Melamchi Water supply project, the ADB is planning to fund renovation of the valley's sewer collection system as well.

In addition to the Guheshwori WWTP, there used to be 4 other operating WWTP's as well, but all have ceased operation. The construction of one of these WWTP's, at Bhaktapur, was funded by West Germany in the 1970s. Construction was coordinated by the central government Dept. of Urban Development and Construction. After construction, O&M as well as funding responsibility was to be handed over to the municipality, but this caused confusion. Operation ceased after the handover. At another WWTP (Bhaktow), a pump failed after the handover, but the municipality didn't have the resources to repair or replace it, so operation ceased. In all cases, population growth caused the volume of wastewater influent to each plant to grow far past the WWTP design volume; this was another reason for the shutdown of the older plants.

Outside Kathmandu Valley, in the town of Sankhu, sewers connect homes to large, communal septic tanks. Settled solids from these tanks are emptied periodically by collection trucks.

Fig. 5.1.17. Panorama view of Guheshwori Wastewater Treatment Plant. From right to left: primary clarifier, secondary clarifier, aeration flume for activated sludge.

Fig. 5.1.18. Guheshwori Wastewater Treatment Plant. Earthquake damage to partition walls in the aerated activated sludge flume.

5.1.5 Flood hazard

The flood hazard in Nepal was investigated by meeting the following experts:

- Dr. Prem Neth Maskey, Professor at Tribhuvan University, Institute of Engineering, Department of Civil Engineering
- Vijaya P. Singh, UNDP

Floods are a common hazard throughout Nepal, due to:

1. Intense rainfall over very steep watersheds (most common);
3. Landslide-induced-dam breaks; and
4. Glacial lake outburst floods (GLOFs).

Due to the lack of river training anywhere in the country, these floods often cause disasters. Some glacial dams were weakened by the recent earthquakes, but not enough to be at risk of bursting and causing GLOFs. In the mountains and hilly regions of Nepal, these floods often strike as flash floods, while in the Terai they occur more slowly and last longer.

Some river banks in Nepal are strengthened with gabions (for scour protection) and spur dikes (to direct flow away from the banks and into the center of the river). Watershed management is also being considered for flood protection. Dams are not used for flood prevention because the sediment load from Nepal's young, erodible mountains is very large, so dams would silt up quickly. Nepalis also doubt the stability of dams. In 2008, a dam upstream of the Kosi River in India burst, letting loose a flood that destroyed 4 villages and a highway downstream in Nepal. Floods and landslides occur every year in Nepal and are perceived as the biggest threat by the public. Flood early warning systems exist on 4 rivers. These are based on upstream water level gauges. Warnings are broadcast on TV and radio, and sometimes to officials' cellphones. The Ministry of Home Affairs, Dept. of Hydrology and Meteorology website lists alerts as well. Chho Rolpa has a community based early warning system for GLOFs.

In Sindhupalchok, a landslide occurred long before the quake due to heavy rains. This backed the Kosi River up into a lake, and the dam burst, washing away this region's road to China. Similar floods frequently occur in Dolokar. Another similar flash flood occurred in 2012 near Anapurna upstream of the city of Pokhara in Western Nepal, and resulted in 72 deaths (BBC, 2015a, and Shrestha, A.B. et al, 2015). This event caused confusion because it occurred at a time of little rainfall (BBC, 2015b). Using satellite remote sensing and field studies, scientists now think this flash flood was caused when a series of landslides in the Seti Gandaki River Gorge dammed the river, followed by a rockfall and avalanche from the high reaches of Annapurna IV. After accelerating over thousands of vertical meters, the rockfall and avalanche slammed into the previously formed landslide dam with such force that it burst apart, letting loose the lake backed up behind it (NASA Earth Observatory, 2012, NASA Earth Observatory, 2014).

Due to the earthquake itself, landslides in Doplejung (northeastern Nepal), Barpok (western Nepal), Pokhara, and Myagdi (western Nepal) had similar consequences. The landslide dam formation in Myagdi (Fig. 5.1.19, *Kathmandu Post*, 2015a) and subsequent overtopping about 10 km upstream of Beni Bazaar in Myagdi on the Kali Gandaki River was carefully observed, so people were evacuated before the landslide dam burst (Fig. 5.1.20, Sharma, B. and Harrismay, G., 2015, and *Kathmandu Post*, 2015b). The Chinese have cleared landslides blocking their own roads in Langtang and Dutupani (the Kodani Highway). The Chinese have a stake in this region for hydropower development.

Fig. 5.1.19 Aerial photo of Myagdi landslide and lake.

Fig. 5.1.20 Maximum flood at Beni Bridge as seen in video at: https://www.youtube.com/watch?v=fRJFyGZtfeI.

Inside Kathmandu, urban flooding is often caused by clogged storm drains suffering from lack of maintenance. People think the central government Dept. of Roads should maintain the drains, but roads are the responsibility of the municipality. Most open drains are large enough to handle flow from heavy rains, but need to be cleaned so they don't clog. In addition, slums have taken root on river floodplains because of mass immigration to Kathmandu and the high land prices in the city. If this continues, it may reduce the capacity of the rivers to carry floodwaters and exacerbate flooding of the city itself.

5.1.6 Conclusions

Damage to structures near Kathmandu was largely reported to be due to lack of maintenance and seismic reinforcement. Despite a lack of funds, natural resources, and construction equipment, the region is slowly adopting modern building methods. The use of reinforced concrete gravity bearing frames with brick shear walls holds promise to reduce the damage incurred by the next event, as long as regular maintenance and inspections are carried out. Seismic strengthening must be applied to historic religious structures such as temples, as well as to homes, hospitals, and other building structures. The lack of elevated transportation infrastructure or tunnels prevented damage of the sort seen during earthquakes in developed countries, but seismic provisions for this infrastructure must be incorporated into design plans as the country develops.

Water supply and wastewater infrastructure in Kathmandu and surrounds was not severely affected by the earthquake, in part because these systems were already insufficient. Infiltration and inflow (I&I) into the water supply distribution system prevented it from being used as a safe drinking water source even before the earthquake. The wastewater collection system is leaky, exacerbating the water supply distribution system's I&I problem. The one wastewater treatment plant in operation experienced only little damage from the earthquake, but treats wastewater collected from only one region of the capital city, and cannot handle even the volume of wastewater generated by this region, leading to most of the city's collected wastewater being discharged without treatment. As the country develops and water/wastewater systems are build and modernized, they should take into account seismic design standards.

Flash floods related to landslides caused by the quake caused damage but no casualties, thanks to evacuation warnings issued by local authorities. As the country develops, river training and flood control structures might be considered, as could automated warning systems for flash floods. Warning systems would be useful if a landslide and flood occurred at night, for example.

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5.2 Nepal disaster logistics: multi-dimensional challenges

Author: Rubel Das

5.2.1 Background and aims

The 2015 Nepal Earthquake claimed 8844 lives; 18,808 people were injured. The Government of Nepal was unprepared for such intense and widespread damage. It requested help from the international community. Numerous non-government organizations (NGOs) and several countries responded in the aftermath of the earthquake. The World Food Program (WFP) estimated that 2.8 million people needed immediate food support (WFP report). These people needed daily food for survival as well as safe drinking water to avoid water-borne diseases. A huge amount of disaster relief came suddenly to Nepal. However, disaster recovery is strongly dependent on effective and efficient distribution of available relief. Nepal faced difficulties in relief distribution because of its mountainous landscape, poor infrastructural development, and other relevant limitations including lack of coordination. Moreover, Nepal is a landlocked country, which poses additional difficulties for aid distribution efforts. **This study was conducted to assess the disaster logistical properties and to identify bottlenecks.**

5.2.2 Methodology

After the 2015 Nepal earthquake, multi-dimensional hazards struck Nepal included damaged houses, historical structures, communication networks, death, and injury. Of seventy five districts of Nepal, fourteen were affected. In some areas, all homes were destroyed. According to aUSAID (2015) report, a total of 773,174 houses were reported as affected. These affected houses were classified into two groups: destroyed and partly damaged. Those destroyed were 501,783 houses. The remaining 271,391 were declared partly damaged. Several institutions including Tribhuvan University and Nepali government organizations initially assessed the degree of house damage. Buildings (particularly hospitals) that had not collapsed were classified into three groups: red, yellow, and green. People in red-marked buildings were advised to evacuate as soon as possible, yellow-marked buildings were deemed useful after reinforcement. Green marked buildings remained useful without any reconstruction work. Below briefly shows methodology for assessing disaster logistics:

- Visiting Kathmandu Durbar Square
- Visiting Institute of Disaster Science, Tribhuvan University
- Interview with Mr. Edmondo Perrone, World Food Program; visiting humanitarian staging area
- Interview with Prof. Surya Raj Acharya, Tribhuvan University
- Visiting Sankhu

Below, numbers show some locations that were visited. This Fig. 5.2.1 is shown to present the coverage area of the survey, not for emphasizing special locations.

5.2.3 Preliminary description of Nepal

Nepal, a land-locked country surrounded by India and China, has a total area of 147,181 square km. The southern part of the country is a flat river plain of the Ganges. The northern part is the rugged Himalayas. The tallest mountain, Everest, is situated on the Nepal–China border. The third tallest mountain, Kanchenjunga, is on the Nepal–India border. The central part of the country is hilly.

The total population of Nepal is 27.8 million (2013 Census), among whom 81.2 percent of the residents follow the Hindu religion. Of the population, 1.142 million (2014) people live in Kathmandu, the capital city. Nepal is home to multiple ethnicities and languages; 125 caste/ethnic groups were identified in the 2011 Census. One-quarter of Nepal's population lives below the poverty line. The Nepali economy depends largely on remittances, which amount to as much as 20–22 percent of the gross domestic

product (GDP). Additional challenges to Nepal's growth include the lack of political consensus. Recently, political parties agreed to pass a permanent national constitution. Many people believe that the earthquake in 2015 might be a stimulus for agreement of all political parties to unite in support of the national constitution.

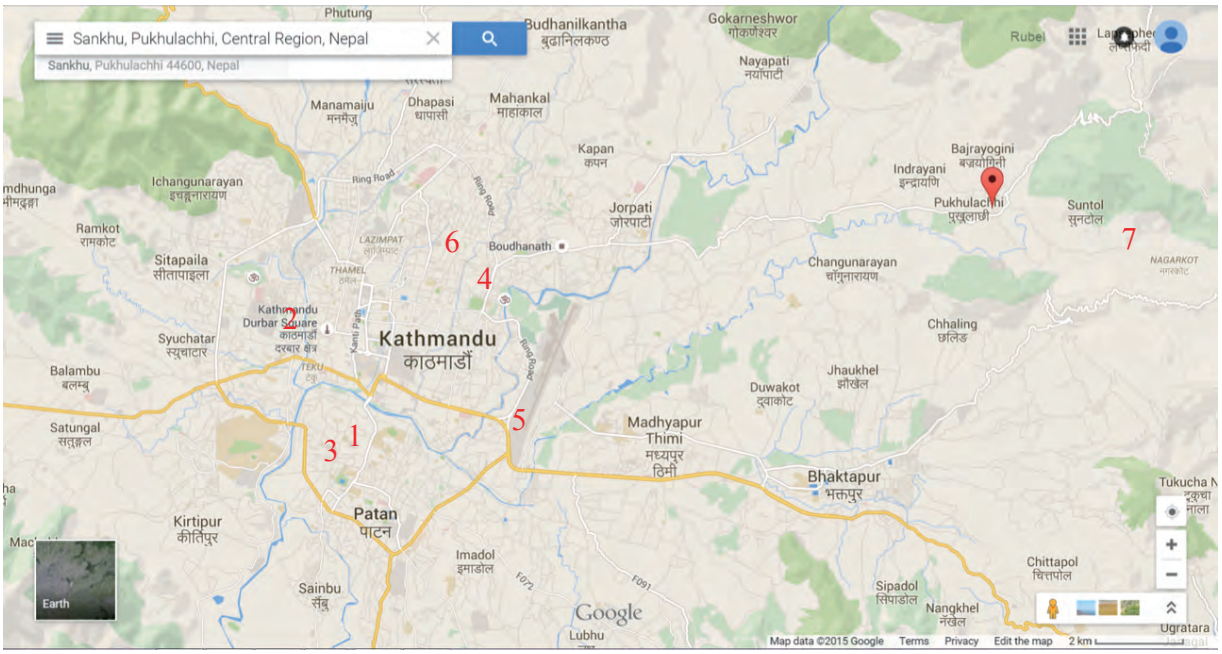

Fig. 5.2.1. Locations of some places visited (source: Google maps edited by author). 1. Hotel Himalaya (base of the team); 2. Kathmandu Durbar Square, which was damaged; 3. JICA office, Nepal; 4. Guheswori waste water treatment plant; 5. Humanitarian staging area; 6. Japan Embassy, Nepal; 7. Sankhu (* number position is approximate)

Fig. 5.2.2. Nepal map (14 Districts within the red border were strongly affected). Source: Google maps edited by author.

Nepal is divided into 14 zones as shown in Fig. 5.2.2. These zones are sub-divided in all 75 districts. Of those, 14 districts were highly affected by the earthquake of April 25, 2015.

5.2.4 Relief activities

The World Food Programme (WFP), the largest aid distributor in the world, leads the Logistics Cluster. They provide three basic services: logistics coordination; information management (mapping and GIS); and common logistics services (air, road, sea transport, and storage). The Logistics Cluster uses all

transport modes including road, rail, and river transport for accessing areas that require relief support. They also engage helicopters to deliver goods to inaccessible areas. Sometimes they hire locally engaged porters or pack animals. In addition, WFP works with the UN-Humanitarian Air Service (UN-HAS). They assist with the movement of health workers, NGO and UN agency staff, donors, diplomatic community, government partners, and media. Actually, UN-HAS also delivers light cargo.

Table 5.2.1 provides a summary of Logistics Cluster activities conducted through July 10. The Logistics Cluster (Log-cluster) delivered 11,297 MT of cargo to different affected areas. Fig. 5.2.3 presents the composition of delivered cargo. It shows that 60% of the cargo delivered was related to shelter. Because of the widespread destruction of houses, affected residents required shelter for each family. As a result, 4 out of every 5 affected people can sleep in a shelter. Fig. 5.2.6 portrays the shelter interior. **According to an affected resident, aid organizations provide only a tent (shelter). The recipient must manage to obtain a bed (and other goods) from a different source.**

Table 5.2.1: Nepal earthquake response, Logistics Cluster

Handled cargo	11,297 MT
Number of destinations covered	118
Total number of organizations served	121
Number of organizations served by air	101
Storage capacity	9640 m^2
Unique system in Nepal	Porters and pack animals

(Source: Log-cluster).

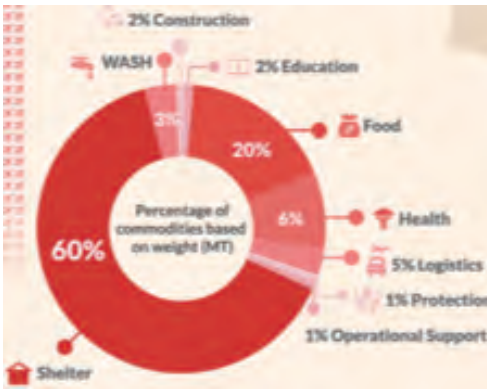

Fig. 5.2.3. Percentage of commodities based on weight (MT) are transported by WFP (source: Log-cluster).

Fig. 5.2.4. Storage locations in Nepal (source Log-Cluster).

Fig. 5.2.5 shows that a number of people still lived in tents in July 2015 in the CBD of Kathmandu (Thammel). According to one observer, people go out to earn money every morning and return to tents for sleeping only. The observer also added that there were more tents immediately after the earthquake. Gradually the number of tents is decreasing.

Fig. 5.2.5. Shelter in Thammel, Kathmandu (July 28, 2015) (photo: author).

Fig. 5.2.6. Inside of a shelter in Sankhu (July 29, 2015) (photo: author).

5.2.5 Facts in disaster response

I have interviewed different organizations. This section presents a perspective on each organization

5.2.5.1 NGO's perspective (Interview of World Vision International) on post-disaster response

According to the Association of International NGOs (AIN), 87 international NGOs were in the field after the earthquake. World Vision (WV) international is one NGO which stands beside affected residents from the beginning of relief operations. Actually, WV prioritizes their activities in the following areas: clean water and sanitation; food; shelter; and protection and care for children. A semi-structured interview with Mr. Surendra Babu Dhakal, Humanitarian Emergency Affairs Manager of WV revealed the following important points.

5.2.5.1.1 Local procurement vs. global procurement

Academicians invariably suggest local procurement of relief items. The motivation behind such suggestions is two-fold. First, local people are familiar with the goods received and are accustomed to using local products. Second, local procurement assists in the recovery of local businesses. However, relief organizations face difficulties related to local procurement. Problems include limited availability of required products and large variation, particularly of quality, of the same products. The affected residents complained about the variation in quality, which produced some dissatisfaction among affected residents. If an affected resident receives higher-quality relief products, another affected resident was unhappy after receiving low-quality relief items. Sometimes affected residents refused to receive relief products because of the product variation. It is therefore important to consider similar product quality for delivering relief. Actually, WV conducted local procurement for the initial two weeks. Thereafter, products were managed by the central office of WV (France). The Nepali government allowed entry of relief items without taxes for the initial 2 months. Therefore, WV adjusted their strategies of relief procurement for the changed environment.

5.2.5.1.2 Government attempts to smooth the flow of relief items

The Government of Nepal applied strong command and control rules to all sectors of humanitarian assistance. According to WV, the strong command and control of the Government of Nepal was helpful for relief activities. The government encouraged residents to leave Kathmandu and return to their own village/city to take care of neighbors. This step reduced congestion in Kathmandu, which allowed smooth relief flow.

5.2.5.1.3 Affected residents' selection and cooperation with local government organizations

Strong local government is necessary for resident identification and relief distribution. In the initial stage, WV targeted 100,000 people in seven districts to receive relief. The target residents were selected with

close cooperation with local organizations. First, WV collected lists of affected residents from local organizations. Thereafter, WV short-listed potential beneficiaries. Then WV staff went to meet and to check the condition of potential beneficiaries. If all criteria of WV were satisfied, then WV dispersed relief items to the beneficiary. A hygiene kit distributed by WV includes 20 different items. It is noteworthy that WV later increased target beneficiaries to 150,000 people (WV website, July 28, 2015)

5.2.5.1.4 Product donation vs. cash donation

Donors were requested to provide cash donations because product donations increase logistical costs. If an NGO receives cash from donors, then they can buy appropriate relief items. Those NGOs can then provide relief items to affected residents. Some NGOs also provide cash to affected residents for their quick recovery. According to WV, product donations to affected residents are better than cash donations. Relief item donations help keep track of and identify beneficiaries. Because cash or relief items are given to residents free of cost, cash donations have a high probability of duplication of relief. Therefore, some affected residents will get more than other affected residents. These situations might create social unrest.

5.2.5.1.5 Poor becomes poorer

Some areas in Nepal were inaccessible even before the earthquake. It might be readily apparent that people in those areas might produce their own food and might survive without external help because no damage occurred in their communities. It becomes too expensive for NGOs to access those areas. Therefore some observers suggest exclusion of those areas from a beneficiary list. However, those areas should not be excluded. People in those areas usually stock food for long periods and invest a large share of their income into stored food items. Because the earthquake damaged their houses and stocks of food, it is necessary to deliver relief items to those people. No reason exists to exclude those inaccessible areas in the logic of logistics costs.

5.2.5.1.6 Changing warehouse location

Generally, academicians assume that warehouse locations are fixed and that they cannot be changed until the end of relief operations. Several reasons underlie such assumptions. The most important reason is cost. Changing the warehouse location incurs cost and difficulty for designing efficient transport operations. However in reality, NGOs change their warehouse locations for several reasons. One reason is safety. If an NGO keeps a product in a warehouse for a long period, then some probability exists that local people might come and might fight for relief items. Because post-disaster circumstances are difficult to control, WV has changed their warehouse locations several times.

5.2.5.2 Logistics coordinator's perspective on relief distribution experience

"We are a simple truck company." Edmondo Perrone, coordinator of the Log-cluster, started discussions by describing themselves as a truck company. Then, the semi-structured discussion with Mr. Perrone revealed details about activities, strategies, and difficulties.

The Log-cluster provides free-of-cost transport service for distributing relief items. NGOs must submit a service request form (SRF) to receive free-of-cost transport service. The Log-cluster uses several transport modes. Trucks are the most common transport mode for delivering relief. The Log-cluster engages 10 trucks of 6–10 MT to deliver relief from Kathmandu to district logistical hubs. If no access road exists in the last mile relief distribution, then the log-cluster uses porter and pack animal systems. A structure of humanitarian logistics is presented in Fig. 5.2.10. Several staging areas are established in different locations. Fig. 5.3.9 shows the capacity and location of staging areas in Nepal.

Fig. 5.2.7. IRIDeS team with Mr. Edmondo Perrone (second from left).

Fig. 5.2.8. Different size forklifts are used for product handling in HSA (on July 29, 2015).

Mr. Perrone arranged a visit to the Humanitarian Staging Area (HSA), Kathmandu. Ms. Richie accompanied us during the site visit. The HSA, Kathmandu was established (in March, 2015) one month before the earthquake. Therefore, the Log-cluster was able to receive donations immediately after the earthquake. HSA Kathmandu was equipped with tents, forklifts, and other equipment. With all these preparations, HSA helped to reduce congestion at the only international airport (Tribhuvan Airport) in Nepal. Because donations were enormous, the HSA faced limitations of labor and space initially.

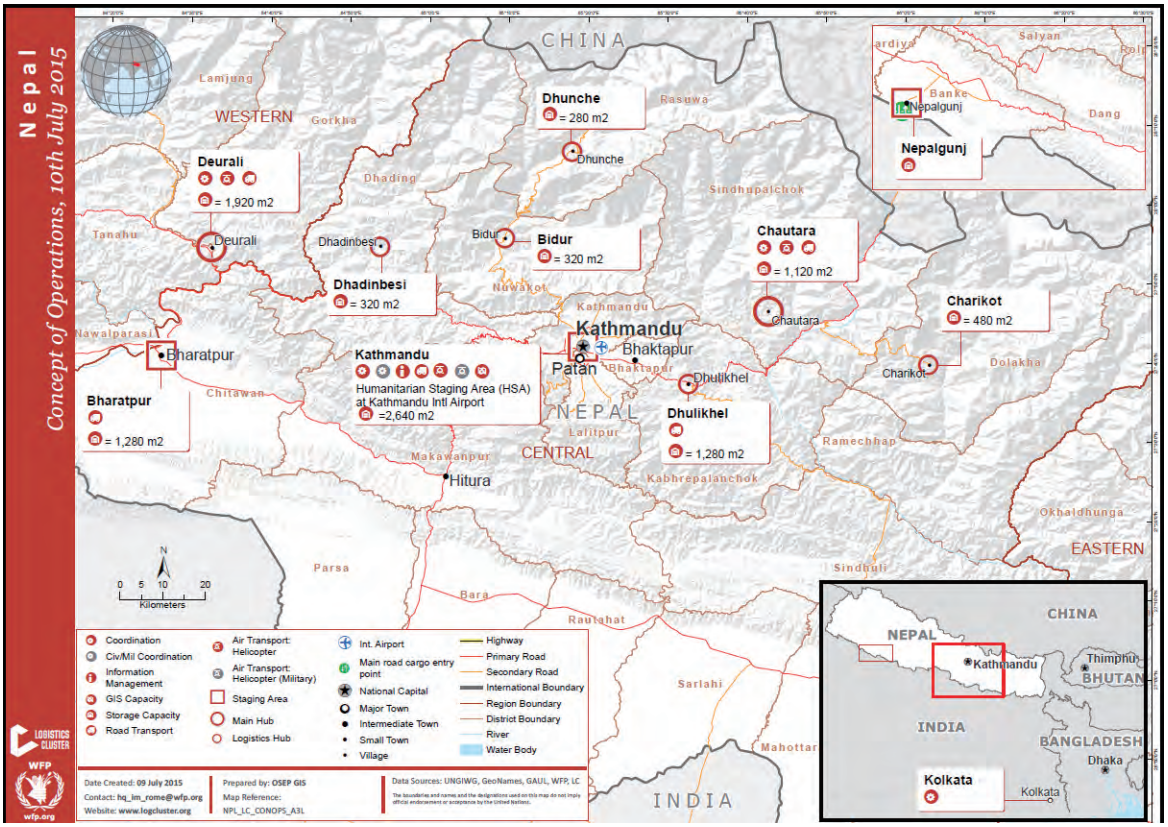

Fig. 5.2.9. Location and capacity of the staging area (July 10, 2015) (source: Log-cluster).

Fig. 5.2.10. Structure of humanitarian logistics in Nepal (source: Relief web).

Below we have listed issues that were identified after interviewing Log-cluster personnel.

5.2.5.2.1 Keep transport market functioning

Log-cluster provides free transport services for transporting relief items from one place to another. This sort of free service might hamper the recovery of the transport industry after a large-scale disaster. Therefore, WFP always tries to keep the transport market functioning without hampering relief distribution to residents. Actually, WFP encourages the use of the Log-cluster service as a last option.

5.2.5.2.2 Unattended relief goods

The WFP maintains a database of relief items. When relief items arrived at the HSA, a representative was obligated to be present at HSA to claim the relief item. After gaining clearance from the representative, WFP inserted data into the database and assigned space for storing the product. When relief items were taken from the HSA, WFP confirmed ownership of the product and checked it with

the database. However, many relief items arrived with no representative available to claim the items. Those unattended relief items created difficulty in the smooth operations of relief sorting and warehouse activities.

5.2.5.2.3 Integrated preparation makes a difference

The HSA preparation created differences in relief distribution. If there were no HSA in Kathmandu, it would take (about) 2 weeks to prepare storage space for relief items. Log-cluster people compared the situations of Haiti (earthquake, 2010) and Nepal (earthquake, 2015). Although HSA Kathmandu was equipped with all facilities to receive relief items, Thribhuvan International Airport was unprepared for unloading of a large volume of relief items after the disaster. Because of insufficient space at Thribhuvan International Airport for landing large amounts of cargo, several flights were diverted to India. Again, limited road density created difficulties of accessing affected residents. Relief items were abundant but the logistical capacity was limited in Nepal.

5.2.5.2.4 Customs processing entails delay

Some products (relief items) were allowed to enter Nepal without tax. Because of the large volume of cargo and limited available labor, many relief items were left inside the airport. Although the Nepali government tried to facilitate effective relief flow, the adopted approach was not innovative. If the Nepali government could find alternative airport facilities, relief flow would be faster.

5.2.5.2.5 Free service is not forever

The planning horizon of providing transport service is dependent on securing the budget. In the first phase, the Log-cluster planned to provide logistical support for the initial three months. That is a very short term for recovery after a large earthquake. Therefore, after securing a sufficient budget, WFP extended their plan until December 31, 2015 (according to the plan as of July 10).

5.2.5.2.6 Coordination is necessary

Shortage of transport services posed a widespread problem after a large-scale earthquake. Sometimes relief organizations delivered items of less than truck load capacity. If there were coordination among relief organizations, full truck capacity could be used. Again complaints arose about duplication of relief items. Several NGOs provided relief items to single residents, although frequent cluster meetings were held to avoid such duplication of efforts.

5.2.5.2.7 Strong local government

Local government power is extremely important to disseminate local situation reports. Because Nepali politics (during relief operations) were not stable and because there was no approved permanent constitution, relief organizations faced difficulties in selecting affected residents.

5.2.5.2.8 Short-term employee planning

To conduct relief item distribution, NGOs hire employees. NGOs must have an employee hiring strategy after a disaster. Because employees are hired for the short term, it is necessary to have a plan of job contract duration. Extra employees for an extended duration can be regarded as a waste of donated money. However, too few employees might hamper effective relief distribution.

5.2.5.2.9 Support of recovery

Several affected areas in Nepal have no road access. Therefore, WFP created projects for making trail/access road to affected areas. In this case, they provide funding for making trails. This sort of project reinforces recovery processes.

5.2.5.2.10 Personnel need sustainable preparation to stay in disaster affected areas

Log-cluster provides no transport service for personnel movement. The United Nations Humanitarian Air Service (UN-HAS) provides air service for delivering cargo and personnel. In the aftermath of the earthquake in Nepal, hundreds of humanitarian personnel (doctors, nurse and others) arrived in Nepal. Because medical doctors must stay in affected areas, the Nepali government took the initiative to check preparedness of doctors' teams. The government requested proof that physicians could ensure reliable service to residents. If a doctors' group did not have required preparation including sufficient food (for at least two weeks), sleeping equipment and medicines, then they were not allowed to go to affected areas. Government officials reported that after taking such initiatives, several doctors' groups refused to go to affected areas.

5.2.5.3 An academician's perspective (Tribhuvan University) on earthquake situation

"Nepal government is the perfect channel for helping earthquake victims," said Professor Surya Raj Acharya of Tribhuvan University. Professor Acharya is the Secretary-general of the Society of Transport Engineers, Nepal (SOTEN). He observed disaster responses closely and was an advisory member of several committees. He was not happy with the disaster response performance. He also criticized the poor disaster preparation. Below, we have listed issues that are identified after the academic interview.

5.2.5.3.1 Preparation should be based on local circumstances

Disaster awareness programs are conducted by several NGOs in Nepal. They include disaster drills, seminars, and personal discussions. According to Prof. Acharya, "NGOs used teaching materials that are produced in developed countries. That is harmful for the country because disaster awareness programs require inclusion of local knowledge. Many children playing in open areas ran to school buildings during the earthquake. Because the school building collapsed, all the children were killed."

Fig. 5.2.11. IRIDeS team with Prof. Surya Raj Acharya (front center) and Dr. Ramesh Pokharel (2nd row right).

5.2.5.3.2 Information dissemination is crucially important

Information was not disseminated effectively after the disaster. Three days after the earthquake, the Government of Nepal declared Kathmandu not safe and asked people to leave Kathmandu. According to Prof. Surya Raj Acharya, this declaration brought panic among the population. People become desperate to leave Kathmandu. Transportation services were insufficient to transfer all people. It created chaos and unrest in society. Because the Nepali people are honest and have strong social bonds, the Nepali government can, with some effort, find ways to spread disaster information more efficiently.

5.2.5.3.3 Needs assessment should be conducted critically

The Nepal Earthquake might elicit some good results for Nepal. The Nepali government must follow the Sendai framework "**build back better**." The transport sector should be an important sector in this

program. Therefore, assessments should be conducted critically. Dr. Pokharel, along with Prof. Acharya, published a newspaper (Ekantipur) column criticizing the post-disaster needs assessment. According to the column, Kathmandu was established in an unplanned way (Pokharel and Acharya, 2015). It is high time to do sustainable development. Therefore, the Nepali government should include transport engineers in its needs assessment. Prof. Acharya criticized the direct foreign country model as not bringing good results to the people of Nepal.

5.2.5.3.4 NGOs are not as effective as they could be

Prof. Acharya criticized the expenses of NGOs for office decoration and management. According to Prof. Acharya, donations could be used better. According to him, donors must consider donations through government channels. The Nepal government might include academic institutes for suggestion of policies for better utilization of funds.

5.2.6 Suggestions

Several issues were identified from the meeting with three professionals. Perspectives of the three personnel vary on the same issue.

5.2.6.1 Set up storage space for disaster relief

The HSA in Kathmandu allowed easy flow of relief distribution. Because the initial period after an earthquake is crucially important, preparing storage space can be beneficial to distribute high urgency relief item to affected residents. Some complementary items of storage space including forklifts and wooden frames should also be prepared. Placement of the storage space near an entry point is necessary. It is noteworthy that the entry point in a country represents an airport, seaport, or dry port.

5.2.6.2 Alternative airports should always be available

Relief items enter a disaster-affected country through all possible entry points. It is therefore necessary to have preparation for the seamless entry of relief items after a disaster. Generally, the first 72 hours after an earthquake are regarded as a critical period during which medical professionals and foreign rescue teams can save many lives. Therefore, functioning airports are important. A country must have plans for alternative airport services.

5.2.6.3 Debris clearing requires planning

Earthquake damaged buildings and other structures generate large amounts of debris. That debris sometimes blocks roads and hinders access to affected residents. Therefore debris clearing is an important part of disaster management. Fig. 5.2.12 shows debris deposited on the ground near the Kathmandu city center. Because of such unplanned debris management, the city environment has become polluted. Moreover, truck operations for clearing debris are a crucially important facet of disaster management. Because the debris is distributed over a vast area, some hierarchy of areas is necessary for sequential clearing of debris.

Fig. 5.2.12. Debris are kept in a playground near Kathmandu city center (photo: author, July 28, 2015).

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5.3 ODA / NGO activity in the recovery phase

Author: Carine J. Yi

5.3.1 Official Development Assistance (ODA)

According to World Bank statistics, Nepal has been receiving official development assistance and aid since 1960. Fig. 5.3.1 shows the top ten countries receiving official development assistance, including Nepal. The intense peaks reflected a high national crisis in countries such as Egypt and Afghanistan. As of the situation in 2013, Nepal ranked 35th of countries receiving official development assistance. On the other hand, the cumulative amount of official development assistant funds received during the period from 1960 to 2013 is little different from the 2013 situation. India received the most, USD 1,666 million and the 10th country is Ethiopia, which received USD 993 million. Nepal received funds of USD 970 million, ranking 44th of cumulative aid received between 1960-2013 (see Fig. 5.3.2).

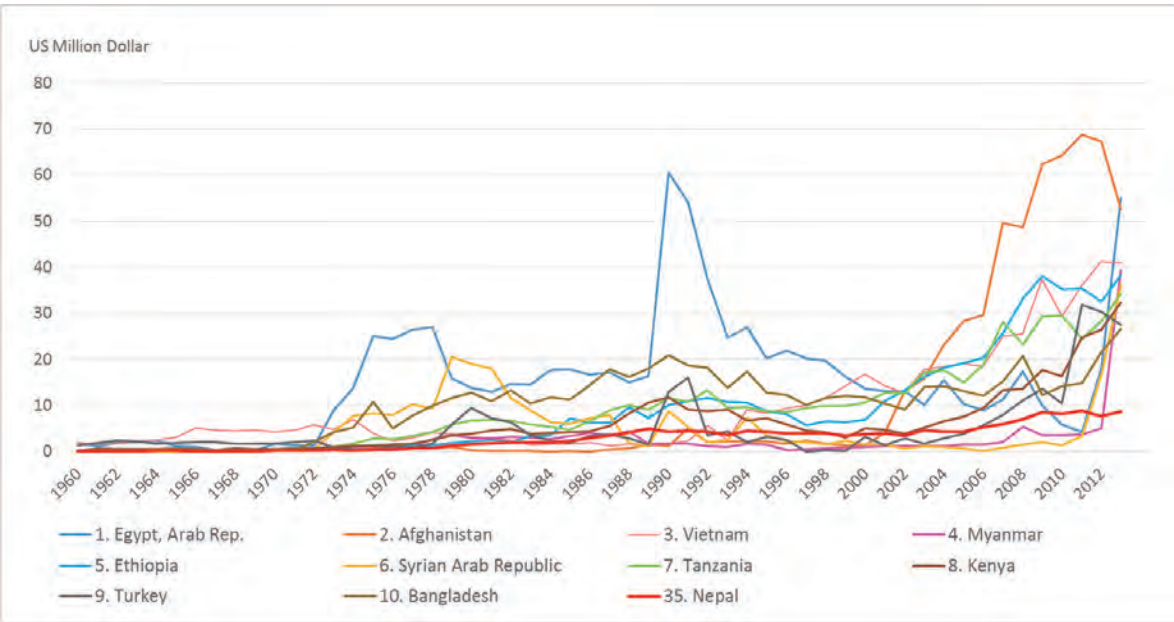

Fig. 5.3.1. Net official development assistance and aids received by countries (current USD) (as of 2013) (Modified ODA data from the World Bank)

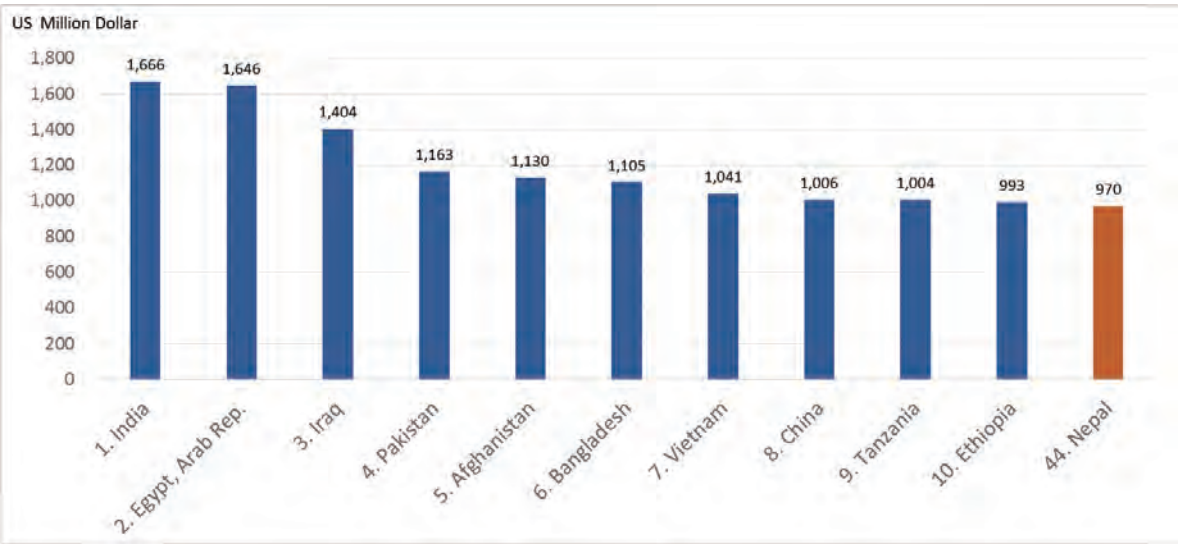

Fig. 5.3.2. The cumulative amount of receiving official development assistant from 1960 to 3013 (current USD) (as of 2013) (Modified ODA data from the World Bank)

Since 1969, Japan International Cooperation Agency (JICA) has been supporting Nepal with grants, loans and technical cooperation of infrastructure development. Table 5.3.1 shows the latest data of Japanese Official Development Assistance (ODA) to Nepal. After the 2015 Earthquake, the Japanese government announced a total of USD 14 million assistance through eight international organizations such as World Food Program (WFP), the International Federation of Red Cross and Red Crescent Societies (IFRC), UNICEF, UNDP, and including other dispatch rescue teams and medical support teams. The Japanese government extended the Emergency Grant Aid of USD 1 million in September 18, 2015, to support transporting humanitarian supplies such as shelters, sanitation goods and foods to the isolated and mountainous areas.

Table 5.3.1. The Nepalese support from by JICA (in billions of Japanese Yen)

Fiscal Year	International Loan	Gratis Fund Aid	Technical Cooperation
2009	-	40.32	21.16 (15.25)
2010	-	50.55	18.85 (14.66)
2011	-	34.15	23.76 (20.40)
2012	151.37	21.95	21.90 (18.89)
2013	-	25.28	19.05
Grand total	790.26	1,944.56	692.88 (655.73)

http://www.mofa.go.jp/mofaj/gaiko/oda/shiryo/kuni/14_databook/pdfs/02-03.pdf

5.3.2 Official aid for earthquake victims

The early stage of earthquake response focused on humanitarian relief assistance. Governments of India and China responded immediately after the earthquake. India dispatched air force planes and rescue dogs with 450 personnel and 43 tons of relief materials including tents and foods. Chinese government announced that CNY 20 million (USD 3.3 million) will be provided in humanitarian aid, rescue teams and dogs, helicopters and generators. Many countries and organizations initiated activities by rescue teams, conducted humanitarian assistance missions and provided funds as well.

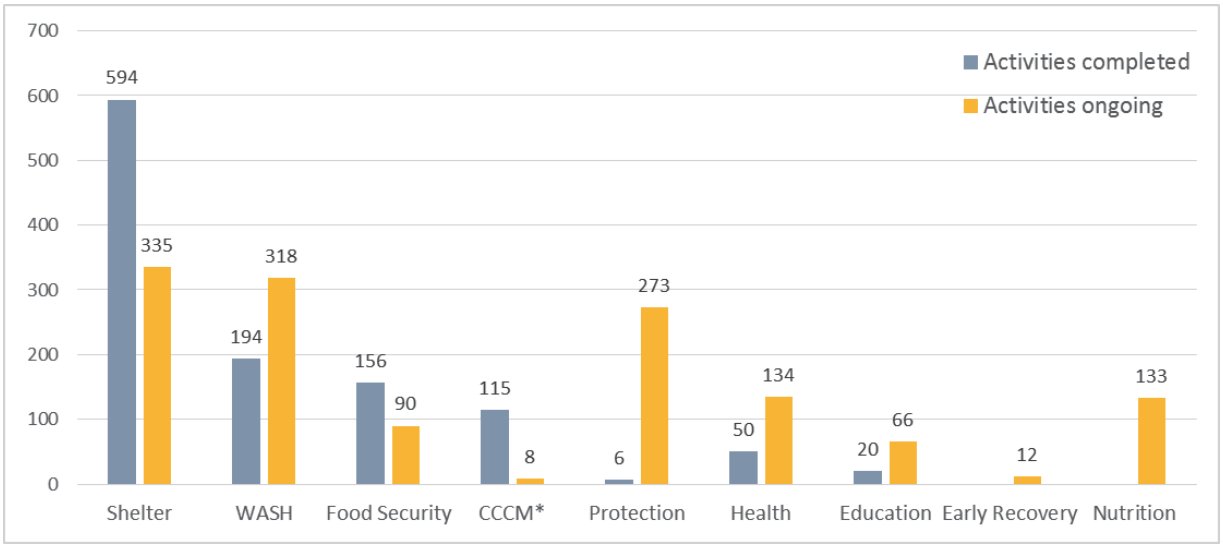

Fig. 5.3.3. Number of activities by OCHA showing detailed activity situation. (Modified based on OCHA situation report of 15 May) *CCCM: Camp Coordination and Camp Management: Camps and communal settlements are temporary sites that established only as a last resort.

The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) established a Nepal office to support the Nepali government in collaboration with international, regional, and district authorities such as UN Agencies, International NGOs, the donor community, and local communities.

Three field coordination hubs were set up in Gorkha, Sindhupalchowk and Dolakha districts to assist civil society to formulate preparedness plans to ensure adequate readiness and response activities at the time of a disaster. The field hubs phased down operations on 30th of September 2015. Projects are mostly scattered in the affected area, with a relatively high concentration in Kathmandu Valley. OCHA released a situation report (May 15, 2015) and summarized Who does What Where When (4W) with details by sector as shown in Fig. 5.3.3. The situation report of OCHA from October 31, 2015 also addressed the fuel crisis (from mid of September and end of October) as a current critical problem. The fuel crisis delayed the time frame for full-fledged humanitarian aid operations such as distribution of relief supplies and medical supplies. As a consequence, 35,000 people did not receive 700 metric tons of wheat and forage seeds. The climatic conditions (monsoon and winter) render access more difficult to most of the affected areas. The Central Emergency Response Fund (CERF) granted USD 1.2 million for aviation services in response to winter preparation. The World Bank listed projects on web-based map with a legend for different sectors such as agriculture, education, transportation and so on (see Fig. 5.3.4). The photo in Fig. 5.3.5 was taken at the Tribhuvan International Airport in Kathmandu on 5 December 2015, and shows relief goods stacked on carriages.

Fig. 5.3.4. The World Bank established the map viewing service which shows the locations where their activities is operating by sectors

Fig. 5.3.5. Relief goods stacked on carriages at Tribhuvan International Airport, Kathmandu.

5.3.3 Damage and needs of the Nepali government

The Nepali government has published an assessment report to address the different recovery needs of various sectors. According to the report, Nepal Earthquake 2015: Post Disaster Needs Assessment Report (2015), the Nepali government estimated USD 7,065 million in total damage. Due to losses by this earthquake, the impact on social sectors was estimated as the highest, USD 355,028 million, including housing and human settlements, health, education, and cultural heritage. Total recovery needs were estimated as Nepalese Rupees (NPR) 669 billion or USD 6.7 billion for the cost of reconstruction with better specifications, equipment, improved governance and risk reduction. In detail, social sectors reported 60.9% (USD 4,077 million), productive sectors at 17.3% (USD 1,156 million), infrastructure sector at 11.1% (USD 743 million). Total needs for cross-cutting issues such as governance (2.8%), disaster risk reduction (1.2%), environment and forestry (3.8%), employment and livelihood (1.9%), social protection (1.0%) and gender and social inclusion (0.2%) were estimated as 10.7% (USD 6,695 million) of the grand total. This recovery calculation of needs does not consider the replacement value, particularly with respect to the housing sector. This assessment addresses that Nepali government prepares to develop a large-scale recovery program based on this assessment. The recovery program involves implementing a large number of activities in a relatively short period of time, which requires enormous preparation in institutional, financial and logistical terms to support implementation.

The Ministry of Finance of the Government of Nepal pointed out in a chart of MDGs and mechanisms adopted to address the goals that the foreign aid has been contributing for socio-economic development of Nepal. However, the financial flow for the implementation of these projects is not clear.

5.3.4 International NGOs' activities in Lalitpur District

ODA fund opened the public subscription for the international NGOs sector through the Nepali government. A survey was conducted by researchers from IRIDeS, Tohoku University, in Khokana and Bungamati areas in Lalipur district, located in the south of Kathmandu Valley, between the 5th and 10th of December 2015. Response operations had shifted focus from earlier preparations for monsoon to winterization. A temporary shelter location map was displayed on the wall of the building in the parking lot in Khokana area as shown in Fig. 5.3.6. The map was prepared by the Center for Integrated Urban Development and UN-Habitat, with support from Japan and the Nepali Government; the map was placed on the wall about 3 meters off the ground. The author found this map difficult to understand, and has some concerns about the contents of the map, the delivery of information of the map and the cartographical methodology.

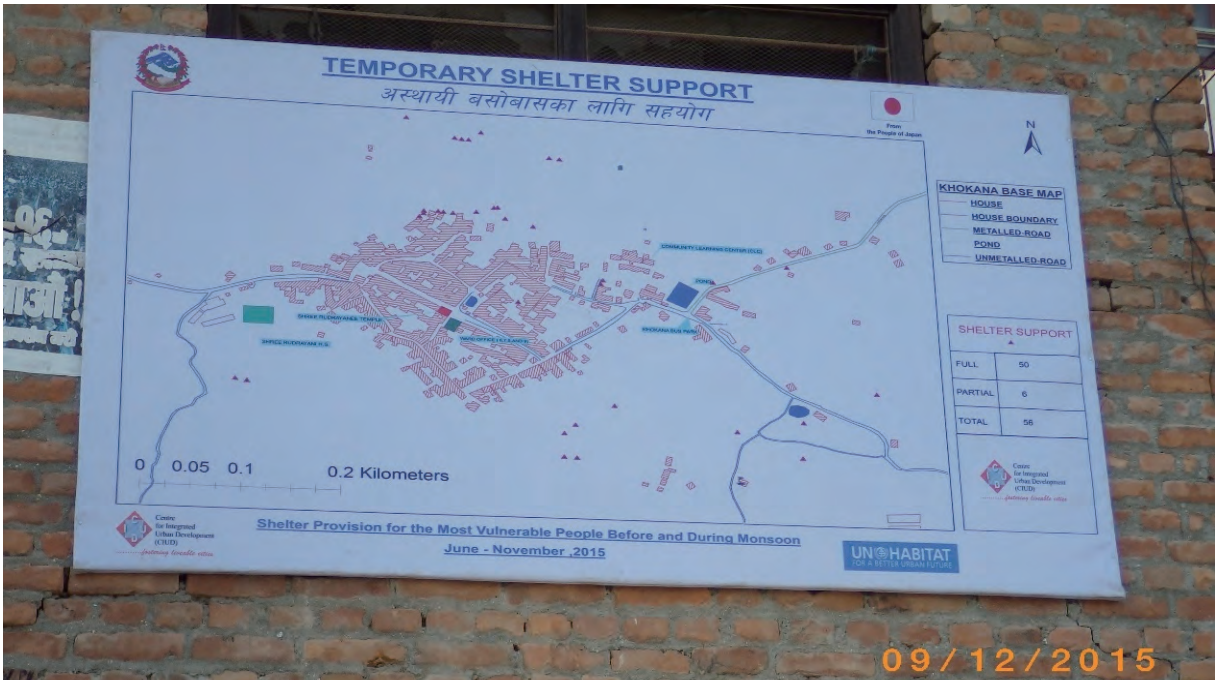

Fig. 5.3.6. Temporary shelter location map was prepared by the Center for Integrated Urban Development and UN-Habitat, supported by Japan and the Nepali Government, in Khokana area.

Temporary shelters/materials have been provided by international NGOs (I/NGOs). Among I/NGOs, the Arbeiter-Samariter-Bund Deutschland e.V. (ASB), the Nepali Moravian Outreach (NMO) and China Foundation for Poverty Alleviation in Khokana and Bungamati areas (see Fig. 5.3.7).

Fig. 5.3.7. Shelter type by the People of Japan, the Arbeiter-Samariter-Bund Deutschland e.V. (ASB), the Nepali Moravian Outreach (NMO) and China Foundation for Poverty Alleviation in Khokana and Bungamati areas (from above-left, clockwise).

The shelters have different forms such as tent, wooden cubicle, or zinc wall/roof. Occasionally, shelters were found that were built with a combination of bamboo walls and zinc roof (Fig. 5.3.8, left) and typical donated water tank (Fig. 5.3.8, right). The Nepali Moravian Outreach (NMO) purchased/rented

the land and built a church hall, Sunday school, kitchen and bathrooms in Khokana village. A NMO report addressed the fact that the landlord for the second installment in Bungamati area raised the rental fee to USD 60,000 until mid January 2016.

Fig. 5.3.8. The shelter built with combination of bamboo wall and zinc roof in Khokana area (left) and typical water tank and donor's name can be found on the surface of the tank (right).

There are some other social issues to be considered, such as human rights. The caste system is rooted in Nepali society. The class of Dalits, as "untouchables" is being ignored by birth. After the earthquake, as of July 2015, ReliefWeb by OCHA released a bright interview of a Dalit disaster survivor who has treated normally without discrimination. On the other hand, Amnesty International left comments, such as: "survivors told the team that the official distribution of tarpaulins favoured those with familial, political or other institutional connections and loyalties. The most widely reported media story in this regard featured parliamentarians taking tents intended for disaster victims. At the local level, the team heard similar complaints". Furthermore, safety for women and girls would face higher risk of sexual violence and exploitation in the aftermath of the disaster (Amnesty International, 2015).

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5.4 Medical and Public Health Management

Author: Shinichi Egawa, Aya Murakami, Hiroyuki Sasaki

5.4.1 Background and aims

Health is severely affected in any type of disaster. Frameworks for disaster risk reduction repeatedly emphasize the importance of knowing the risk, reducing the risk and preparedness to act, ultimately aiming at protection of people's physical, mental and social wellbeing (IDNDR, 1994, WCDRR 2005 and 2015, Aitsi-Selmi, 2015). Reducing risks in an earthquake prone country like Nepal definitely starts with the seismic strengthening of buildings to prevent them from collapsing to save lives of the people as the first priority. However, the architecture in Nepal has historical value and the socioeconomic status of Nepal did not allow retrofitting all buildings and houses. In total, the M7.8 Nepal Gorkha Earthquake 2015, and the biggest aftershock, M 7.3 on May 12, resulted in 8,898 deaths and 22,309 injuries, 7,324 (3,221 major and 4,103 minor) surgeries performed, 5.6 million people affected, 2.8 million people displaced as of Aug. 6, 2015 (WHO, 2015h).

The Sendai Framework for Disaster Risk Reduction (SFDRR) has the target to "substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030" (WCDRR, 2015). In the Nepal Earthquake, 7,532 schools and 1100 hospitals were damaged (Government of Nepal National Planning Commission, 2015).

In the M9.0 Great East Japan Earthquake on Mar. 11, 2011, hospitals located in coastal areas were severely damaged by the tsunami. In addition to emergency care for injuries, various physical and mental health needs arose in the affected people and even in the responders due to the large scale of devastation and combined radiation disaster caused by the nuclear power plant accident. An aging society, declining local population, lack of sufficient nutrition and hygiene, loss of daily medication, lack of local access to medical facilities and medical information, logistics problems, and problems in coordination of relief activities complicated the situation (Egawa, S., 2013a, b).

As a comprehensive international research institute of disaster science, IRIDeS dispatched multidisciplinary survey teams to Nepal. We investigated the medical and public health management in Nepal to clarify the preparedness of health sector and the real situation surrounding health after the Nepal Earthquake 2015.

5.4.2 Methods

We conducted direct site visits of affected hospitals in Kathmandu, Ministry of Health and Population (MoHP), Japan International Cooperation Agency (JICA) Nepal Office, Embassy of Japan in Nepal, National Tuberculosis Center, Center for Disaster Studies in Tribhuvan University, United Nation Development Programme (UNDP) Nepal Office, World Food Program (WFP) logistic center and one of the severely damaged suburban areas, Sankhu.

Before the on-site visit, a counterpart in Nepal, Dr. Basu Pandey, Director, Division of Leprosy Control, Ministry of Health and Population (MoHP) was contacted and the schedule was adjusted. Local maps of hospitals were created by Dr. Eric Mas in IRIDeS and information and documents such as the Post Disaster Needs Assessment (PDNA) (Government of Nepal National Planning Commission, 2015) and the latest Health Cluster Bulletin (WHO 2015a-c) were obtained online.

When visiting hospitals, interviews with administrative staff of hospitals included the contents of the post-disaster hospital assessment sheet as previously used (Egawa, S., 2015). But, due to the limited

number of hospitals and limited time frame, investigations were mainly done by voluntary questioning according to the principles of the assessment sheet.

Post-visit assessments were performed through online searches of relevant documents. Reports from MoHP, World Health Organization (WHO), Global Disaster Alert and Coordination System (GDACS) and relevant sites using keywords "health cluster", "Nepal Earthquake 2015". DesInventar is an online database of disaster statistics of all hazards including epidemics implemented by each state government in collaboration with UNDP. Nepal is one of the participating countries of DesInventar and data from 1971 to 2007 were retrieved. DesInventar has official records from the Government of Nepal about the unexpected increase of death, injuries and affected people regardless of the type of hazards. The observation about the cause of disaster in DesInventar is described in free text and therefore need re-categorization for statistical analysis. Data cards were downloaded from DesInventar online database (http://online.desinventar.org/desinventar/#NPL-DISASTER) and analyzed using JMP Pro 12.1.0 Software (SAS Institute, CA)

5.4.3 Results

5.4.3.1 Health profile

The life expectancy at birth in Nepal in 2012 was 68 years, 1 year longer than that of the WHO South-East Asia region and had increased by 6 years over the period from 2000-2012. The under-five mortality rate and the maternal mortality ratio have dramatically decreased in the latest decades although the prevalence of contraceptives, antenatal care and the rate of birth attended by skilled personnel is still below the average of the WHO region. Adult risk factors including raised blood glucose, raised blood pressure, obesity and tobacco use are average for the WHO region. The leading causes of death in Nepal are chronic obstructive pulmonary disease (COPD) (9.2%) followed by ischemic heart disease (9.2%), stroke (8.2%), lower respiratory infections (7%), and diarrheic disease (3.3%), with the latter two being among leading causes of child death. In both sexes in the period of 2000-2012, the increase of cardiovascular disease, diabetes and chronic respiratory disease are remarkable. Death due to HIV, tuberculosis and malaria is slightly increasing in both sexes. Immunization against diphtheria, pertussis and tetanus (DPT) for 1-year-olds is increasing rapidly and reached more than 90%, which is better than the average of the WHO region (<80%) (WHO, 2015i).

Population using improved drinking water sources reached more than 80%, while the population using improved sanitation facilities are under 40% (WHO, 2015i). We visited water and wastewater facilities to investigate the availability of clean water and sewage system (see Bricker, Section 5.1. in this report). The baseline hygiene situation in Nepal had very limited availability of potable water from a tap, although the water purification system is working at the upstream water intake, due to the limited and aged pipe system and the water pipe running parallel with the sewage system. People in suburban areas are using water from wells and sometimes directly drink water from wells.

5.4.3.2 Nutrition

By visiting UNDP Nepal Office, it was understood that Nepal was once a food exporting country, but now Nepal imports various foods from other countries. The PDNA also reports that undernutrition has been a longstanding problem especially in the affected area (Government of Nepal, National Planning Committee, 2015). Children, pregnant and lactating mothers and senior citizens had potential vulnerabilities because of undernutrition. Fig. 5.4.1. indicates the trend of children with undernutrition (<-2SD) in Nepal based on the growth standards of healthy children which can be achieved through healthy practices such as breastfeeding their children and not smoking during and after pregnancy regardless of ethnicity, socioeconomic status and type of feeding (WHO 2006). Malnutrition of women still occurs at a higher rate (24.4%) compared to developed countries, while the overweight population

is rapidly increasing (8.6%) as indicated in Fig. 5.4.2. Both trends, however, are showing the improving situation of nutrition in Nepal.

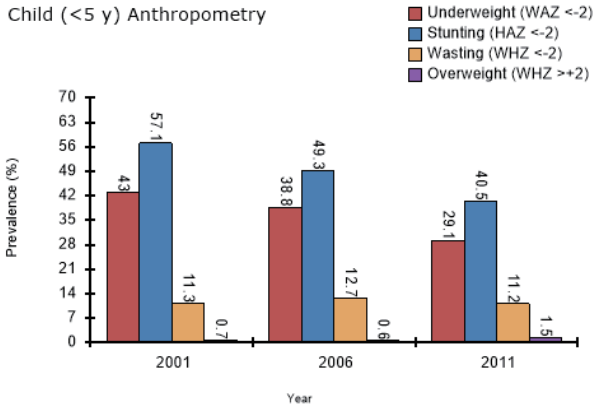

Fig. 5.4.1. Indicators of child malnutrition in Nepal.
(Source: WHO Nutrition Landscape Information System (NLiS), 2015)

Definitions for Fig. 5.4.1.:

- Underweight: weight for age <-2 standard deviations (SD) of WHO Child Growth Standards median
- Stunting: height for age < -2 SD of the WHO Child Growth Standards median
- Wasting: weight for height < -2 SD of the WHO Child Growth Standards median
- Overweight: weight for height > +2 SD of the WHO Child Growth Standards median

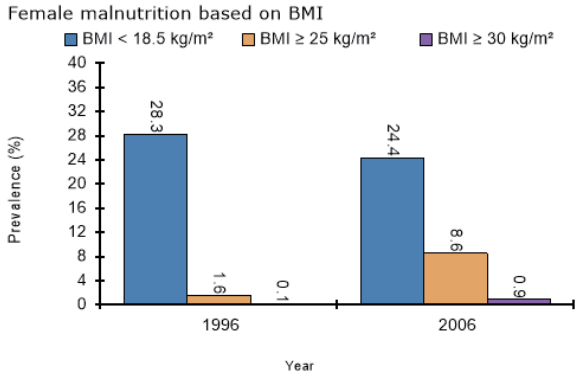

Fig. 5.4.2. Malnutrition in women in Nepal.
(Source: WHO Nutrition Landscape Information System (NLiS), 2015)

5.4.3.3 Health problems in past disasters

DesInventar indicates the biggest cause of death related disaster in Nepal is epidemics (Fig. 5.4.3.). Fig. 5.4.4. indicates the trend of death by epidemics of any cause from 1971-2007 in Nepal indicating that infectious disease related death has remained very common even until recently.

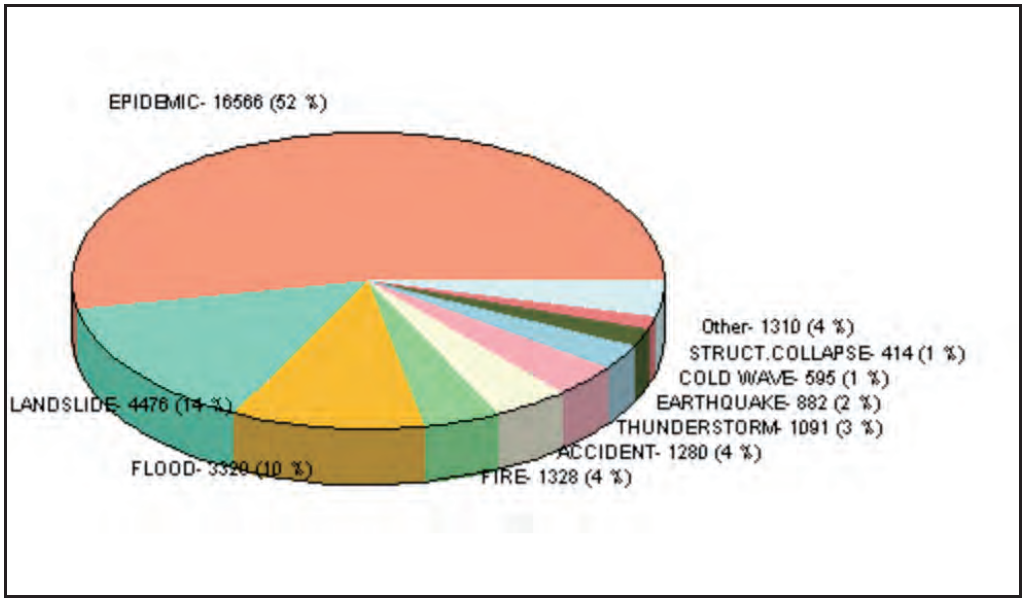

Fig. **5.4.3**. The number of death by disaster types in Nepal (available at http://www.desinventar.net/DesInventar/profiletab.jsp?countrycode=nplretrieved on Jan. 10, 2016)

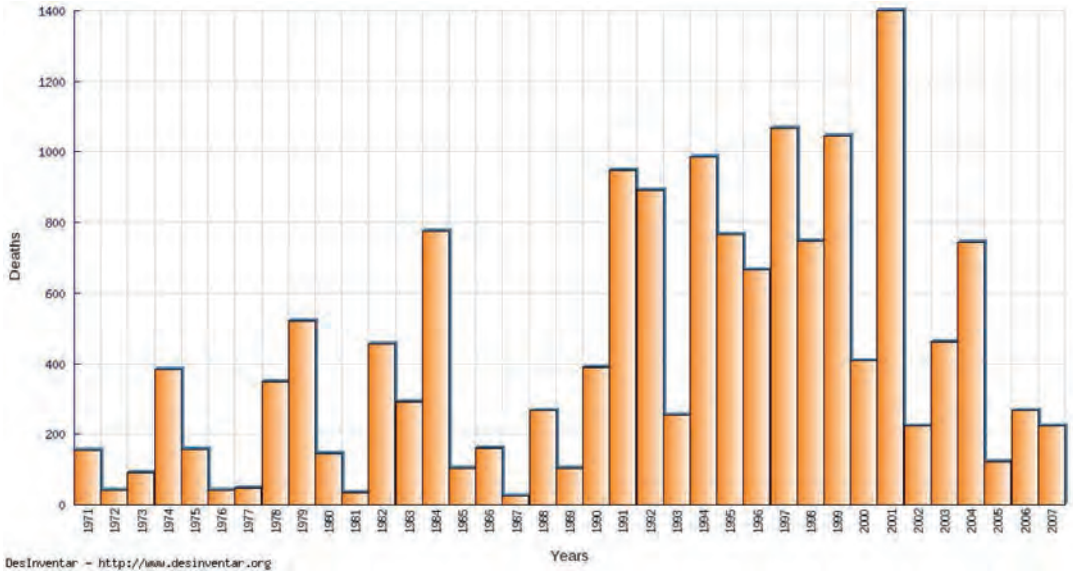

Fig. 5.4.4. Trends of deaths caused by epidemics in Nepal from 1971-2007 (Graph created by DesInventar http://online.desinventar.org/desinventar/#NPL-DISASTER on Jan. 7, 2016).

We classified the names of diseases into diarrhea, fever, nervous system, respiratory and others according to observations about the cause of disaster in each record of DesInventar. If there is no specific description about the disease, it was categorized unknown including diseases in animals and plants. As shown in Fig. 5.4.5., diarrheic diseases, including cholera and dysentery, was the biggest cause of death in past disasters.

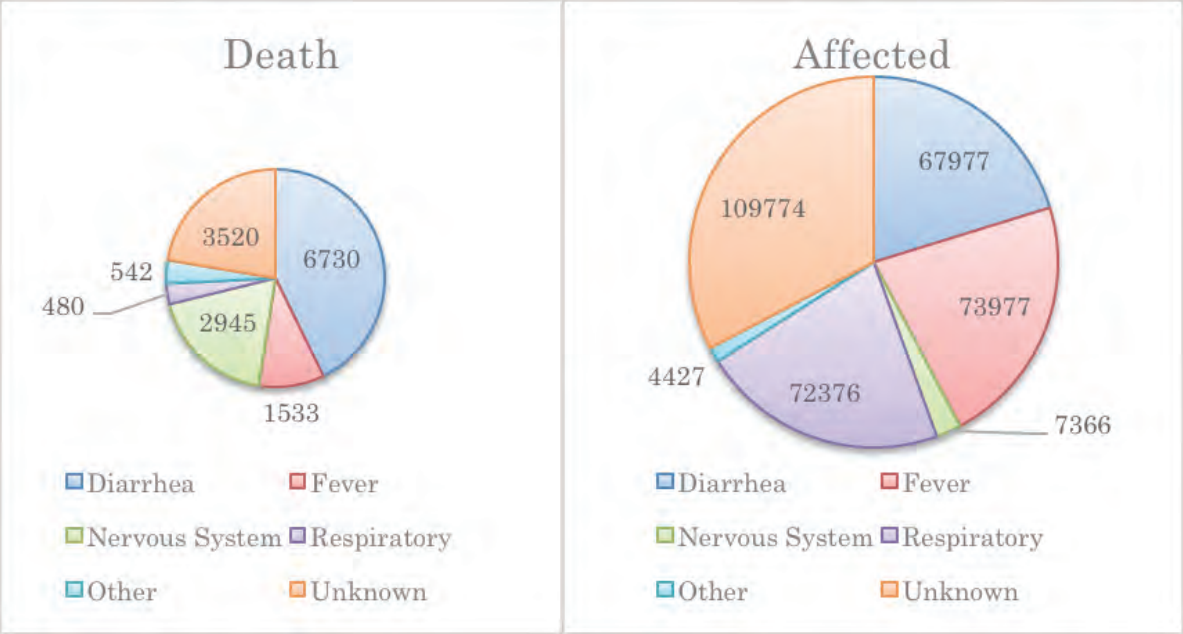

Fig. 5.4.5. Number of deaths and affected people by epidemics in disaster in Nepal 1971-2007 according to DesInventar data.

5.4.3.4 Health care system preparedness for disaster

The Institute of Medicine, Tribhuvan University (IOM-TU) is the oldest national medical school in Nepal and most medical doctors and government authorities are graduates from IOM-TU. With the administration of MoHP, virtually every district now has medical colleges and hospitals as tertiary hospitals. Regional experts established the Program for Enhancement of Emergency Response (PEER), which includes Hospital Preparedness for Emergencies (HOPE), since 2004 in collaboration with MoHP and Johns Hopkins University in the U.S.A. PEER is managed by MoHP and the Asian Disaster Preparedness Center (ADPC) and National Society for Earthquake Technology (NSET) to train healthcare workers and administration staff and mainstream disaster risk reduction in all developments. PEER is operational in nine countries and funded by United States Agency for International Development - Office of U.S. Foreign Disaster Assistance (USAID-OFDA), with supplemental support from American Red Cross (ARC) (Asian Disaster Preparedness Center, 2011). HOPE addresses structural, non-structural, organizational and medical concerns of health facilities in order to improve capacity to respond effectively to emergencies. The first course of HOPE was conducted in Nepal in 2004, institutionalized by NSET and successfully continuously organized by IOM-TU. IOM-TU conducted HOPE in the five other countries (Bangladesh, India, Indonesia, Pakistan and the Philippines) in the region and MoHP supported the budget for this activity. HOPE was modified to cope with multi-hazards. Instructors' capacities are strengthened through multi-step learning and teaching experiences to be able to organize and evaluate the courses including various units of disaster medical and public health management. Hospital administrators, engineers, physicians, nurses and planning staff are the candidates for the course. The HOPE course includes interactive lectures and discussions, case studies and a variety of exercises and simulations. The following topic are lectured (from the web page of TU-IOM http://www.iom.edu.np/?page_id=106 retrieved on Jan 10, 2016).

- *Overview of Disasters*
- *Disaster Risk Management*
- *Disaster Epidemiology and Patterns of Injury*
- *Hazards*
- *Structural Components*

- *Non Structural Components*
- *Functional Collapse of Hospitals*
- *Pre- Hospital Care*
- *TRIAGE*
- *Emergency Department*
- *Principles of Disaster Medicine*
- *Hospital Emergency Incident Command System (HEICS)*
- *Hospital Preparedness Planning*
- *Techno-Industrial Disasters*
- *Complex Emergencies*
- *Mass Casualty Incident*
- *Mass Gathering Event*
- *On-Site Medical Care*
- *Psychosocial Consequences of Disaster*
- *Inter-agency Coordination*
- *Hospital Internal Disaster*
- *Mass Fatality Management*
- *Disaster Risk Communications*
- *Resource Management*
- *Epidemics and Emerging Infections*
- *Return to Normal Health Operations*

WHO and Nepal have been implementing the WHO Country Cooperative Strategy (CCS) 2013-2017 (WHO 2012). Reducing the health consequences of natural and human induced disasters is one of the strategic priorities, recognizing that the health sector is particularly prone to the effects of disasters because of the country's geographic and population size, which translates to a limited margin of human, material and financial resources. CCS also recognizes that disasters tend to have a twofold impact on health systems: directly, through damage to the infrastructure and health facilities and the consequent interruption of services at a time when they are most needed; and indirectly, by potentially causing an unexpected number of casualties, injuries and illnesses in affected communities (WHO, 2012). The expected hazards in the CCS of 2012 included floods, landslides, earthquake, fire, epidemics as well as the effects of climate change, avian influenza, industrial accidents, explosions of improvised explosive devices, road accidents and poisoning i.e. multi-hazard preparedness. In seismic vulnerability ranking, Kathmandu valley was placed top of the global hazard map expecting MMI 9-11.

CCS also recognizes epidemics as disasters including cholera and gastroenteritis. The Government of Nepal implemented an Early Warning and Alert Response Surveillance (EWARS) system to detect any epidemics using sentinel sites all over the country, but cases from communities not visiting hospitals are not reflected in the surveillance data. The strategic priority of CCS to reduce the health consequences of disasters focuses on the following two topics and respective approaches (WHO, 2012).

5.1. Strengthen national capacity and coordination in health sector emergency risk management; Strategic approaches

5.1.1: Advocate for adequate human resources in the area of health sector emergency preparedness at all levels.

5.1.2: Strengthen the tools, skills and support systems to enable district health systems to undertake initiatives in emergency risk management.

5.1.3: Provide technical support to programmes for reducing the vulnerability of health facilities to the effects of disasters in accordance with the National Disaster Risk Reduction Strategy and hospital safety initiatives.

5.2. Promote and support a coherent intersectoral approach to health emergency preparedness and response including recovery.

Strategic approaches:

5.2.1: Provide technical and policy support for the development and implementation of an intersectoral mass casualty management strategy.

5.2.2: Strengthen partnerships with Government, nongovernmental and civil society organizations for more effective planning, coordination, and response linking with the existing Inter Agency Standing Committee (IASC).

5.4.3.5 Reality of the Nepal Earthquake 2015

5.4.3.5.1 Outline of health impact

The M 7.8 Nepal Earthquake 2015, on Saturday (a holiday in Nepal) Apr. 25, and the biggest aftershock, M 7.3 on May 12, resulted in 8,898 deaths, 22,309 injuries, 7,324 surgeries performed, 5.6 million people affected, and 2.8 million people displaced as of Aug. 6, 2015 (WHO, 2015h). Of the total impact, 141 deaths and 3159 injuries were attributed to the May 12 earthquake (WHO, 2015c).

Health Cluster Bulletins (WHO, 2015a-h) reported the increasing number of dead, lost and injured as well as cases treated according to the updates as shown in Fig. 5.4.6. It took more than a month to finalize the accurate numbers of human health damage. The number of health cluster partners had two peaks at 2 and 8 weeks after the disaster. It is remarkable that the cumulative number of cases treated is far bigger than the number of injuries and reached more than 100,000 after one month. Considering that the final numbers of injuries and surgeries were fixed at 202,309 and 7,324 respectively at the beginning of June, and outbreak of infectious diseases was minimal, most of the treatment could be due to that of non-trauma and non-communicable disease (NCD). Another reason of the increased number of cases treated can be the cumulative counting of repeated treatments of a single patient. The requested amount of funds for the health sector was finalized at 41.8 million USD which was gradually covered up to 45.8% as of Aug. 2, 2015.

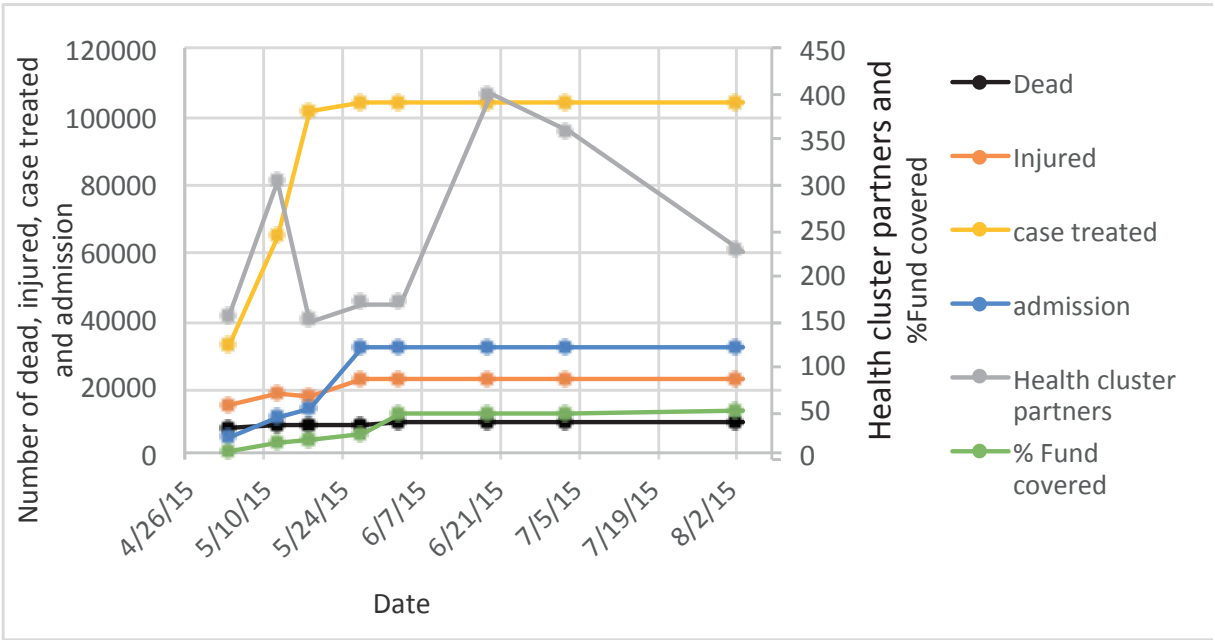

Fig. 5.4.6. Trends of health damage and response according to the WHO Health Cluster Bulletins.

5.4.3.5.2 Good practices

5.4.3.5.2.1 Hospital retrofitting

Since Nepal is an earthquake prone country, retrofitting of the hospitals was achieved at a high rate especially in Kathmandu where most hospitals are located. All but four referral hospital remained standing (WHO, 2015a). All Kathmandu hospitals continued functioning after the May 12 earthquake (WHO, 2015c). MoHP developed Standard Guidelines for the Post-disaster Reconstruction of Health Facilities (WHO, 2015f). Slightly more than 100 days into response, 99% of damaged health facilities has resumed services across affected districts. (WHO, 2015h).

5.4.3.5.2.2 Medical assistance and coordination

Surge capacities were distributed to the hospitals by health cluster, to provide a "hub and spoke" approach. Four non-functioning district hospitals were replaced with field hospitals. Foreign Medical Teams (FMTs) were encouraged to treat NCDs. WHO Treatment guidelines for NCDs were distributed to health professionals to calculate the required amount of medicine using the gender-disaggregated data of the districts. Assessment of remaining hospitals identified the necessity of urgent assistance (WHO, 2015a). More than 200 national medical teams and about 100 FMTs substituted for the non-functioning health facilities of severely affected districts. These FMTs were deployed by the health cluster. Push type provision of essential medicines and supplies were done. MoHP provided trauma treatment protocols to FMTs to avoid unnecessary over treatment including amputation. Alternative care and rehabilitation was established to decrease the congestion of the hospitals by admitted patients who need long-term care (WHO, 2015a).

Daily health cluster meetings were conducted immediately after the disaster. MoHP updated the partners daily, and the meeting notes were circulated to the partners every evening. The Health Cluster participates in Inter-Cluster meetings and the WASH Cluster. A working group for post-trauma rehabilitation was suggested. The Health Cluster invited Camp Coordination and Camp Management Clusters to update partners on health issues. Hubs were set up in Gorkha and Dhading Districts (WHO, 2015a). Operational Health Cluster meetings were started in Gorkha and Sindhupalchok. The Health Cluster mapped partners' abilities and facilities for effective coordination (WHO, 2015b).

FMTs substituted for critical infrastructure and worked closely with District Health Offices (DHOs) and reported the end of their work, exit plans and transition strategies as needed. A coordination desk was established at Tribhuvan Airport for a referral service of critical patients airlifted from affected districts (WHO, 2015b). Exits of FMTs were coordinated by the Health Cluster to avoid gaps in services. The remaining 58 FMTs faced the May 12 earthquake but restarted the treatment of surge patients immediately. Two FMTs withdrew in light of safely concerns (WHO, 2015c). To evaluate the effectiveness of FMTs, survey forms were developed and distributed to FMTs. The survey is kept anonymous and confidential.

5.4.3.5.2.3 On-site training of health professionals

Rapid deployment of health professionals supported affected health facilities, even in remote areas. Hospitals in Kathmandu were adequately staffed (WHO, 2015a). Standardized Interagency Emergency Health Kits (IEHK) were supplied from multiple donors (WHO, 2015b). About 1,000 health personnel were trained by the China Medical Team in laboratory tests, specimen collection, field disinfection, surveillance of infectious disease, health promotion and post-disaster psychological assistance, etc. (WHO, 2015d). The Injury Rehabilitation sub-cluster trained carers, paramedics and nursing staff to identify patients requiring rehab and in the handling of complex trauma patients. Training about emerging infectious diseases, especially dengue, was provided (WHO, 2015f).

MoHP carried out capacity building of health workers about disaster risk reduction including Mass Casualty Management (MCM) and Hospital Preparedness for Emergency (HOPE) programs. Even with limited resources and under the most challenging circumstances, a group of people, notwithstanding their own personal tragedies, who are truly compassionate, ethical and determined to save lives and provide relief, could make all the difference (WHO, 2015f).

5.4.3.5.2.4 Trauma and injury

More than 20,000 people were injured in the disaster and a third of patients required follow up care and rehabilitation. The number of trauma patients started decreasing in a week. Hospital staff dealt well with injuries and no gaps in surgery and trauma care were identified (WHO, 2015a). The Injury Rehabilitation Sub-cluster was established. The Health Cluster developed an assisted discharge system to encourage patients, including issuing ID cards and follow-up services for free. Hub hospital coordinators were assigned to collect detailed information about the status and medical needs of discharged patients (WHO, 2015b).

5.4.3.5.2.5 Surveillance and infectious disease

Although some cases of diarrhea were found, no remarkable outbreak of infectious diseases was reported. WHO supported MoHP to assess the severely affected districts. NGOs shared their assessments with the Health Cluster. MoHP introduced prospective syndromic surveillance using the observation of the out-patient department of hospitals (WHO, 2015a). Many NGOs helped the assessment using electronic assessment tools (WHO, 2015b). Establishment of EWARS including zero-reporting and its daily reports indicated a decrease of epidemic-prone diseases and trauma. Surveillance focused on four symptoms of acute respiratory infection, acute watery diarrhea, acute bloody diarrhea and fever of unknown origin from 60 sentinel surveillance sites that consisted of all district hospitals, private hospitals and FMT camps in the 14 severely affected districts. Rumors of suspicious outbreaks were verified by multiple channels and most rumors were denied.

Rapid detection of epidemic-prone diseases and intervention prevented outbreaks. Stool samples have tested negative for Vibrio cholera, Shigella and Salmonella (WHO, 2015b). EWARS continuously indicated the decrease of epidemic-prone diseases. Field laboratory facilities also confirmed no outbreaks of diarrheic pathogens or malaria vectors (WHO, 2015c). As the situation settled down, the surveillance form was revised to normalize the disease spectrum (WHO, 2015e).

TB and HIV patients were advised to seek continuous medical treatment for free to avoid the development of drug resistance. The National Tuberculosis Center conducted post-disaster rapid assessment of national tuberculosis program including rapid assessment of functionality of DOTS (Directly Observed Treatment System). The result facilitated the promotion of DOTS recovery and psychosocial support of patients. At least 517 (83.6%) of 698 TB patients and 134 (88.7%) of 151 drug resistant TB patients continued anti-TB treatment after the Apr. 25 earthquake (WHO, 2015d). Immunization for vaccine preventable diseases was promoted especially for children under five (WHO, 2015g).

5.4.3.5.2.6 Mental health

The sub-cluster for Mental Health was established by WHO, MoHP and TU-IOM, and initiated from the three hardest hit districts. For the past three years, primary health care centers were providing mental health care with support from mental hospitals and these initiatives were strengthened by permanent teams consisting of one psychiatrist, one psychologist and two supporting staff. The psychosocial working group under the Social Protection Cluster also supported this (WHO, 2015a). Mobile teams of mental health care were deployed. WHO emphasized the importance of giving time for natural recovery rather than medicalizing the problem. In Dhading district, psychosocial treatment and counseling was

implemented, which attracted many people (WHO, 2015b). Mental Hospital, Patan, deployed a mental health team to Dhading district and provided psychosocial support in the form of psychological first aid (PFA) and relaxation therapy. On average, 30-40 persons per day visited this service. PFA was provided to more than 1,500 people (WHO, 2015c).

Department of Psychiatry and mental health TUTH responded with the establishment of a '24 hour crisis intervention and psychological help desk which was aimed to provide immediate psychosocial support for those who were suffering acute psychological reaction in response to the earthquake. The out-patient department was functional immediately and there was no breach in the in-patient care. Psychiatry services were also provided to triage area in the emergency at TUTH and Trauma center at Bir hospital.

Many on-site trainings to health workers, teachers, media persons about psychosocial interventions in trauma, and psychological first aid was provided by the department. The department also provided mental health services at Chautara in Sindhupalchowk, one of the major disaster affected areas in the country.

The Psychiatrist Association of Nepal dispatched mental health and psychosocial support teams and managed mobile mental health camps in the affected area (WHO, 2015d). Psychosocial support was provided to teachers and children in schools (WHO, 2015g). Psychosocial support was also provided to older persons through health camps (WHO, 2015h).

5.4.3.5.2.7 Maternal care and care for children

In the 14 severely affected districts, 60,000 pregnant women and 10,000 deliveries were expected every month. Each month, 1,500 women may have complications during pregnancy and childbirth requiring medical care (WHO, 2015b). Six hospitals were identified as referrals for emergency obstetrics and the Sub-Cluster for Reproductive Health was established. UNICEF provided 50,000 neonatal kits. This Sub-Cluster developed a standard assessment form for reproductive health care services. Pre- and post-delivery care was provided through a national reproductive health care protocol for standardized care. The Child Health Working Group was also established and distributed flip charts for Integrated Management of Childhood Illness to hospitals and FMTs. District Public Health Officers conducted vaccinations for measles, mumps and rubella (MMR) (WHO, 2015a). Guidance notes for parents/care-takers on counseling for children after natural disaster were developed and disseminated. Equipment and supplies for reproductive health were adequately reached and provided. Resuming maternity services in the damaged facilities were accelerated (WHO, 2015b). Shelter homes were established for pregnant women with complications, postnatal mothers, newborns and children under five who have been left homeless to have safe place to stay after being discharged from hospitals. Drugs and materials to prevent postnatal hemorrhage and infection were distributed adequately (WHO 2015c).

5.4.3.5.2.8 Advocacy of hygiene and sanitation

WHO, Water Sanitation Hygiene (WASH) Cluster and Non-Governmental Organizations (NGOs) helped health facilities restore water and sanitation facilities. Mobile water quality testing laboratories were set up. Pit latrines were built in temporary shelters. A regular supply of water, chlorine tablets and hygiene materials were ensured (WHO, 2015a). Quality of water sanitation was strictly monitored and the contaminated water was corrected by increasing the residual chloride levels. WHO helped the WASH Cluster in health facilities. Health information was provided through Female Community Health Volunteers (FCHV) with the help of the National Health Education Information and Coordination Center (NHEICC) for wider outreach. Health related posters and leaflets were disseminated (WHO, 2015b). Six key hygiene messages were broadcast from local radio stations in the severely affected districts. Post-earthquake communication plan was also finalized by NHEICC to promote the hygiene aspects of shelters (WHO, 2015d). Health information from local health centers

through radio station and SNS were disseminated in many districts (WHO, 2015g). In Patan Hospital, which we visited, the community donated foods for patients, but the hospital accepted only uncooked materials and processed the food for the patients inside the hospital to avoid food and water-borne infectious disease.

5.4.3.5.2.9 Logistics

The World Food Program (WFP) as the logistics center was building a test operation center next to the Kathmandu airport for training just before the earthquake. It immediately served as the real logistic center accepting and supplying the supporting materials (see Das, section 5.2 of this report). WFP transports all goods and supplies, except human resources, to distant areas. Due to the limited and costly air transport, ground transportation and sometimes porter and cargo animals delivered materials to mountainous area. WFP never dropped materials from the air to assure face-to-face delivery.

The Government of Nepal encouraged people to leave Kathmandu Valley to help the people in their home towns, which significantly decreased congestion within the city so that emergency vehicles could operate more smoothly. The recovery of communication tools including cell phones were relatively quick and there had been no lack of fuel for cars. Medical Camp Kits were created and set up by WHO and WFP as temporary field hospital facilities replacing primary health care facilities in the highly affected areas before permanent restoration, due to expected monsoons (WHO, 2015d).

5.4.3.5.3 Gaps

5.4.3.5.3.1 Preparedness

A WHO rapid assessment team found the hospitals were in shortage of a range of critical medical supplies, including emergency medicines, surgery kits, IV fluids, antibiotics and suturing materials (WHO, 2015a). Regular supply and buffer stock of medicine and other essential supplies in remote areas needs to be ensured. Prepositioning of supplies for at least three months will ensure the continuity of services even after roads are inaccessible during the peak of monsoon season (WHO, 2015g). Outside Kathmandu Valley, 40% of approved posts for health workers were vacant even before the earthquake (WHO, 2015a).

5.4.3.5.3.2 Vulnerability of building architecture

Buildings of Nepal have historical value and retrofitting for seismic strengthening was not promoted sufficiently, although people and the national government were aware of the earthquake prone nature of the country. Frequent aftershocks, especially the May 12 earthquake, prompted fear among people and some people fell down from heights. The building code had been implemented long before the earthquake according to the international standards for seismic strength, but during construction after the approval from the municipal office, the level of actual strength deteriorates. The culture in Nepal regards upper floors as better place for living and the limited land area made the upper part of the houses heavier. Falling adobe and bricks of the building without reinforcement fell down and caused injuries, and also caused the collapse of buildings and houses resulting in the frequent major injuries such as bone fracture, head and spinal injuries.

5.4.3.5.3.3 Safe hospitals

Four district hospitals ceased functioning due to infrastructure damage. Damaged infrastructure and limited materials, lack of medical supplies and essential medicine in the hospitals deteriorated the function of remaining hospitals. Some services were interrupted for more than 100 days because of landslides and road blockage in monsoon season. Eighteen health workers and volunteers lost their lives and 75 were injured in the disaster (WHO, 2015h).

More than 90% of health facilities in the 14 severely affected districts were not functional. District Health Offices were also damaged. WHO found that there was no predefined procedure of medical waste management. Restoration of primary health care services with tents and essential packages was the temporary measure for urgent needs before the monsoon season (WHO, 2015b). The May 12 earthquake completely destructed some of the health facilities already damaged by the Apr. 25 earthquake (WHO, 2015c). Cold chain status was a concern only in a limited district although immunization efforts were taken (WHO 2015d).

5.4.3.5.3.4 Management of injuries

The management of spinal cord injuries was identified as a critical gap. In the Kathmandu area, children, youth (age 6-18) and older citizens over 60 years made up one of six trauma patients. Sixty percent of injuries involved bone fractures, 13% were spinal cord injuries, and 11% were head injuries that could have been avoided by retrofitting buildings and education and training on self-protecting behavior in the shaking (WHO, 2015a). Additional facilities were needed for rehabilitation including psychosocial support for patients discharged from hospitals (WHO, 2015b). The capacity of step-down care facilities was limited for patients who could not be discharged due to damage and loss of homes. Many Emergency Obstetric Maternal and Neonatal Care (EmONC) facilities were damaged by the earthquake and needed urgent rehabilitation (WHO, 2015c). A number of post-operative surgical-site-infections were noted by follow up of discharged patients, thus the necessity of community level follow up was recognized (WHO, 2015d). The total number of amputations reached about 60 and the total number of spinal cord injuries reached 200-300 in Kathmandu Valley (WHO, 2015e).

5.4.3.5.3.5 Infectious disease

Initial assessments using phones did not give correct syndromic prevalence (WHO, 2015a). There was a low prevalence of amoeba enteritis, chickenpox. Four patients with tetanus were detected, and two of them died (WHO, 2015f).

One stool sample in Kathmandu was positive for vibrio cholera. Nearly 60,000 people were displaced in 104 displacement sites across 13 districts. Diarrhea was the most common problem in 41% of the sites due to the lack of adequate latrines and evidence of open defecation. Also the majority of displacement sites do not have evidence of hand-washing, which raises the possibility of outbreak. An outbreak of diarrheic disease in Sindhupalchok occurred in the beginning of July and salmonella and typhoid were positive. A rapid response team and the WASH cluster were dispatched and controlled the outbreak within 2 weeks (WHO, 2015h).

5.4.3.5.3.6 Psychosocial support

WHO estimates 5 to 10% of people will suffer from mental illness as a result of humanitarian emergencies. There were anecdotal reports of alcohol misuse and withdrawal symptoms (WHO, 2015b). Provision of support for pre-existing cases of mental disorders, relapse cases, and new cases suffering from acute mental distress requiring medical treatment was a challenging gap. There was only one psychiatric hospital in the country (WHO, 2015b) and psychosocial support was tried in only limited areas (WHO, 2015c).

5.4.3.5.3.7 Support for health workers

Addressing health workers' emergency needs for shelter, foods and psychosocial support remains an important priority. Health workers and Female Community Health Volunteers (FCHV) may face needs, shelter, foods, and psychosocial stress, too. Most of the health workers were affected by the earthquake, losing their houses, families, friends and neighbors. Staff transportation was difficult especially in northern villages. Some health care workers had been stranded because of landslides and many did not have food. Due to frequent aftershocks, many could not sleep sufficiently (WHO, 2015c). Four medical

aid workers were killed in a helicopter crash. A shortage of human resources was remarkable in the 14 severely affected district (WHO, 2015e). There were unsolved demands for shelter and psychosocial support for health workers (WHO, 2015h).

5.4.3.5.3.8 Gaps between Kathmandu and remote areas

Transportation of medical supplies to remote areas was difficult due to limited air transport (WHO, 2015b). Village District Committees (VDCs) in northern areas had significant medical needs, but were under-covered due to difficulties of access (WHO, 2015c). Stored medicines will be damaged due to rain and unregulated temperature in remote areas. Access to reproductive health care service is limited in remote areas. Health care for pregnant women and babies was disrupted by monsoon and service under tents (WHO, 2015h).

5.4.3.5.3.9 Budget from the Government

The hospital administrators we met both in public and private hospitals emphasizes the gaps between hospital expenses for disaster response and the reimbursement from the government at three months after the onset.

5.4.3.5.3.10 Treatment of chronic diseases

WHO Health Cluster bulletins mainly focused on trauma, infectious disease, reproductive health, child health and mental health, but not on the NCDs that are going to be larger burden of health problems in Nepal. After seismic retrofitting, hygiene promotion and nutritional improvement, the share of health risks due to NCD will increase.

5.4.3.6 Ministry of Health and Population (MoHP)

On July 27, we visited the Ministry of Health and Population (MoHP) and very fortunately met with Minister Mr. Khagaraj Adhikari, with the kind coordination of counterpart Dr. Basu Pandey, Director of Leprosy Control Division of MoHP. The Minister emphasized the importance of public health in disaster and expressed appreciation for the help from Japan. The Minister summarized the achievements of the Health Cluster in avoiding any major outbreaks of infectious disease and more than 99% of primary health care centers were functionally restored, even through replacement, before monsoon. The Minster also appreciated the importance of mental health care in disaster and was planning to improve the accessibility to the necessary care. We also met the Secretary of MoHP, Dr. Lohani Guna Raj, and found that the response operation, airport control of FMTs and medical resources were performed mainly by MoHP. Dr. Lohani Guna Raj stressed the effect of trauma care guidelines for FMTs successfully suppressed the number of amputations without supervision by Nepalese doctors.

Next, we met Dr. Khem Karki, Member Secretary of Nepal Health Research Council, who coordinated Health Cluster meetings. Dr. Karki clarified the initial response of the health sector. Dr. Karki was researching the activities of health cluster partners and case-treated so that they can evaluate the response. The trauma guideline was created from the lessons of earthquake in Haiti, which created uncontrolled and unnecessary amputation of affected people and created a number of people with disabilities. The guideline strictly prohibits the amputation by FMTs without supervision of Nepalese doctors and it was successful. Promotion of public awareness of hygiene and sanitation through radio and SNS prevented the outbreak of diarrheic disease and acute respiratory infections. MoHP coordinated the designations of FMTs, and the order to the residents of Kathmandu to return to their home towns greatly reduced the congestion of the Capitol for emergency vehicles to operate. Since the earthquake occurred on a Saturday, school buses were used to transport people from Kathmandu. Oxygen factory was restarted under security protection by Nepal Army. Communication tools including cell phones were restored quickly.

Dr. Karki explained the coordination of FMTs according to their official deployment and levels of equipment, i.e. Level 1: Outpatient care, Level 2: Surgical care, Level 3: Intensive care. Equipped and trained FMTs were designated to the 14 severely affected districts. The Japan Disaster Relief (JDR) team had equipment for hemodialysis and was assigned to the field hospital in Sindhupalchok. Dr. Karki emphasized the importance of official deployment and logistical support of FMTs from the dispatching country. Otherwise, some voluntary FMTs with insufficient resources and logistics disrupt the operation and disappear eventually.

Fig. 5.4.7.a Minister Mr. Khagaraj Adhikari (left) talking with Prof. Egawa

Fig. 5.4.7.b Minister (center) and the task force members

Fig. 5.4.7.c Secretary, Dr. Lohani Guna Raj (back row, third from left) who was in charge of MoHP response at the disaster

Fig. 5.4.7.d Dr. Khem Karki at Nepal Health Research Council (back center) and Dr. Basu Pandey (back right), Director of Leprosy Control Division both of whom coordinated Health Cluster and FMT control at airport.

5.4.3.7 Patan Hospital

On July 28, we visited Patan Hospital, one of the governmental district hospitals in Kathmandu that treated more than 1,500 patients and performed 271 surgeries. It has the Patan Academy of Health Science (PAHS) to educate health professionals. Since other public hospitals in Kathmandu Valley were severely damaged, Patan Hospital played a significant role in disaster response although its non-retrofitted part was partially damaged.

Immediately after the Apr. 25 earthquake, the disaster situation was declared and patients who could be discharged were sent home. As it was Saturday, most of the staff were off and it took a while to gather staff. The Incident Command Center (ICC) was established within 60 minutes and triage was started in the area outside of the ER because of aftershocks (WHO, 2015g). At least two of five administrative members of the hospital should be in the ICC to continuously manage the response operations. Patan Hospital had performed a disaster drill three months before the Apr. 25 earthquake. Light, water and sanitation were managed as planned. The Surge Capacity plan was activated. The huge corridor of the ground floor was assigned as the Yellow Area (Fig. 5.4.8.a). The operating theater and Intensive Care Unit (ICU) were in the old building had not been retrofitted yet and was damaged severely.

Challenges of Patan Hospital were relocating the key facilities to outside the hospital including the field operating theater and its supplies and power circuits. During the transportation of patients in the ICU, some patients lost their lives because of the lack of electricity to drive ventilators and devices.

Fig. 5.4.8.a Indicator of Yellow Area. Green area was set outside of the building.

Fig. 5.4.8.b Entrance of Emergency Room designated as the Red Area

Fig. 5.4.8.c Partially destroyed ward in Patan Hospital

Fig. 5.4.8.d Retrofitted ward was fully functional

Fig. 5.4.8.e Patan Hospital provides psychiatry which is underserved in Nepal

Fig. 5.4.8.f Mother and Child Service Center provided reproductive health care during disaster.

Fig. 5.4.8.g Vice Chancellor Prof. Dr. Sangita Bhandary (third from left) and the survey taskforce. Most of the hospital and PHAS was retrofitted.

Fig. 5.4.8.h Library book shelf of PAHS. Medical education is in English and most of good quality medical journals are donated. Online journals are also available at the lowest cost.

The Black Area was created to place 57 dead bodies (WHO, 2015g). Security and gate control was maintained to secure belongings. Due to the hot temperature, help from local authorities to manage the bodies was inadequate.

Oxygen and water supply problems were faced from Day 3. Medication and food was adequate. Local people donated food materials and the hospital received only fresh uncooked materials to avoid food- and water-borne infectious diseases. Propane gas was the most commonly used for cooking. Water is usually from wells and tanks purchased daily which continued during and after the disaster. Patan Hospital accepted not only inpatients, but also their family and relatives at one of the biggest maternity facilities with tens of deliveries from before the earthquake. Pregnant women, postnatal mothers, newborn babies and small children are the most vulnerable during and after disaster. Tens of deliveries and Cesarean sections were carried out daily in the tents outside the hospital after the earthquake due to the surge after disaster.

Patan Hospital raised public awareness of hygiene and sanitation using local radio station and SNS to prevent the outbreak of epidemic-prone diseases and it worked well. Availability of propane gas also helped avoid the burning of debris for cooking and acute respiratory disease.

A help desk was established to provide general information to visitors and press. A name list of dead bodies was placed on a notice board. The armed police force was effective to control crowds visiting hospitals. Field hospitals were also protected by the Nepalese Army. After the May 12 earthquake, the triage operation and spatial management was much smoother.

Preparedness, stock maintenance, pre-arranged protocols and durable communication tools are essential for hospital emergency management. Safe hospital structures, non-structural and functional needs should be achieved. Since long before the earthquake, PAHS has been accepting many foreign doctors to provide opportunities to learn about community medicine in Nepal. Such networks and capacity building through education are important.

5.4.3.8 Annapurna Hospital

On July 28, we visited Annapurna Hospital in Kathmandu, a private hospital with 50 beds, which treated many trauma patients. The surgeons specialized in neurosurgery but reacted as general surgeons to save injured people. The structure of the hospital was not damaged by the earthquake and it did not stop running during the disaster. Electricity was immediately changed to the emergency power generator. Hospital safety was investigated one week after the Apr. 24 earthquake. Water was stocked in a reservoir tank underground. Cartridges of filters to make potable water were sent form relatives in U.S.A. and helped a lot. Foods were adequately provided from supporters and suppliers. The hospital also helped with temporary housing of employees. After surgeries, the rehabilitation of the patients became a big problem because of a limited number of beds. A step down facility was managed by collaboration with local NGOs to support patients with disabilities.

Hospital President Dr. Basant Pant obtained a Ph. D. in Japan and is closely connected with the Japanese Association of Neurosurgery and Japanese Society in Nepal. All treatment was given for free after disaster, but the people tended to go to the crowded public hospitals. President Pant insisted that the coordination and reimbursement mechanism from the government should be improved.

5.4.4 Discussion

There are certain limitations to capture the whole picture of disaster and its medical and public health management due to the sudden occurrence of the disaster and chaotic aftermath. However, this IRIDeS fact finding mission and emergency survey was performed three months after the Apr. 25 earthquake after preliminary contact with local counterparts such as Government of Nepal officers and researchers

in Tribhuvan University, UN agencies and NGOs, Embassy of Japan and JICA. If we visit immediately after the disaster, it is not possible for us to perform a self-sufficient survey and to obtain adequate information due to the chaotic situation and lack of resources. It will further cause harm for the people in the affected area.

There were some remarkable differences from the previous large scale disasters we have investigated as IRIDeS including the Great East Japan Earthquake (GEJE) in 2011 (Shibahara, 2011, Egawa, 2013a, b) and Typhoon Haiyan Disaster in Philippines in 2013 (Egawa, 2015). The anti-seismic disaster risk reduction was insufficient in Nepal and water-related hazards such as tsunami or storm surge did not affect Nepal, while heavy rain, landslides and flooding have definitely affected damage and evacuation.

The onset of disaster was unexpected but was on Saturday, a national weekend holiday in Nepal which is supposed to have reduced the number of victims especially in schools. The vulnerability of building structures is the root cause of disaster damage and resulted in a huge number of injuries and people's fear of shaking. If the standard building code was appropriately implemented, the number of deaths and injuries could have been greatly reduced. Similarly, injuries due to rushing out of buildings from fear of aftershock can be reduced. The PDNA pursues disaster risk reduction by implementing building codes, enforcing appropriate techno-legal regime, motivating people to retrofit unsafe structures, and adopting risk sensitive land-use planning for future development (Government of Nepal National Planning Commission, 2015).

People's health is damaged greatly both mentally and physically in disasters. Both aspects are closely related to each other and avoiding physical damage also helps prevent mental damage of the affected people. Psychological First Aid (WHO, 2011) prioritizes providing practical care and support which does not intrude to avoid causing further harm. Responders should assess the both physical and mental health needs of the affected people, especially of the vulnerable population including women, children, youth, older citizens, people with disabilities, indigenous people and anybody who needs special assistance. As recommended by SFDRR, the active participation of these vulnerable population as the stake holders improves and makes more human-centered disaster risk reduction. We have to be aware that the health risks change dynamically according to exposure to the hazard, vulnerability and capacity represented by the following equation, because this enables us to consider how to reduce disaster risk.

Risk = (Hazard exposure x Vulnerability) / Capacity

In Nepal, health risks were not only injuries, but also infectious disease outbreaks caused by poor sanitation. Promotion of public awareness by the Health Cluster with the WASH Cluster to use improved quality water and hygienic and sanitary conditions successfully prevented any outbreak of infectious disease except one.

Hospitals should be the last buildings standing in disaster to protect community health. The Safe Hospital Campaign has been promoted globally and multi-hazard measures are taken. Most of the tertiary district hospitals, except four, endured the earthquake after having been retrofitted with seismic strength. Partial damage did not stop hospital operations and the surge of medical needs were adequately managed by the Health Cluster led by MoHP, WHO, DHO and partners. Structural, non-structural and functional strength of the hospitals are essential for rapid response to disaster. In Nepal, the primary health care (PHC) facilities, especially outside Kathmandu Valley, were severely damaged by the earthquake and ceased functioning. The Health Cluster deployed national medical teams and FMTs to replace these PHC facilities and treated more than 100,000 patients. The available posts of these PHC facilities were, however, vacant before the earthquake, suggesting that the improvement of basic health level and shrinking the gaps between Kathmandu and remote areas are key issue for further development.

Education and training of health care professionals resulted in the successful achievement of providing treatment, coordinating support from national and global relief aid, managing FMTs and the influx of medicine and resources. Within a week from the disaster, the Government of Nepal and WHO ordered FMTs to stand down if they had not arrived in Nepal to avoid unnecessary congestion of Tribhuvan Airport. The Health Cluster coordinated the activities of FMTs and distributed several guidelines for trauma treatment, child and reproductive health as well as mental health by creating sub-clusters and working groups.

The Incident Command System of health administrators and coordination through a multi-sectoral approach achieved successful management. Pre-disaster education and training including MCM, HOPE and disaster drills strengthened the capacity of health workers. Mental health and psychosocial needs of health workers and responders were also recognized and supported by the Health Cluster.

Multi-disciplinary members of the emergency survey taskforce deepened the survey and understanding of both structure and infrastructure of society. Any sector cannot be functional without the harmonization of clusters. A multidisciplinary approach helps a lot to understand the functions of different clusters after disaster. Visits to the water/ water treatment facilities, WFP logistics center, and Sankhu Town with our team members deepened understanding of damages and preparedness. Nepal is a country of more than 100 ethnicities and languages. English is the official language, but Hindu spoken by one of our team members helped a lot to communicate with the local people.

We noticed the dignity of people of Nepal to deal with the huge disasters even though they may need help from outside. Building back better and reconstruction development can be achieved by their own efforts and governance. The Constitution of Nepal was adopted in Sep. 2015 but created a complicated situation between the surrounding countries, which stopped the influx of foods, fuels and resources necessary for the reconstruction. It may take time, but we believe in the resilience and dignity of people in Nepal.

5.4.5 Conclusion

The emergency survey taskforce visited Nepal after the devastating earthquakes and found that the disaster medical and public health management was very successful. The physical and mental health needs of the affected people were diverse and dynamic. The Health Cluster lead by MoHP, WHO and partners coordinated the health response activities through a multisectoral approach. National medical and public health preparedness of Nepal is impressive, though the health needs could have been greatly reduced by seismic retrofitting. People and health centered disaster risk reduction measures should be implemented by the autonomic mechanisms of people in Nepal in collaboration with international commitments through research, sustainable development and education.

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5.5 Disaster-related Infectious Disease Assessment

Author: Haorile Chagan-Yasutan and Toshio Hattori

5.5.1 Background and aim

Natural disaster is often accompanied by outbreaks of disaster-related infectious diseases (DRID) due to various risk factors which arise after disaster. Disasters inevitably increase chances of exposure to nature in affected people, who can be exposed to pathogens in soil and/or animals, vectors, crowdedness, stress and harsh climates. The expected DRID could be very heterogeneous and are affected by the area, climate and populations of the disaster area.

Nepal is a developing country located in a sub-tropical area having lots of issues and challenge for public health response and cost effectiveness and efficient intervention. Nepal has been facing different challenges of emergencies and re-emergencies of infectious disease burdens with equitable health services throughout the country.

On April 25, 2015, a 7.8-magnitude earthquake hit Nepal. In the aftermath of the earthquake and aftershocks, WHO raised concerns about the transmission of infectious diseases across Nepal. As pointed out in its May 26 report, "population displacement, crowding, limited quantities of safe water, inadequate hygiene and toilet facilities, and unsafe practices in handling and preparing food are all associated with disease transmission. There is a risk of an increase in communicable diseases, including diarrhea, respiratory infections, and mosquito borne diseases, particularly with the rainy season approaching soon" (Bagcchi, 2015).

In order to track risk factors and management of infectious diseases after the April 2015 earthquake in Nepal, we visited Kathmandu and Chitwan. In this survey, we try to understand how the disaster affected people and efforts to prevent epidemics of DRID.

5.5.2 Methods

We consulted colleagues and were introduced by Moti L. Chapagain, the former Principal Professor and Head of Microbiology of Chitwan Medical College. He recommended we survey Chiwan area because there will be a variety of infectious diseases, and future development of a medical center has been planned there. These conditions might be fruitful for us for future collaboration, and we decided to visit Chitwan Medical College (Chitwan is 150km from Kathmandu: 20 mins by air or 4 hours by road). In Chitwan, we also visited the government run Bharatpur Hospital.

In Kathmandu, we visited the National Tuberculosis Center and observed their activities as well as Laboratory. We also visited an infectious disease hospital/lab and other laboratories working on TB and other infectious diseases, including JE and dengue. We also visited the leprosy control division at the Department of Health and learned about their activities and had the chance to interview a health care officer of a remote-mountain area of Nepal.

5.5.3 Results

5.5.3.1 Hospital situation at Chitwan

Accompanied by Dr. Pandey (Director Leprosy Control Division, Department of Health Services, Ministry of Health, Nepal), we could visit Chitwan Medical College Teaching Hospital (CMCTH) and Bharatpur Hospital in Chitwan. In CMCTH, trauma was the most frequently seen in affected patients after the earthquake although it is a less affected area. We were told that a significant number of patients from the earthquake-affected area were sent to the hospital. There was an increase in cases of fever of unknown origin after earthquake, but it was not clear whether these diseases were caused by seasonal

reasons or DRID. According to doctors, common infectious diseases in this area include: tuberculosis, malaria, dengue, typhoid fever, hepatitis A&E, and influenza and there also may be leptospirosis and chikungunya. However, it is difficult to diagnosis patients due to the lack of diagnostic kits.

Fig. 5.5.1. With director and doctors of CMCTH.

Fig. 5.5.2. With an admitted trauma patient

Fig. 5.5.3. CMCTH Lab

At Bharatpur Hospital, even several months after the earthquakes, a long line of patients was seen at the outpatient department and many of the admitted patients lay on the floor due to the shortage of beds. Bharatpur Hospital is one of the Government-referred Post Disaster Management Hospital in Nepal and took care of more than 100 cases from earthquake affected areas by the end of July, according to Dr. Manik. In the Emergency Department, a fever of unknown origin is a big concern of the hospital and diagnostic tools were not available when we visited. According to the doctors in the hospital, more than 500 patients with dengue-like symptoms were admitted last year; however exact diagnosis was not done. Based on the above information, we realized that a simple and easy pathogen detection system is necessary for diagnosis.

Fig. 5.5.4. Admitted patients

Fig. 5.5.5. Discussion about patients

Fig. 5.5.6. At an isolation room

5.5.3.2 Prevention and management of infectious diseases in Kathmandu

In Kathmandu, we visited a government hospital and interviewed the associate director. It was found that the water supply and toilet facilities were prepared immediately after the disaster. The government also supplied food for disaster affected people. These preventive methods reduced the numbers of patients to even lower than before the earthquake.

5.5.3.3 National Tuberculosis Center in Kathmandu

In Nepal, 45% of the total population is infected with tuberculosis (TB). 40,000 people get TB every year; there are 20,000 new sputum positive cases and 5,000-7,000 people die each year from TB. Among TB patients, multi-drug resistant TB (MDR-TB) is in emergency status and the positive ratio is 2.2% in Nepal, according to the director. It is necessary to survey the occurrence of TB using rapid and sensitive diagnostic methods. Also a management strategy for prevention of infection is necessary in the post-disaster situation due to population displacement and crowded life in camp.

Fig. 5.5.7. With a director

Fig. 5.5.8. With a director, staff and Dr. Pandey

5.5.3.4 Leprosy Control Division

In Nepal, the prevalence rate of leprosy is more than 1 per 10,000 population, and stigma and discrimination is still a problem. How to take care of these patients in disaster is a major issue. Nepal has strong political commitment for leprosy control programmes and methods for distribution of drugs for these patients after disaster should be included as management of infectious disease in disaster.

Fig. 5.5.9. Visiting the Leprosy Control Division

5.5.3.5 The conditions in local areas

According to the interview with health care authorities in remote mountain areas, the water lines were damaged and food as well as safe water was not available and many patients suffered from diarrhea but causative pathogens were not identified.

5.5.4 Discussion

Although the April 2015 earthquake killed about 9,000 people and left many thousands more injured and homeless, no big outbreak of infectious diseases was reported in big cities because of empirical efforts by government, hospital, clinic and people. The reasons for the success of prevention in Kathmandu were as follows. First, the government asked people from outside Kathmandu to go back to their home; this strategy makes it more easy to manage safe food and water and also minimizes the number of admitted patients at Kathmandu hospitals. Second, government and hospitals distributed water filters and most hospitals gave boiled water and well cooked food for patients and their families. Third, government know their own risk of communicable diseases after disaster and had a prevention training for doctors and other health care workers just before the April earthquake; doctors at Patan Hospital told us that this training was very helpful. Finally, national vaccine programs have been done regularly and affected people had a strong enough immune system to prevent casual infectious diseases. In contrast to Kathmandu, many residents live in the remote mountain area and it is difficult to send food and safe water immediately. It should also be noted that in remote areas, people often live with animals in their houses. These animals also suffer from disaster and it would be important to save animals from infectious diseases in a holistic health concept so that humans could avoid zoonosis. Furthermore, information about these areas is limited and need more study.

Recently it has been revealed that the devastating quake that hit Nepal in April 2015 did not release all of the stress that had built up underground, and has pushed some of it westwards (Avouac, 2015). Therefore experts predict there will be a next earthquake. To prevent and know the risk of each infections diseases it is important to use point of care testing. For this purpose we are trying to establish a quick and effective diagnostic kit for infectious diseases in the post-disaster period in resource-limited settings. Also, it will be ideal if we could diagnose various infectious diseases in one kit in Nepal.

5.5.5 Conclusion

1. Outbreaks of infectious diseases have been prevented by optimal methods in Nepal.
5. Tropical diseases share the features of disaster-related infectious disease (DRID).
6. A holistic health concept should be considered to control the vectors and zoonosis.
7. Development of a simple and easy point-of-care testing is necessary for correct diagnosis for unknown fever especially in a disaster setting.

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5.6 Post-disaster mental health need assessment – seeking collaboration between Trubuvan University and Tohoku University

Author: Hiroaki Tomita

5.6.1 Background information

The following background information about Nepal is useful to understand psychosocial characteristics related to disaster mental health (based on the Nepal Earthquake 2015, Post Disaster Needs Assessment Sector Report issued by Government of Nepal National Planning Commission).

- Nepal is a landlocked country with high geographical diversity and is divided into three types of ecological zones, running from almost sea level to the highest point on earth. The nation is prone to a range of natural hazards.
- Between 1996 and 2006, a Maoist insurgency was aimed at establishing a communist state and reducing inequalities related to gender, caste, ethnicity, and rural-urban divides. A peace agreement has been followed by continued political instability, and a new constitution remains to be finalized.
- Economically, Nepal is classified as a low-income country with low levels of development. The economy revolves strongly around agriculture, but as of recently remittances from migrant workers in Gulf countries have formed almost a third of income.
- Over 60 different languages are spoken by more than 35 ethnic groups. Most people adhere to Hinduism (81%) and Buddhism (9%). Although forbidden by law, the Hindu caste system is an important principle of social organization. The caste system is complex and currently undergoing changes, but plays a role in distribution of political and economic privileges.
- Gender disadvantage varies across ethnic groups, with most ethnicities adhering to greater or lesser degree to a patriarchal value system. Suicide is the leading cause of death for women of reproductive age.
- Cultural and religious identity can influence the experience of a traumatic event and ways of (collective) healing and coping. Government health care is free of charge, but access to health care in rural areas is limited. Most people use multiple health systems, including Ayurveda, Tibetan medicine and shamans, with allopathic (biomedical) care often as a last resort.
- Most research on mental health in Nepal has focused on populations affected by political violence. Around 15 to 20% will have a mild or moderate mental disorder (e.g. mild and moderate forms of depression and anxiety disorders, and PTSD). Around 3 to 4% will have severe mental disorder (e.g. psychosis, severe depression, severely disabling form of anxiety disorder).
- Broadly, for many Nepali-speaking groups the heart-mind (man) is the organ of emotion and memory, whereas the brain-mind (*dimaag*) is the organ of cognition and social behavior, which regulates behaving appropriately. Other aspects of the self that are affected by mental health and psychosocial problems include one's social status, spirit/soul, physical body, family and social connections, and ancestral connections.
- Mental health and psychosocial problems can be attributed to life stress, physical illness, religious infractions, bad karma, and being born with an inauspicious astrological forecast (e.g., poor fate). In Nepali and other languages spoken in Nepal, there are no terms that directly translate as biomedical psychiatric categories, such as depression, PTSD. Idioms related to "mental" illness (e.g., *maanasik rog, maanasik samasya*) represent problems with the brain-mind, which are often perceived as incurable and highly stigmatized. Idioms related to the heart-mind (e.g., *manko samasya, manmaa kura khelne, manma pir padne*) are perceived as something that can be healed and are generally socially acceptable to discuss. Traumatic intrusive memories related to disasters can be described as

wounds/sores on the heart-mind (*manko ghau*). Somatic complaints are also common among persons with psychological distress; examples include paresthesia/numbness or tingling (*jhamjham aaune*), abdominal pain/acid reflux (*gyastrik*), headaches and head burning (*thauko dukhne, kapaal polne*). Families are likely to seek multiple forms of care simultaneously for mental health problems and may present the same distress in different ways to different practitioners. Much help-seeking takes place outside the formal mental health system. Women, despite carrying a greater burden of mental health problems, may be less likely to pursue formal care in Nepal. Trauma survivors, such as torture and disaster victims, may feel responsible for negative life events affecting them and their families and thus may be less likely to seek care. Care for suicidality is rarely sought through biomedical services due to fear of police involvement, as suicide is a crime in Nepal. Traditional healers are the most prevalent care practitioners in Nepal and are often the first point of call for individuals with mental health problems. Some traditional healers, for example *dhami-jhankri, lama*, or *gurua*, address psychological distress by appeasing the spirits or witches believed to be responsible, or calling back a lost soul. Tibetan Medicine is another traditional healing system with an extensive psychiatric/psychological practice including diagnosis and treatment of stress and conditions resulting from traumatic events.

- In the social sector, a number of local and international non-governmental organizations offer psychosocial support services, some with the capacity to train non-specialists using concise, manualized training programs to deliver psychosocial support. Combined, these organizations have trained hundreds of psychosocial workers, the vast majority of whom have completed short courses. Several publications also emphasize the importance of building appropriate psychological and mental health interventions into the education sector to reach children. Many vulnerable groups are excluded from education, and physical and psychological punishments practiced commonly in schools have been demonstrated to lead to depression and suicidality among students. The informal sector, including families, friends, neighbors, local religious and cultural assemblies, and community-based organizations, such as women's groups, mothers' groups, child clubs, youth groups, is the most common site of help-seeking for mental health and psychosocial problems in Nepal due to the perception that family and religious supports are more appropriate contexts for disclosure and coping. Informal sector supports often focus on solving problems perceived to be the root causes of distress (e.g., economic problems), rather than simply providing an outlet for emotional catharsis. Based on social hierarchy, informal sector supports, especially religious-affiliated groups, may exclude marginalized groups who also carry the greatest burden of mental health and psychosocial problems.
- In Nepal, there is no mental health act and the National Mental Health Policy is yet to be fully operational, though several policy frameworks do make mention of mental health.
- The current National Mental Health Policy for Nepal aims to: (1) ensure minimal mental health services for the entire population, (2) develop human resources through training programs for specialist and general health Workers, (3) protect human rights of the mentally ill, (4) improve awareness about mental health.
- The state-run mental health facilities include approximately 400 beds and human resources consisting of 0.18 psychiatrists, 0.25 nurses, and 0.04 psychologists per 100,000 people. There is a lack of infrastructure to support mental health services, resulting in poor supply of drugs at the grassroots level and poor referral pathways from primary to tertiary services. There is a lack of standardized practices for prescribing psychiatric drugs among health workers. Help-seeking through psychotropic medication is increasing throughout Nepal, and most psychiatric drugs can be obtained without a prescription.

- Less than 3% of the national budget is allocated to the health sector, putting the health budget at US$330 million in 2010. One percent of this was allocated to mental health, and 0.08% was actually spent on mental health (IRIN, 2013, and Jordans, 2010).
- Mental health and psychosocial relief are not adequately addressed in the Health Sector Emergency and Disaster Response Plan of the Ministry of Health, but several concrete initiatives have taken place to plan and prepare for mental health and psychosocial support in emergency situations. There is one hospital in the country, located in Kathmandu, exclusively devoted to psychiatric and mental health care. Outside of Kathmandu, there are four government hospitals that offer psychiatric services, located in Bharatpur, Pokhara, Nepalgunj, and Biratnagar.

5.6.2 Aims

The aims of the 3rd Nepal Visit of IRIDeS Post-Earthquake Response Team are as follows.

1. Meeting with Dean of Tribhuvan University (TU) Institute of Medicine (IOM) for discussion on a Memorandum of Understanding (MOU) between TU-IOM and IRIDeS, and potential collaboration between the two institutes
2. Meeting with Executive Directors of TU Teaching Hospital for discussion on potential collaboration between TU-TH and IRIDeS
3. Meeting with Prof Ojha and members of the Dept. of Psychiatry for interviewing about the background situation (mental health before the disaster and current situation of post-disaster mental health of the society) and discussing collaborative plans on post-disaster mental health issues.
4. Meeting with the founder of AMDA and members of AMDA Nepal
5. Grasp current situation of TU-IOM and Nepal

5.6.3 Methods

Hiroaki Tomita, Prof, Dept. of Disaster Psychiatry, IRIDeS, visited TU-IOM during September 3rd – September 6th, 2015, and had a meeting with representatives of TU-IOM to share information on the effects of the disaster and available resources to rebuild communities, and discuss collaborative relationships between TU-IOM and IRIDeS.

5.6.4 Results and discussions

5.6.4.1 Meeting with Dean of TU-Institute of Medicine (IOM) for discussion on MOU between TU-IOM and IRIDeS, and potential collaboration between the two institutes

A meeting was held with Prof. Rakesh Prasad Shrivastav MS FRCS (ENT Head & Neck Surgeon), TU IOM Dean, Prof. Bimal Kumar Sinha MBBS MS (ENT Head & Neck Surgeon), TU IOM Assistant Dean (Planning), Prof. Saroj Ojha and Hiroaki Tomita (Fig. 5.6.1). The following issues were discussed, and agreed on among the attendees.

- Agreed to proceed with the MOU, and cultivate a collaborative relationship
- Collaboration on post-disaster mental health would be concrete.
- It can be expanded to other collaborations. Disaster response, medical information can be issues.

5.6.4.2 Meeting with Executive Directors of TU Teaching Hospital for discussion on potential collaboration between TU-TH and IRIDeS

A meeting was held with Prof. Deepak Prakash Mahara (Arthroscopy/Arthroplasty Surgeon), Executive Director, Prof Prem Krishna Khagda, Professor of Department of Gastrology, Dr. Ojha and Tomita (Fig. 5.6.2). The following issues were discussed and agreed among the attendees.

- A MOU between IOM and IRIDeS would be favorable.

- Collaboration between the two institute should begin with one activity focused on post-disaster mental health issue, and can be expanded to other areas.
- Infectious disease control, public health, medical information, disaster response, obstetrics and gynecology can be issues. It is understandable that radiation is an important issue in Japan.
- Information regarding HOPE program will be shared with IRIDeS.

Fig. 5.6.1.

Fig. 5.6.2.

5.6.4.3 Meeting with Prof Ojha and members of the Dept. of Psychiatry for interviewing about the background situation of psychiatry and mental health before the disaster and current situation of post-disaster mental health of society, and for discussing collaborative plans on post-disaster mental health issues

In the aftermath of the earthquake, the Tribhuvan University Teaching Hospital (TUTH) Department of Psychiatry has been involved in providing mental and psychosocial support to the affected population. THTH and other organizations are providing the following services:

- Training to health workers on mental health interventions for earthquake affected population
- Translation of international documents on emergency
- Mental health services to the affected population at district hospitals
- Mental health services to the affected population at the community and household levels
- Psychosocial counseling services at district hospitals and the household level

Dr. Ojha introduced his post-disaster activities via media. This time, media has been very effective for psychosocial education. People have become more aware of mental health issues. So far, no systematic survey has been done on mental health issues.

Fig. 5.6.3.a, b

A meeting with Mr. Suraj Sigdel and Dr. Ojha was held to discuss detailed collaborative research plans. Then a meeting with other faculty of the Dept. of Psychiatry was held to share information regarding mental health activities in Nepal. Finally, a meeting with resident doctors was held in the psychiatric ward. Staff of the Dept. of Psychiatry have been going back and forth to the affected communities to provide mental health support, however no systematic survey has been done. There are 16 districts out of 75 in Nepal severely affected by the disaster. The area is over 100km, so it has been done as a 1-week rotation program.

There used to be only around 20 psychiatrists and only one medical school in Nepal. However, currently, there are 3 public medical schools and several private medical schools and 5 psychiatrists/ per year have newly obtain medical certification in TU-IOM alone, and 15 psychiatrist/per year in the country. So, there are over 100 psychiatrists in Nepal. However, the problem is that the majority of them are concentrated in Kathmandu. That is directly related to Dr. KC's hunger strike. Currently, all resident doctors of TU-IOM are on strike. A considerable number of beds have been closed, and only faculty see urgent patients. Sonya Martin, MD, CIWEC Hospital PVT. LTD. joins 1 time/week to the activities of the Dept. of Psychiatry, and her husband is an anthropologist.

Fig. 5.6.4. a, b, c

5.6.4.4 Meeting with the founder of AMDA and members of AMDA Nepal

5.6.4.4.1 Meeting with the founder of AMDA (September 2, 2015)

A meeting with Shigeru and Tomoko Suganami was held to discuss potential collaborative relationships.

5.6.4.4.2 Meeting with members of AMDA Nepal (September 3, 2015)

A meeting was held with Dr. Saroj Prasad Ojha, Chairperson, Dr. Anil Kumar Das, Secretary (Dermatologist), Sudesh Regmi, Senior Administrator, Jeevan Pd. Ojha, Advisor (Butwal Chamber of Commerce & Industry, Rupandehi)

5.6.4.5 Grasp current situation of TU-IOM and Nepal

Activity of TU-IOM was seriously affected by political conflict regarding medical policy of the government. Usually, there are long lines of patients, however, currently there are very few due to the strike.

Fig. 5.6.5. Tribhuvan University Teaching Hospital

Fig. 5.6.6.a Right after the occurrence of the Nepal Earthquake 2015, the Red Area was located in the entrance of the emergency room.

Fig. 5.6.6.b, the Yellow Area was located on the right-side area.

Fig. 5.6.6 c. The Green Area was located in the left-side area of the picture.

5.6.4.6 Meeting with Dr Gobinda KC

Dr. Yogendra P. Singh, MD PhD, FICS, Professor Surgical Oncology, Dept of Surgery, along with Dr Ojha, arranged a meeting with Dr. KC (Fig. 5.6.7 a, b).

Fig. 5.6.7. a, b

The following information is reproduced from newspaper articles:

- "Dr. KC to begin hunger strike today" Post Report, Kathmandu, Published: 24-08-2015 12:11. Aug 24, 2015- Senior orthopaedic surgeon at Tribhuvan University Teaching Hospital (TUTH) Dr Gobinda KC will start his hunger strike from 4 pm today. KC will stage his sixth fast-unto-death at the TUTH premises demanding reforms in the country's medical sector.
- "Govt holding talks with Dr KC's supporters" Post Report, Kathmandu, Published: 03-09-2015 19:50
- Medical students take out a rally in support of Dr Govinda KC in New Baneshwor, Kathmandu, on Wednesday. Dr KC is on a hunger strike for the past 10 days to press the government to implement the recently unveiled Health Profession Education Policy drafted PRAKASH TIMILSENA

Fig. 5.6.8.a, b

5.6.5 Discussion

The following three issues were highlighted through discussions with Nepali mental health workers. Collaboration would be focused on the following 3 issues:

- Mental health survey on communities affected by the disaster
- Developing post-disaster mental health education systems for local community and evaluating the effect of the program
- Assess social awareness of mental health and post-disaster mental health.

The grant proposal integrating the above plan will be submitted to several grant funding agencies. Mr Suraj Sigdel, along with Prof Ojha, would be a person in charge of integrating information regarding the collaborative projects. The project might include transcultural issues. Variance in mental health among tribes can be an interesting theme.

Collaboration between the two institute should begin with one activity focused on post-disaster mental health issues, and can be expanded to other areas. Infectious disease control, public health, medical information, disaster response, obstetrics and gynecology can be issues.

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5.7 Housing and Education Recovery Assessment

Authors: Aiko Sakurai and Elizabeth Maly

5.7.1 Background

The Nepal Earthquake that struck on April 25, 2015, followed by aftershocks, with the largest on May 12, caused severe damage including loss of life, building damage, and destruction of lifelines and infrastructure. Over 8,790 people were killed, more than 22,300 were injured, and more than 8 million people were affected, almost 1/3 of the total population of Nepal (National Planning Commission, 2015). Response and relief were complicated by pre-existing poverty and development challenges, as well as geographical difficulties of reaching remote and devastated mountainous areas. Moreover, with recent political upheaval following years of conflict and instability, Nepal's new permanent National Constitution was only approved several months *after* the earthquake, at the same time that national level recovery measures and agencies were being established. Within this context, both the housing and education sector suffered heavy damage, and face large challenges for recovery.

5.7.2 The Sendai Framework, Build Back Better, and connection of housing and education

In recent years, the concept of "build back better" has become widely used as a guiding principle for disaster recovery, both in housing and education recovery. Adopted in March 2015 at the 3rd World Conference of Disaster Risk Reduction, the Sendai Framework for Disaster Risk Reduction (SFDRR) emphasized building back better. The SFDRR also linked housing and education in recovery in Priority 3 at the national and local level 30 (j) in the post-disaster phase, and calling for:

> *Strengthening the design and implementation of inclusive policies and social safety-net mechanisms, including through community involvement, integrated with livelihood enhancement programmes, and including maternal… housing and education… towards the eradication of poverty, to find durable solutions in the post-disaster phase and to empower and assist people disproportionately affected by disasters* (SFDRR, 2015).

Although community-based holistic disaster recovery has been promoted in both housing and education sectors, as of yet, specific connections between housing and education recovery are rarely discussed.

With the support of many national experts, line ministers, and development partners, Nepal's National Planning Commission carried out a post-disaster needs assessment. Including *Volume A: Key Findings*, and *Volume B: Sector Reports*, the *Nepal Earthquake 2015 Post Disaster Needs Assessment* (PDNA) report (National Planning Commission, 2015) was published before the International Conference on Nepal's Reconstruction (ICNR) held on June 25, 2015 (Ministry of Finance, 2015). The PDNA also calls for a recovery that includes several issues highlighted in the SFDRR as key factors: the concept of Build Back Better; and an integrated model of recovery that takes vulnerabilities and community knowledge into account and emphasizes communities themselves as stakeholders (National Planning Commission, 2015).

As the first large disaster after the SFDRR, recovery after the 2015 Nepal Earthquake will be the first that can embrace these principles, and apply them towards a people-centered and resilient recovery. In this context, this report represents an attempt to understand the situation of damage and recovery in the housing and education sectors in Nepal after the 2015 earthquake, as well as possible connections between housing and education in ongoing recovery.

5.7.3 Survey methods

After reviewing key relevant literature and reports, and receiving advice from experts with field research experience in Nepal, the authors visited Nepal from December 5-December 10, 2015. Because of limited time and the ongoing fuel shortage caused by a blockade by India, the survey focused on areas within the Kathmandu Valley, with attempts to learn from local experts and focus on an accessible local area in more detail. To grasp the basic situation of post-earthquake reconstruction and disaster prevention in Nepal in the education and housing sectors and consider connections between these sectors for future resilience in disaster recovery, the field survey had three goals: 1) to clarify the current situation of housing recovery; 2) confirm the damage and recovery in the education sector, and 3) to identify potential connections between housing and education for disaster risk reduction in recovery. To ground the survey and these questions in a localized context the field visit focused on one location, the village of Khokana, which is a traditional Newari settlement in Lalitpur District within Kathmandu Valley.

Interviews were held with experts in housing and education, including professors at Tribhuvan University, the National Society for Earthquake Technology-Nepal (NSET), UN Habitat, and JICA. In addition, the team visited Khokana village several times, and learned from a representative of the Khokana Reconstruction Committee and Loo Niva Child Concern about challenges of both housing and education recovery in Khokana. Interviews were also conducted with head teachers at four local schools.

5.7.4 Housing recovery situation

5.7.4.1 Housing damage

With almost 500,000 houses completely destroyed and more than 250,000 houses partially damaged, housing and human settlements was the sector with the largest damage (National Planning Commission, 2015). A major factor that contributed to the large-scale destruction of housing was the prevalence throughout the country of unreinforced masonry houses, which are extremely vulnerable to earthquakes (National Planning Commission, 2015). 58% of all housing in Nepal is constructed with stone or brick masonry with mud mortar without any seismic reinforcement (National Planning Commission, 2015). Based on data from the Ministry of Home Affairs (MoHA), the 2011 National Census, and the assessment of NSET, the PDNA calculated that 95% of completely destroyed houses and 68% of partially damaged houses had been built of low-strength masonry (National Planning Commission, 2015). Based on the number of households that became homeless, the PDNA calculated there would be a need for the reconstruction of almost 610,000 new houses (National Planning Commission, 2015).

5.7.4.2 Shelter Cluster coordination

The Global Shelter Cluster is the coordination mechanism providing humanitarian shelter assistance to people affected by disaster and conflict (http://www.sheltercluster.org). Part of the UN Cluster system created in 2005, the Shelter Cluster (SC) has coordinated housing support after subsequent major disasters. The SC has been functioning in Nepal since the 2009 Koshi Flood; after flood response activities were complete, the SC has been focusing on contingency planning and preparedness (Shelter Cluster Nepal, 2015d). Shelter Cluster Nepal is co-led by Nepal's national Department of Urban Development and Building Construction (DUDBC), the International Federation of the Red Cross (IFRC) and Nepal Red Cross Society (NRCS). The Cluster works closely with its 120 partner agencies involved in shelter interventions, "to ensure coordination, technical support, and high-level information management between all bodies" (Shelter Cluster Nepal, 2015d). With 4 hubs (Western, Northeastern, South Eastern and Central) in disaster-affected areas, the SC holds regular coordination meetings, and through its website, http://www.sheltercluster.org/response/nepal-earthquake-2015, the Cluster serves as a information clearinghouse for housing issues, including district profiles and situation reports, technical

advisories, government directives and other reference materials. An interactive Dashboard (http://www.sheltercluster.org/node/8172) with an map interface that shows shelter activities in 14 priority districts can be filtered by organization, type of support, and percent complete (Shelter Cluster Nepal, 2015b).

Since the 2015 Nepal Earthquake, the SC has been involved in coordinating various partner agencies' activities from emergency response, temporary sheltering, and planning for permanent housing recovery. The distribution of tarpaulins/tents and blankets was prioritized in the emergency phase, along with packages of non-food items (NFIs)—tool kits or "household kits" that include tarpaulin, blankets, nylon rope, kitchen utensils and clothing (Shelter Cluster Nepal, 2015c). For the temporary housing phase, the SC "recommends material and cash support, with the addition of advice and information, to support households build and improve temporary shelter in the most appropriate and suitable way," which is aligned with the Government of Nepal's plans to provide a 15,000 rupees to households with fully destroyed houses to buy 2 bundles of corrugated galvanized iron (CGI) sheets (Shelter Cluster Nepal, 2015f).

With not all areas receiving coordinated assistance, there were also many reports of spontaneous and independent community-based mutual assistance, especially as young Nepalese organized to collect and distribute aid to local communities, often harnessing the power of social media and international network of Nepalese in other countries (Chetri, 2015, Ekin, 2015 and Carpenter, 2015).

In addition to supplies for shelter construction, additional guidance for materials for winterization measures was developed by the SC Winterization Technical Working Group. Targeting households in mountainous areas 1500 meters or more above sea level, the distribution of winterization packages was a priority for shelter agencies in December 2015, as the coldest winter months are between December and February. According to the *Winterization Update* of Nov. 2015, there was an estimated target of more than 200,000 people living in temporary shelter at altitudes of 1500 meters or higher (Shelter Cluster Nepal, 2015e). As of the final SC meeting in early December 2015, distribution of only 40,000 kits had been completed (Shelter Cluster Nepal, 2015g).

The Government of Nepal (GoN) announced the permanent housing reconstruction program in June 2015, but primarily because of unresolved political and governmental issues, the implementation of this program has been delayed. Shelter Cluster Nepal partner agencies will be involved in permanent housing reconstruction in coordination with the GoN, and related preparation and coordination is ongoing. Co-led by UN-Habitat and the International Organization for Migration (IOM), the Recovery and Reconstruction Working Group (RRWG) was established within the SC, with the goal of becoming a platform for "coordination, strategic coordination, and technical guidance" for agencies involved in long-term recovery, and to coordinate partners' activities with the GoN housing reconstruction plan (Shelter Cluster Nepal, 2015f). The RRWG was launched in August 2015 within the current SC structure for responding to the 2015 earthquake; after January 2016, it is planned the the SC will scale down their activities to focus on preparedness, monitoring of remaining humanitarian needs over winter, and response to other emergencies, similar to their pre-earthquake functions. In January 2016, the RRWG will be replaced by the Earthquake Housing Recovery and Reconstruction Platform (HRRP), which will also be co-chaired by UN-Habitat and IOM. The authors had the opportunity to attend the last SC meeting on Dec. 8, 2015, where the HRRP was announced and its new co-chairs were introduced to partner agencies and participants (Shelter Cluster Nepal, 2015g).

5.7.4.3 Plans for permanent housing reconstruction and recovery

Although the PDNA released in June 2015 already included the Government of Nepal's plan to distribute 200,000 rupees (almost $2000) for reconstruction to each household whose house was completely destroyed, the implementation of this plan was stalled by delays in creation of the National

Reconstruction Agency and related recovery measures. This in turn was delayed and complicated by the concurrent process of establishing a permanent national constitution, finally adopted (after 10 years) in September 2015, which resulted in a new parliament, while at the same time there were a series of political crises (Sharam and Najar, 2016).

The creation of the National Reconstruction Authority (NRA), a centralized body to oversee earthquake reconstruction, was announced in September 2015, but the appointment of the first chief executive was never approved by Parliament. After a new government was elected in October, the new Prime Minister appointed a new chief executive of the NRA on Dec. 26, 2015 (Sharma and Najar, 2016). The NRA will oversee the finalization of housing models, provide related financial assistance for housing reconstruction, as well as be responsible for rebuilding schools, hospitals, and other buildings and infrastructure (Sharma, 2015). Almost 9 months after the earthquake, the NRA officially announced the National Reconstruction Campaign on Saturday January 16, 2016, a date timed to coincide with January 15th, the anniversary of the 1934 Earthquake, observed in Nepal as National Earthquake Safety Day. However, the actual disbursement of funds or reconstruction of housing will not begin until April 2016, a full year after the earthquake (Sharma and Najar, 2016).

Since the housing reconstruction plan was first announced in the PDNA in June, principles for housing reconstruction included: residents' participation and an owner-driven housing recovery; a holistic reconstruction with build back better applied to safer settlements as well as houses; and building long term community resilience by reducing vulnerabilities and improving construction practices (National Planning Commission, 2015). In October 2015, Nepal's national Department of Urban Development & Building Construction (DUDBC) released the Design Catalogue for Reconstruction of Earthquake Resistant Houses which is planned as the design and building guidelines for individual housing, and to "provide rural households with clear guidance regarding earthquake resistant construction techniques and to support them to have house designs in compliance with the National Building Code of Nepal," (DUDBC, 2015). These designs were created as suggestions for a variety of housing design options for rural reconstruction, but are not mandatory (DUDBC, 2015).

According to the the introduction of the HRRP at the SC meeting on Dec. 8, 2015, the HRRP will coordinate with the GoN to implement a rural housing reconstruction program modeled on the owner-driven housing reconstruction program that was carried out in Pakistan, which has become an internationally recognized good practice and model for housing recovery (Arshad and Athar, 2013). Following that example, support for housing reconstruction would be dispersed in 3 tranches, with inspections to check for building safety before the next tranche is dispersed. Based on discussion at the Dec. 2015 SC meeting, a key issue for coordination between humanitarian agencies and NGOs may be related to housing provision, to avoid duplication of permanent housing benefits. GoN's owner-driven housing recovery program will target exclusively rural housing reconstruction, and the 200,000 rupee housing reconstruction grant is intended only for households with completely destroyed houses. As of December 2015, there were no government measures announced to address potential gaps in beneficiaries, including those households in non-rural areas, outside of targeted districts, or with partial housing damage. In interviews, housing experts acknowledged the importance of these issues and the need of support for these groups, as well as for the large number of renters in Kathmandu urban area.

5.7.4.4 Safe building construction: Linking reconstruction of housing and schools

Earthquake resident construction and building the capacity of builders, especially masons, was a key theme for government programs as well as non-governmental organizations involved in reconstruction planning. Training for masons is planned as a part of the GoN's housing reconstruction; masons will then lead the construction with community members building houses.

The National Society for Earthquake Technology-Nepal (NSET), a leader of earthquake safe building practices and retrofitting, also has been involved in various building safety initiatives in the last several decades, as discussed in more detail in the following section on schools and education. NSET takes a community-based approach to all activities, including mason training; not only are masons themselves involved, but local residents are also invited to observe the training, with the goal of raising awareness and understanding of safe building practices throughout the community. By using this kind of community-based construction training for retrofitting schools, knowledge of safe building practices can also be introduced for housing construction, as the community's capacity is developed holistically and local workers begin to incorporate safe building techniques.

One serious concern that was raised was related to the use of appropriate technologies in reconstruction. The Design Catalogue (DUDBC, 2015) for housing reconstruction includes four possible building materials and combinations (stone or brick, combined with concrete or mud mortar). Whereas the most common types of existing buildings are those with mud mortar, some donor agencies will not support anything less than very high seismic resistant construction using cement. However, requiring this level of structure causes additional difficulties for construction, such as the additional cost and transportation required to bring cement to remote areas. As the 200,000 rupee grant for housing reconstruction will likely not be enough to build an entire house, requiring the more expensive "safe" materials also creates an additional economic burden for the household. Conversely, people may accept the initial concrete house, and then add on with poor quality materials. Finally, donors who make these stipulations will be limited to helping only wealthier residents who can afford the more expensive materials, thereby allocating their resources away from those who need support the most.

5.7.5 School and education recovery assessment

5.7.5.1 Damage to the education sector

The education sector in Nepal was severely affected by the 2015 Earthquakes. 35,986 classrooms were destroyed and 16,761 additional classrooms were damaged. In addition to the impact on education facilities and buildings, children and their care-givers in the affected areas are in need of psychosocial support and the protective environment that education can provide (Nepal Education Cluster, 2015a).

5.7.5.2 Education system and educational development in Nepal

In Nepal, the structure of education consists of pre-primary education (from age 3 for 2 years), primary education (from age 5 for 5 years), lower secondary education for 3 years, secondary education for 2 years, and higher education for 2 years. Currently primary education is free and compulsory, with government plans to extend to this to lower secondary education as well.

Since the 1990s the Government of Nepal, supported by international donors, has been implementing educational sector reforms and several educational projects to attain internationally agreed upon educational goals, such as Education for All (EFA) and Millennium Development Goals (MDG). Among several educational goals, increasing the number of students at the primary education level is the top priority. In the last ten years, the net enrollment rate at the primary education level has improved and attained 95.3% in 2012/2013 (UNESCO, 2015a). The government pursued several strategies to achieve universal education for all: bringing schools closer (within 30 minutes) to settlements; abolishing school fees including registration fees, tuition, school operation, and textbooks at primary level; and ensuring children's basic needs are met in schools, such as drinking water, separate toilets for girls, safe environment and mid-day meals in disadvantaged schools (UNESCO, 2015a).

However, the enrolment ratio only represents the percentage of pupils attending primary schools out of the total population of primary school-aged children. High rates of repetition and dropouts still remain major issues due to poor quality of education, lack of school capacity, and lack of parental support, etc.

According to the 2011 Census, 1.2 million school-aged children (15% of the total school-aged population) are out-of-school in Nepal. Educational development in Nepal faces many socio-economic challenges to achieve EFA goals, including income disparity, geographical disparity, gender disparity, disparity by caste and disability, disparity among public schools, and between public and private schools (Ishida, 2015).

5.7.5.3 School governance in Nepal

The community school system is the main mechanism for providing basic education in Nepal. The 1999 Local Self Government Act articulated the transfer of school management to local bodies, including district development committees (DDCs) and village development committees (VDCs) to enhance local ownership in school management. The seventh amendment to the 2001 Education Act further accelerated the reallocation of responsibility to the community level by empowering school management committees (SMCs). Communities have both authority as well as responsibility to develop and operate schools to address needs for quality education. The government provides earmarked funds to support school development activities for teacher salaries, grants for scholarship, and free textbooks. Although the community school system is legalized and international donors support the increasing capacity of school management committee, in reality community participation in education is very limited. Corruption among educational authorities at district level and political intervention into education are serious problems that hinder real community participation in education (Bhatta, 2009, and UNESCO, 2015a).

5.7.5.4 Safe school initiatives in Nepal

The National Society for Earthquake Technology-Nepal (NSET) is a pioneer of promoting school retrofitting in Nepal, along with international donors such as the World Bank, ADB, and UNDP. A continuous initiative led by NSET since 1999, the School Earthquake Safety Program (SESP) is a holistic approach to improve the earthquake safety of communities by intervening in schools. SESP assists in making schools safer against earthquakes through seismic strengthening of school buildings, training school teachers, students and parents on earthquake safety and enhancing earthquake preparedness of schools. It also focuses on making communities safer by propagating the knowledge from schools to the communities, and training local masons on safer construction practices. NSET so far has retrofitted 125 schools from 1999-2014 through its own projects/programs and in total 364 school buildings have been retrofitted (NSET 2014).

5.7.5.5 Education Cluster

With heavy damage to the education sector from the 2015 Nepal Earthquakes, the Education Cluster was activated on 26 April with all the clusters as part of the UN coordination system. Priority actions of the Cluster were to provide early childhood development (ECD) and access to protective learning spaces for school-aged children, and to support targeted children to acquire lifesaving and disaster preparedness skills and psychosocial support to restore wellbeing and build the resilience of children and their communities. Of an estimated 3.2 million school-aged children in earthquake-affected districts, the Education Cluster targeted 1.5 million children in the most severely affected areas. Due to the earthquakes, 2.2 million school-aged children were at risk to be out of school. The Education Cluster requested 24.1 million USD for assistance; 11.3 million USD (47%) was funded as of June 2015. The Education Cluster had 73 partners, including 37 international NGOs, 32 national NGOs and 4 UN agencies, and was led by Department of Education, UNICEF and Save the Children.

As of the end of June 2015, the Cluster had supported the establishment of 1007 Temporary Learning Centers (TLCs) and Child Friendly Spaces (CFS) in 16 districts, about 22% of the target of 4,668, and had provided 100,700 children with access to the TLCs. Out of a target of 19,000, 94 teachers and facilitators (0.4%) had been trained on psychosocial support. A total of 4,500 schools had been

structurally assessed. After the Government of Nepal reopened schools on May 31, 2015, the Cluster coordinated with school management communities and VDCs (Nepal Education Cluster 2015b). Delays in the education sector were partly the result of the paralyzed overall recovery process, political turmoil and economic sanctions posed by the Indian Government in relation to the newly established constitution.

5.7.6 Key findings from the survey in Khokana

5.7.6.1 Background

The Newar people have lived in the Kathmandu area since the Malla Dynasty, which started in the 12th century and lasted for 600 years. With their own language and customs, Newari culture is still alive in the Kathmandu Valley, and visible in the form of local customs including traditional Newari architecture and settlements. The village of Khokana is less than 10 km south of Kathmandu, in the district of Lalitpur. Khokana is a traditional Newari village with most residents belonging to the Jyapu, the Newari farming caste. Along with production of mustard seed oil, which is done in cooperatives that have also existed for centuries, most people in Khokana are farmers, with main crops including wheat, potatoes, and mustard seed. A traditional Newari settlement, Khokana is organized into a unique pattern of 4 streets radiating from a central square. With vernacular brick Newari architecture, Khokana is a "model of a medieval settlement pattern with a system of drainage and chowks" [town squares], (Figs 5.7.1 and 5.7.2), with the living heritage of mustard seed old production, and has been included in UNESCOs tentative list for nomination for World Heritage status (UNESCO, 2015b). Buildings in Khokana suffered heavy damage in the earthquake with 80-90% of housing becoming unlivable. Damage was especially severe for structures that were built with unreinforced masonry/unfired mud bricks. In many cases, the façade was built from stronger, fired bricks, and other parts built with mud bricks had collapsed (Fig. 5.7.3).

Fig. 5.7.1. Main Square and temple

Fig. 5.7.2. Traditional building in Khokana

Fig. 5.7.3. a,b, Damaged houses, Khokana, Dec. 2015.

In December 2015, many residents were staying in temporary housing (primarily made of corrugated metal sheets, Fig. 5.7.4) that they had built on their own fields or other properties nearby the village. Some support for temporary housing had come from several different NGOs who had provided materials. According to local leaders of reconstruction support activities, as of Dec. 2015, most residents were unsure of the possibility of rebuilding their houses. They had heard of some government programs for reconstruction grants and loans that could be used for building construction, but were waiting to receive more information. As farmers, many residents own land, the sale of which could partially finance reconstruction. However, as the loss of this land for farming would also have negative impact on their lives, it was not often perceived as a desirable option. As a village with rich architectural heritage, reconstruction in a way that preserves this history is a huge challenge. Local groups, including the Khokana Reconstruction and Rehabilitation Committee, are engaged in various efforts to promote a historically sensitive reconstruction that will preserve the local and traditional Newari style.

Fig. 5.7.4. Temporary housing of galvanized metal on the village edge, farmland in the background

Fig. 5.7.5. A community building rebuilt soon after the earthquake through coordination of the Khokana Reconstruction and Rehabilitation Committee.

5.7.6.2 Methodology of survey on schools and community in Khokana

The field survey was conducted at three schools in Khokana Village and one in Bungamati Village in Lalitpur district. The goal of the school visits was to understand the damage and recovery situation after the 2015 earthquakes and how schools located in traditional Newari villages collaborate with the affected community and with external agencies for recovery assistance. Semi-structured interviews were conducted in English with either the head teacher or deputy head teacher at each of the schools. Through direct observation of the school sites, the schools' site configuration, construction and any reinforcement history, and earthquake damage and repairs were confirmed and documented.

5.7.6.3 Education in Khokana

There are 2 public secondary schools and 3 private schools (2 secondary and 1 primary level) in Khokana. According to the Village Profile of Khokana VDC, Lalitpur from 2010, the literacy rate of Khokana was 65.51%. More than one third of the total population was illiterate. The population from ages 5 to 19 was 1,408 (34%) out of the total population of 4,126. According to the survey in the Village Profile, 14% of school-aged children did not go to school. The major reason of non-enrolment was poor economic condition of the family.

5.7.6.4 Damages of schools in Khokana

According to the damage assessment of public schools in Khokana conducted by NSET, the earthquakes damaged two public schools: Rudrayanee Secondary School and Shree Yuwa Vidhayanth Mandingo Secondary School. 52% of classrooms at Rudrayanee Secondary School were partially damaged, and 20% at Shree Yuwa Vidhayanth Mandingo Secondary School. All the five toilets at Shree Yuwa School were also damaged. More detailed information was obtained through the school visits, where the results of damage inspection were post on individual buildings: a green sign for safe, and a red sign for damaged/dangerous (Fig. 5.7.6).

Fig. 5.7.6. Signs showing building inspection results: Left-Green for safe; Right-Red for unsafe.

At Shree Yuwa Vidhayanth Mandingo Secondary School (Fig. 5.7.7a,b,), both the two school buildings had a green sign to show the buildings were safe. One of these buildings had been built by support from the Fukuoka Rotary Club, and the other building had been built by a group from Oxford University. Both buildings were made of brick and mortar and had been retrofitted with the support of NSET. The head teacher said that only toilets had been damaged by the earthquakes and they had been left as broken due to a shortage of funding.

Fig. 5.7.7.a, b. Shree Yuwa Vidhayanth Mandingo Secondary School. Left: School buildings with green signs (safe); Right: view from the School

At Rudrayanee Secondary School, 4 of the 7 school buildings had been assessed as safe (green) and the remaining 3 buildings had been designated unsafe (red) (Fig. 5.7.8 and Fig. 5.7.9). Out of the 3 "red" buildings, one was totally damaged and had already been demolished. Different donors had supported the construction of the school buildings over the past 30 years. The main building was constructed 15 years ago by Shizuoka's Rotary Club and built of brick and cement with iron pillars. Other donors supporting building construction had been Nepal government, Japanese embassy, Japanese company. Buildings had been added along with the increase of students.

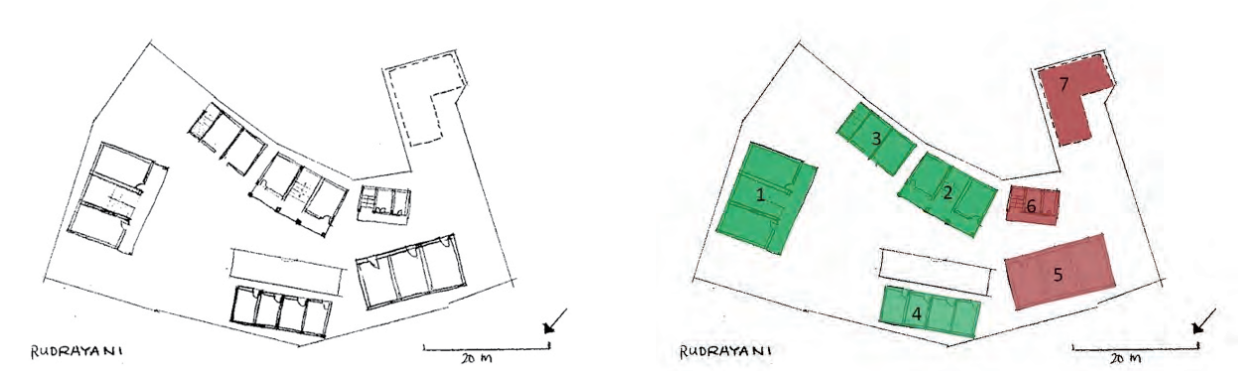

Fig. 5.7.8. Layout of Buildings at Rudrayanee Secondary School (Diagram: Maly)

Fig. 5.7.9. Rudrayanee Secondary School. Top left: Main school building (#1); top right: building that survived (#3); lower left: damaged unsafe school building, red sign (#6); lower right: remains of a school building after demolition (#7)

5.7.6.5 Education Recovery Assistance in Khokana

Table 5.7.1 shows the summary of assistance in the education sector in Khokana Village and Lalitpur District, according to the Nepal Education Cluster database as of October 2015. Several different agencies were involved in roles of project owner, donor and implementing agencies. Major donors are USAID, UNICEF, FCA, and Tsu Chi Foundation. In Khokana Village, Restless and Tsu Chi are major project donors and Loo Niva is added as an implementation agency under Restless sponsored by USAID/UNICEF. Compared to other affected and remote districts, provision of assistance is advanced due to easier access from Kathmandu.

Table 5.7.1. Summary of Recovery Assistance at Schools in Khokana and Lalitpur

Recovery Assistance Support	Established or Distributed/ Targeted in Khokana Village	Established or Distributed / Targeted in Lalitpur District
Temporary Learning Centers	1/6 at two schools	158/238 (66% completion)
Teachers Training Targeted and	15 trained out of 19 targeted	1160/1220 (95% completion)
School Kits	3 kits distributed out of 3 kits	309/374 (83% completion)
ECD (Early Childhood	1 kit distributed out of 1 kit	177/177 (100% completed)
REC (Recreation) Kits	1 kit distributed out of 1 kit	190/190 (100% completed)

(Source: Nepal Education Cluster database, October 2015)

Though school visits, it was found that in Khokana, schools that received donor assistance include only one public school, Rudrayanee Secondary School, and one private school, Zing Secondary School. Rudrayanee School received the full package of all types of assistance in the education sector, and received government compensation of 100,000 rupees. On the other hand, Shree Yuwa Vidhayanth Mandingo Secondary School did not receive any support after the earthquakes because the school was not very damaged by the earthquakes. The head teacher of Shree Yuwa School mentioned that even though the school building was undamaged, the school should receive assistance since children were affected and many lost their houses and were living in temporary shelters. Since damaged schools also received larger amounts of donations for daily and school life, like uniforms, school supplies or bags, the lack of this kind of assistance may contribute to children transferring to other schools where they could receive more of such donated supplies.

However, although it is a private school, Zing Secondary School received temporary learning centers (TLCs) after the earthquakes. According to the head teacher, the reason was that the school buildings were opened three days after the April earthquake and used as a childcare center for the village people. When the Tsu Chi Foundation visited schools and found the childcare center, they provided support in the form of 2 TCLs. However, since the school is private, the government stopped Tsu Chi to support Zing School. Therefore, the three more TLCs planned could not be provided to the school.

5.7.7 Discussion

5.7.7.1 Retrofitted School Buildings

According to NSET, this is the first case for retrofitted schools to experience earthquakes in Nepal. Sanada (2015) confirmed the effectiveness of retrofitted school buildings in Bhaktapur; the same was observed at two schools in Khokana and Bungamati villages of Lalitpur. Without retrofitting, Rudrayanee Secondary School had three “red” buildings; while Shree Yuwa Vidhayanth Mandingo Secondary School had both the two retrofitted buildings assessed “green” without any major damages. Adarsha Shilayubak Secondary School in Bungamati had three attached buildings that had been retrofitted by NSET; all these school buildings had also been assessed as “green”. For this scale of earthquake, retrofitted buildings proved strong enough to survive the earthquake with minimum damage. However, the challenge based on this experience is how to ensure people understand the importance of retrofitting buildings. At Yuwa Vindhayanth Mandingo Secondary School, the authors received the impression that although the buildings had survived safely, a larger issue that the school was facing was the disparity of external assistance, which they did not receive since buildings were not heavily damaged. This could raise questions about selection criteria of recipient schools for recovery assistance (who should receive assistance, affected school or affected children).

Fig. 5.7.10. Adarsha Shilayubak Secondary School. Left: Attached school buildings; right: gap between of the building blocks, 2nd floor

5.7.7.2 Community participation in education recovery

School Management Committees (SMC) at two public schools in Khokana were involved in the recovery process. At Yuwa Vindhayanth Mandingo Secondary School, a SMC meeting is held monthly. After the earthquakes, the members discussed about school safety and decided to build additional stairs to make smooth evacuation from the second floor. The stairs were funded by donors but manual labor was provided by parents.

At Rudrayanee Secondary School, the SMC has more active involvement. Though the SMC met once in a month before the earthquakes, after the earthquakes SMC meetings were organized to decide whether to accept external assistance offered, and how to use it. This school seemed to be well connected to the local community. The name of the school comes from the temple, the original location where the school was built 150 years ago; later it became a public school. At the school, though the head teacher does not always stay at school, the deputy head teacher is an original resident of Khokana Village and deeply involved with daily school business. For example, even before the earthquakes, women's group meetings were occasionally held at the school and a hall was built for the group in the school. At a time of the earthquakes, the deputy head teacher helped residents who had been staying at the school as an evacuation shelter organize building materials and build their temporary houses. These efforts support the holistic life recovery of the local residents and also support education recovery, since these earthquake survivors needed to move out of the school buildings when school reopened at the end of May.

The presence and role of intermediate agents could help to facilitate communication between schools and the community. In addition to locally connected and respected teachers, community-based organizations also play an important role. An example of this kind of organization in Khokana Village is the Loo Niva Child Concern Group, who had been promoting child rights and youth development through education project activities since its establishment in 1997. Loo Niva became an implementing agency of education recovery assistance, such as temporary learning center, teacher training and delivering school and ECD kits, since they knew the community and schools before the earthquakes. The temporary learning center, the first TLCs built after the April earthquake, was built using the traditional local Newari style by local designer through collaboration among the Department of Education, UNICEF, Loo Niva Child Concern Group and Restless Development, a development organization. The combination of an active local school head and community-based organization led to

the realization of such smooth construction and localized TLC building at the school. For the future, it would be increasingly effective if such community-based educational support organizations could continue to work in the field of disaster preparedness for sustainable community development.

Fig. 5.7.11. Temporary Learning Center at Schools. Left: TLC with Newari design at Rudrayanee School; right: TLC at Zing School, provided by Tsu Chi

5.7.8 Conclusion

Due to limited schedule and shortage of gasoline, the survey was conducted in a short period and limited to within Lalitpur District. Therefore, it is hard to draw any conclusions based on findings from the survey this time. However, the survey helped to grasp the situation in the housing and education sectors as of Dec. 2015, during the ongoing transition from the response phase to reconstruction, and to describe a snapshot of the educational recovery seven months after the earthquakes in Nepal as discussed above. In the housing sector, winterization efforts were the final activities in the response phase. Preparation for recovery and reconstruction was underway, with the final meeting of the Shelter Cluster (SC) as the coordination body for response held in early December, and the SC Recovery and Reconstruction Working Group to be replaced by the Earthquake Housing Recovery and Reconstruction Platform (HRRP) preparing to launch in January 2016. In education also, the emergency phase of the 2015 Nepal Earthquake was already over in December 2015, and all recovery and reconstruction activities have transferred from the disaster response team to the regular development team. Going forward, earthquake recovery and educational development should continue to be studied together in order to capture lessons learned from the earthquake experiences and to make schools disaster resilient in their local context. The impact of earthquake on enrolment, residents' perception of public schools and their preference to sending children to private schools, and support for disabled children were important topics that should be followed up based on the survey.

The authors identified the three following aspects as the main connections between school and housing recovery, based on this field visit. First, for local residents, especially families with school-aged children, housing and education recovery cannot be separated. As long as families are living in schools as evacuation shelters, classes cannot resume. Even after children are attending school again, their poor housing situation in temporary housing impacts their health and ability to study. Families who suffer a negative economic impact from disaster, including related to housing need, may have additional difficulty sending children to schools. Second, to promote the construction of safe buildings, especially for training local masons and buildings, the reconstruction of safe schools can have a much wider benefit and can increase local capacity and awareness throughout the community, which will then improve the safety of houses. Third, even if the housing and education recovery are considered separately in terms of policies and recovery projects, the authors found several examples of organizations working in recovery at different levels who are involved in activities that include both the education and housing sectors. Community groups and individuals with multiple roles at the local level were also found to be considering school and housing recovery, with multiple roles. As a traditional Newari town, with a unique history and heritage, active local organizations, and strong connections to

outside supporters, some of the findings in Khokana are specific to this community. Therefore, it would also be worthwhile conducting comparative analysis with other villages affected by the earthquakes in Lalitpur District as a next step.

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