Towards community disaster resilience in Nepal, a focus on maternal and neonatal health

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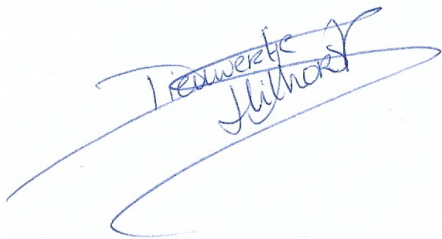of

Master of International Health

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Signature:

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Abbreviations

ANC	Antenatal care
FCHV	Female community-health volunteer
IAWG	Inter-agency working group
LMIC	Low- and middle-income countries
MDG	Millennium development goal
MISP	Minimum initial-service package
MMR	Maternal mortality ratio
MOHP	Ministry Of Health and Population
NMR	Neonatal mortality ratio
NGO	Non-governmental organization
PNC	Postnatal care
PPP	Public-private partnership
PTSD	Post-traumatic stress disorders
RAND	Research and development
RH Kits	Reproductive health kits
RCT	Randomized controlled trial
SBA	Skilled birth attendance
SRH	Sexual and reproductive health
UN	United Nations

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Abstract

Introduction: The 2015 earthquake caused severe damage to the health system in Nepal. 446 health facilities were destroyed, the majority of which offered birthing services. About 93,000 pregnant women were at risk for adverse birth outcomes. There was a gap of health service delivery between the earthquake and the set-up of a local and international health service delivery response.
This thesis explores the effects the 2015 earthquake had on maternal and neonatal health and identifies strategies to foster community resilience for maternal and neonatal health for future disasters.

Methodology: A descriptive literature and desk review was undertaken. The conceptual framework of RAND was used to analyse the data.

Results: The 2015 earthquake had consequences for maternal and neonatal care with respect to health care, food hygiene and water. Gaps were identified in disaster preparedness such as a lack of awareness about disaster risk and risk communication and a lack of community engagement in community programs and disaster planning.

Conclusion: A disaster-prone country like Nepal will face other disasters in the future. Interventions to increase community resilience include: Strengthening of awareness programs. The use of multiple sources for risk communication including technology. Promote active engagement of the community in disaster planning (including maternal and neonatal health) through education and women's groups. Community resilience can contribute to effective, timely response and continuous health care after disaster but additional research is required in this field.

Keywords: maternal, neonatal, disaster, resilience, Nepal

Word count: 12.127

Chapter 1 Background

With a total land area of 147.181 km2, Nepal is a relatively small country divided into seven provinces and 75 districts. However, it is marked by various climates and rough terrain. Nepal contains three ecological zones: mountains, hills and the southern plains also known as Terai. It exhibits large altitudinal differences—from the Terai, 300 m above sea level, to the top of Mount Everest, 8800 m above sea level (1). Nepal is disaster prone because of its location in the Himalayas. Since the year 2000, on average of 329 people per year have lost their lives due to natural disasters that include floods, landslides, and earthquakes (2).

Nepal has a total population of almost 28 million people, which has doubled in the last 40 years. The population below 15 years of age represents a large part of the population (37%); 6% is above 65 years of age and 11% is below five. Fertility rates are declining, with a current fertility rate of 2.3 children per woman. A difference in distribution is found in urban and rural settings: 2.0 children per woman in urban settings, and 2.9 children per woman in rural settings (1).

Historically, Nepal has had a caste system. According to the 2001 census, a total of 103 different ethnic castes exist in the country. Of these, the five primary castes are the Newar caste, which is the highest and counts 33.1% of the population; the Chhetri (31.6%); Brahmin (21.8); Janajati (8.7%); and the Dalit (2.8%), which is the lowest caste and is generally ignored by the government.
The predominant religion is Hindu, which includes 95.6% of the population; 2.6% is Buddhist, and 1.7% is Christian (3).

Of all women, 33% have never been to school; only 15% have had more than a secondary education. The total years of education per woman increased with 1.5 years since the demographic health survey 2011, from 3.5 to 5 years. Sixty-nine percent of the women are literate. Urban women are more likely to be educated than rural women. In addition, the proportion of women without education is the highest in the lowest wealth quintile (1).

As a landlocked country between two superpowers—India in the west, east and south, and China in the north—Nepal is almost fully dependent on India for trade and transit facilities and access to the sea in the Bay of Bengal. The economic growth of the country decreased from 4.8% (2010) annually to 0.4% in 2016 (4). Lack of technological progress, remoteness and natural disasters are some of the factors that hinder the economic development of the country (3).
The majority (76%) of the population is involved in agriculture, with 70% of the women being involved in agriculture. Most of the women work for

their family and are not paid. The latest demographic health survey (2016) shows stable employment numbers, with 57% of women and 89% of men being employed (1)

Nepal has experiences political instability for decades, including a civil war that lasted from 1996 to 2006. Political development followed, but a few months after the 2015 earthquake, the Nepali government adopted a new constitution that resulted in a man-made economic and humanitarian crisis. Strikes and riots were reported in the Terai region, which is the economic trade and border area with India. In response, India closed the border for five months, with consequences for the nutrition, transport, and reconstruction activities in multiple sectors. The consequences for the health sector were severe due to the lack of essential medication, as well as necessary transport and fuel needed to run aggregates during frequent power cuts and to maintain cold chains (5)(6).

Since Nepal adopted the new constitution in 2015, the previously centralised health-care system has slowly become decentralised. Primary health-care services are provided at sub-health posts, health posts, primary health-care centres and district hospitals (3). These services are financed by the government and offer health care free of charge. Regional hospitals and specialised facilities provide health care at the secondary and tertiary levels (1).

Nepal was one of the countries on track to achieve millennium development goal MDG 4 and 5 (7) with an MMR of 170 in 2011, but it suffered a setback to 258 per 100,000 live births in 2015 (8). Prior to the earthquake, increasing trends were seen in access to antenatal care (ANC), with 84% of women attending at least one of the four recommended ANC visits. Sixty-nine percent attended all visits, 58% of deliveries were attended by a skilled birth attendant, and 57% of the deliveries took place in a health facility. In addition, 57% of the women and new-borns received a postnatal check within 48 hours of delivery (1). Neonatal mortality decreased from 50 per 1000 live births (1996) to 21 per 1000 live births in 2016. However, neonatal mortality is responsible for the majority of child deaths. It accounts for an estimated 54% of under-five child mortality (9)(1). Infection, birth asphyxia, prematurity and hypothermia are the main causes of death (10).

Over recent decades, the MOHP in Nepal has introduced several strategies to promote access and tackle barriers in access to maternal and neonatal health, so as to decrease MMR and NMR in line with the MDGs. A policy on skilled birth attendance (SBA) was introduced in 2006, which resulted in the training of human resources across the country (1). A birth-preparedness package was introduced to help parents prepare for birth. It included education on danger signs and readiness if a medical emergency occurs. The national safe-motherhood programme and the safe-delivery incentives programme were introduced to encourage institutional births or

SBA in home deliveries, which are associated with lower MMR and NMR. Community-based, integrated management of childhood illness and a community-based new-born-care package, immunisation programs and umbilical-cord care for new-borns were all introduced to decrease NMR and to ensure better care for new-borns (11)(12).

Nepal has a widespread network of female community-health volunteers (FCHV) who are trained to treat diseases at a very basic level or refer if needed. They also inform people about family-planning and provide basic health education regarding food, lifestyle and sanitation (13).

Chapter 2 Introduction

2.1 Problem statement

Increasing numbers of people are affected by disasters due to climate change, or because the geographical location of a country makes it disaster prone. In 2015, 346 natural disasters were reported globally, with a total of 22,773 deaths and 98.6 million people affected (14). Disaster is defined by the World Health Organization as "a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society using their own resources" (15).
In 2015, Asia was hit the hardest by the earthquake in Nepal, which caused casualties and damage (14).

The effect of disasters exacerbates complications in already weak systems and affects people unequally. The most vulnerable, women and children, are especially affected (16). Their vulnerability is influenced by social, gender and geographical conditions that also affect their ability to obtain basic needs like food, water, shelter and health-care after a disaster strikes (17).
Moreover, pregnant and lactating women and new-borns are vulnerable, as they have an ongoing need for antenatal care and skilled birth attendance, including emergency obstetric care, postnatal and new-born care. Disruption in maternal and neonatal care can lead to adverse birth outcomes and preventable deaths (16) (18).

The health sector and health infrastructure in Nepal was severely damaged by the 2015 earthquake (Figure 1). Of the 4118 public-health facilities in Nepal, 446 facilities, from hospitals to health posts, were completely destroyed. Of the 446 destroyed facilities, 84% (i.e. 375) were situated in the 14 most-affected districts. Yet another 765 facilities were partly damaged (19). Many of the destroyed facilities, 417 out of 446, were health posts that offered birthing services. These facilities are essential entry points for
healthcare (20).

In the aftermath of the Nepal 2015 earthquake, about 93,000 women were pregnant and up to 10,000 women were delivering each month. Of these, 1,000 to 1,500 were at risk of pregnancy-related complications requiring emergency obstetric care. An estimate of 90 women per day were in need of a caesarean section (21). This is a major concern, as disruption in regular services, infrastructure and resources can lead to an

increased risk of maternal mortality (MMR) and neonatal mortality (NMR) (16)(18).

The consequences of the 2015 earthquake went beyond the capacity of the Nepalese government to respond, and the international community was activated. However, international aid in the acute emergency phase after the 2015 earthquake was delayed due to heavy weather conditions, in combination with limited capacity of the national airport to cope with the many international supported flights. Organised rescue activities were delayed up till five days (22). Delays were even more extended in geographically hard-to-reach areas, where people were without help for weeks (13).

Only a few months after the 2015 earthquake, the population was confronted with yet another disaster in the form of a man-made economic and humanitarian catastrophe, as India blocked the borders for a period of five months in association with Nepal's newly introduced constitution. With only one road accessible to China due to landslides, the country was isolated and lacked basic needs like fuel, gas, medication and food. Thus, the rebuilding of the system was hindered, and limited opportunities existed for transport and cold chains (6)(23).

Prior to the 2015 earthquake, the government of Nepal prioritised disaster-response activities; yet gaps were found in the implementation of preventive measures. Health facilities were declared priority buildings, but improvements to building structures, safe equipment storage, and preventive measures to protect power and water supplies were lacking (22), as were health promotion and preparedness (17).

Building community resilience can fill these gaps(24), as the concept includes health promotion, preparedness and capacity building to respond in a timely and effective manner and to thereby recover from the negative health effects disasters can cause. Strengthening communities in low resource settings such as Nepal is efficient because of the use of local resources (including knowledge, skills, financial resources and supplies) in place (25).Community resilience can help to overcome the time the government and international community take to organise response activities and allocate supplies. It can also lessen the time it takes to overcome the geographical difficulties in Nepal and to reach disaster affected areas. A stronger and resilient community prior to disaster can better mitigate the negative effects of disaster and prevent long recovery periods (25)(17).

Community resilience is defined as "the ongoing and developing capacity of the community to account for its vulnerabilities and develop capabilities that aid in preventing, withstanding and mitigating an incident; recovering in a way that restores the community to its self-sufficiency and at least the same level of health and social functioning as before the incident and

using knowledge from the response to strengthen the communities ability to withstand the next incident" (25). A community can be explained from different views; geographical, faith based or cultural. However, for this thesis, community is used in geographical terms based on geographical area covered by health department (25).

2.2 Justification

Nepal has made improvements in recent decades in maternal and neonatal health. More and more women are using antenatal-care (ANC), skilled-birth attendance (SBA) and postnatal care (PNC) (1). As mentioned above, the 2015 earthquake caused major damage to the health system, including its birthing services (19). As a consequence, thousands of women and new-borns were at risk for pregnancy-related complications in the aftermath of the 2015 earthquake (20). Sexual and reproductive health is emphasised on global levels during and after disasters (26) however, not included in the Nepalese's disaster guidelines at times of the earthquake (27).
Nepal has been active in disaster risk reduction and management though difficulties and gaps were present in disaster preparedness and response after the 2015 earthquake with respect to coordination and contrasting protocols and guidelines on government and local level. However, the government recognize the need for local capacity and community based approaches in disaster risk reduction (2).
Studies showed community resilience has become an important element in disaster preparedness and response to mitigate the negative effects of disaster (28).

This thesis explores the effects the 2015 earthquake had on maternal and neonatal health in Nepal. It explores the levers and core components of community resilience and identifies the best practices from other countries so as to make recommendations to the MOHP of Nepal.
Research on maternal and neonatal health during disasters from different countries, including recommendations with emphases on community-based interventions to increase resilience for maternal and neonatal health, has been published. However, no such studies were found for Nepal.

2.3 General objective:

To explore the effects, the 2015 earthquake had on maternal and neonatal health, and to identify strategies to foster community resilience in maternal and neonatal health for future disaster to advice the MOHP of Nepal on effective strategies to increase community resilience focussed on maternal and neonatal health.

Specific objectives:

to explore the effects, the 2015 earthquake had on maternal and neonatal health in Nepal,
to explore strategies to increase community resilience which focus on maternal and neonatal health,
to identify lessons learned in strengthening community resilience in other countries, and
to offer advice to the MOHP regarding effective strategies for increasing community resilience focussed on maternal and neonatal health.

2.4 Methodology

2.4.1 Study type

To answer the objectives of this thesis, a descriptive literature and desk review was undertaken.

2.4.2 Data collection

Literature was found using Google scholar, PubMed and Cochrane. Websites from the WHO, UNICEF, UNFPA, EMDAT were used, and the website of MOHP Nepal was also searched for reports in English.
A general set of search terms was used independently or combined using AND/OR:
Earthquake, disaster, health, maternal, neonatal, community, resilience
A second set of search terms was used and added or in combination with the general set for chapter 3, 4 and 5:
utilization, promotion, education, preparedness, engagement, communication, public, private, partnership.
Nepal was added as term when searched specifically for Nepal.

Articles were first selected on the basis of their titles and abstracts. They were fully read if applicable to this study. Abstracts were read from articles published from recent disasters occurred over the last ten years until the end of December of 2017 related to maternal health and neonatal health, community resilience and disasters in Nepal and other LMIC. In sequence, references were checked for other relevant studies on the topic.
Articles from research in high-income countries were included if no literature was available from LMIC.

2.4.3 Study limitations

This thesis is a descriptive literature and desk review; no primary data is included.
Since the earthquake in Nepal happened recently, not much academic literature is available on this topic. To overcome this limitation, articles published on the influences previous disasters had on maternal and neonatal health and community resilience in Nepal were used in addition to international literature on natural disasters, maternal and neonatal health and community resilience.
Only articles published in English were included.

2.4.4 Framework: RAND activities for building resilience

Community resilience is a rather new concept in the field of public health. According to Patel et al. (29), there is no consensus on the definition of community resilience. During the search a selection of recurrent components were identified —such as local knowledge, community networks, communication, economic investments, preparedness, resources, leadership and mental outlook—which contribute to increasing community resilience (29). The conceptual framework developed by Research and Development (RAND) includes these components. RAND is a U.S.-based non-profit institution that aims to improve policy and decision-making through research and analysis. RAND has published multiple studies on community-disaster resilience and has implemented community-resilience activities world-wide. Based on their studies, RAND has developed a framework for disaster resilience that is specifically focused on the health sector (Figure 1). This was an important reason to choose this framework over the Sendai framework for disaster risk reduction, which is a global guideline with seven global targets that includes all work sectors (30). The RAND framework is based on literature reviews, qualitative study and an expert panel and developed with regard to the public health sector. Based on the literature review, eight levers of community resilience were identified and associated with community resilience. These levers can be interpreted as pre-conditions needed for the core components of community resilience (25). The model is used to describe and explore strategies of community resilience focused on maternal and neonatal health.
The first lever, wellness and access, is focused on health promotion and access to health services to guarantee continuation of health care for those in need. This will lead to higher levels of physical, psychological and financial health. A healthier population needs fewer resources and less recovery time after a disaster and improve community resilience. Education, is important to make people aware of the risks of disaster, how to prepare, how to respond and how to recover on individual and community level. Risk communication is important in health messaging. A

limited understanding of health messages influences the actions to be taken to prepare and recover from a disaster. Collaborations with NGOs and local government in disaster education improves community networks. Involvement of community representatives and health specialists in community networks improves education initiatives and increases community resilience.

Engagement and self-sufficiency are essential in participation and disaster planning to increase the responsibility for the health of households and the community. Engagement also improves social connectedness. These social networks can be used to spread disaster-related information and increase community resilience.

Partnerships between communities and government ensure support in disaster preparedness and response or increased knowledge about disaster. It also increases the resources in the community, which improves the capability to recover from disaster. Engagement of communities unites efforts, creates solidarity, and improves community resilience.

Quality and efficiency are cross cutting levers applicable for all levers of community resilience.

Figure 1 Conceptual framework Rand 2011 (25)
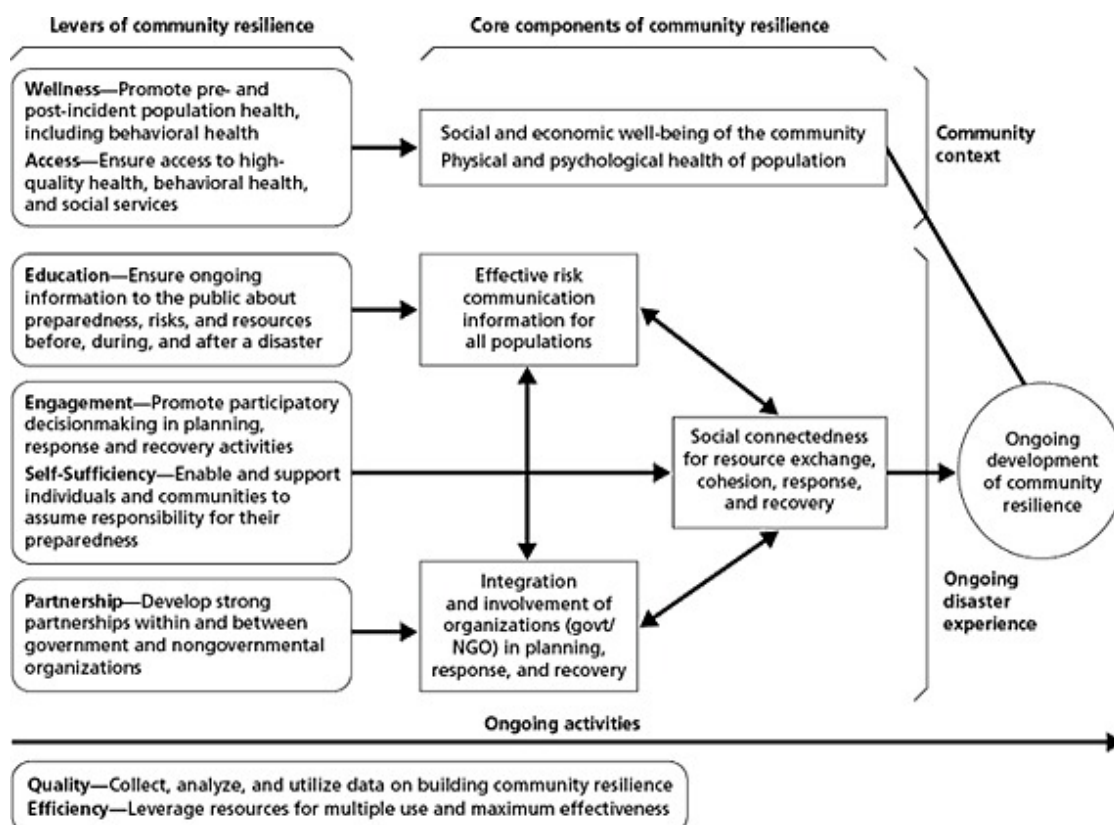
Chapter 3: The effects of the 2015 earthquake on maternal and neonatal health

Understanding a community's vulnerabilities influences one's ability to mitigate negative disaster affects. For this reason, this chapter provides an overview of the known effects of the 2015 earthquake on maternal and neonatal health in Nepal.

As described in the problem statement, the health system was severely damaged by the 2015 earthquake, which threatened maternal and neonatal health due to disruption of care (16). The availability of medication and equipment was also in danger, as supply chains were threatened due to geographical and distribution barriers. In addition, curfews, increased risk of human trafficking and sexual violence, and a lack of transport formed barriers to seek care, and were among the reasons for these disruptions in maternal and neonatal care (31).

Because an already disappointing harvest (19) was followed by the 2015 earthquake and a manmade humanitarian crisis with India (5), food became scare. After the earthquake, 1.4 million people were in need of food assistance (19).The food consumption decreased in the most affected areas, with immediate impact on the nutritional status. An estimate of 135,000 pregnant and lactating women were affected (19). A diverse menu including vitamins and minerals is essential for maternal and neonatal health(16)(18). To overcome this problem, the government launched food programmes and supplements through health facilities targeting pregnant and lactating women and other vulnerable groups, which started soon after the needs assessment and ran for one year(19). The 2015 earthquake destroyed up to 500,000 houses and 250,000 were partly damaged, which resulted in more than 2 million homeless people. Months after the quake, thousands of people still lived in temporary shelters (19).
The cold winter months following the earthquake were of concern, as the shelters were not suitable for the cold and wet months. Moreover, it was not possible to warm up the shelters because of a lack of gas due to the ongoing humanitarian and economic crisis (5). In addition, shelters were overcrowded, which increased the risk of disease outbreaks and sexual harassment. Insufficient shelter in cold and wet circumstances increases the chance of hypothermia, which is a threat for neonates(1).
Cultural- and gender-sensitive aspects (e.g. women need privacy for breastfeeding) are generally lacking in temporary shelters (32). It was financially impossible to build new homes, both because of a lack of financial backing from the government, and because of a lack of building materials caused by the humanitarian political crisis (5)(6).

Lack of clean water and poor sanitation are well known to facilitate disease outbreaks. Clean water was a problem after the earthquake. Water flow in the capital was disrupted for seven days (22). Reservoirs were polluted and pipelines were destroyed. Collecting water from distant sources increases the domestic burden on women and comes with a risk of gender-based sexual violence and human trafficking (16)(19). In addition, a lack of knowledge about hygiene and the use of water sources resulted in high-risk behaviour. Precautions such as boiling water were generally not prioritised by the people (33). Because the earthquake destroyed latrines, people started to defecate near the same rivers they used as their water sources for drinking and hygiene, which increased the risk of waterborne diseases. Breast feeding must be emphasised in the aftermath of disasters to prevent waterborne diseases in new-borns, caused by bottle feeding with dirty water and poor personal hygiene (16)(34). No disease outbreaks were noticed after the earthquake (35).

Nepal was proactive in disaster management and disaster risk reduction by the establishment of the national strategy for disaster risk management, a set of strategic interventions on policy level (2009). However, this document had not become an act by the time of the 2015 earthquake, and the country was subject to the old disaster act (2). Nepal's disaster act dates back to 1982 and is focused on rescue activities. Mitigation, preparedness and resilience are not considered in this act (22). Likewise, health promotion and disaster preparedness are not prioritised (17). Moreover, the disaster guidelines do not include sexual and reproductive health (27). Nepal is actively working to improve disaster risk reduction, and recognises the role of community involvement in improving resilience (2).

Chapter 4 Community resilience

This chapter provides an overview of strategies, experiences and knowledge regarding the levers and core components of disaster resilience in Nepal. The first lever of the framework explores wellness, the promotion of pre and post incident health, including behavioural health, and social services (25).

4.1 Wellness (promotion of pre and post incident health)

As regards community resilience, pre-incident promotion of healthy behaviour and access to health care contributes to the overall health status of a community. Healthy people are less vulnerable and more resilient to the negative effects of disaster (25). Vulnerability is determined by hazards present in the community. The ability to withstand the effect disaster has on health and mental health requires resources that are available in communities. This concerns human resources, supplies and financial resources, which raises the importance of local storage points, allocation of resources, developing a community warning system, and establishing an emergency funding system (33).

In recent decades, improving maternal and neonatal health has been emphasised through community-based programmes (36). Community-based programmes minimise the equity gap between community members and facility-based programmes by rendering them more equitable for those in need, disadvantaged groups and rural areas (37).

As discussed in Chapter 1, maternal and neonatal health has been widely promoted in Nepal through several community-based programmes. Research has identified several barriers on the demand side. For example, the demographic health survey identified obtaining permission for treatment, financial resources for treatment and distance or lack of facility in the village as demand-side barriers (3). Other barriers—such as low quality of care, transport (38) and a lack of awareness about maternal and neonatal care (39)—are present as well. In the aftermath of a disaster, the demand and supply-side barriers are exacerbated due to unsafe travelling, a damaged health system, and the prioritising of basic needs in terms of financial resources—all of which negatively impact pregnant women and new-borns (18).
However, sexual and reproductive health (SRH) has not been included in any disaster guideline or framework in Nepal (27). Nevertheless, a sexual-and reproductive-health sub-cluster was formed after the earthquake by the UN and governmental agencies in line with the MISP guidelines (31). Success in the deployment of medical and nursing teams was observed, as were successful SRH outreach camps, which were offered free of

charge. Reproductive health kits (RH kits) were distributed, although logistical and geographical barriers were identified that emphasise the need for preposition kits in the future. Dignity kits that contained products for hygiene and essential clothing were distributed, but they were not adjusted to the Nepali context, with the result that they lacked essential items for Nepali girls and women (e.g. a sari and a shawl)(27).

The MOPH declared all treatment after the earthquake free of charge (19)(31). One month after the earthquake 20 field hospitals were running, and 47 national and 133 international medical teams were deployed (19). Although the government declared aid was free, it was a challenge to receive it. Roads were blocked or inaccessible due to landslides. Another initiative taken in response to the earthquake appeared in the form of transition homes. Fifty transition homes were established between two and six months after the earthquake. They were built close to emergency obstetric and neonatal care facilities to offer women and new-borns free and safe shelter, clean water, sanitation and food. Women were allowed to use these services to overcome the negative effects on their or their new-borns' health before they returned home, as no emergency funds were available for emergency transport in case of medical complications (27).

The need to integrate sexual and reproductive health into disaster preparedness and management has been emphasised on a global level over the years (26)(40). Strengthening maternal and neonatal health on the community level is an important aspect of reducing risks and vulnerabilities before disaster strikes. Community involvement is vital to increase the workforce at the community level, for example with respect to community health workers, the development of intervention packages, and home visits (26).

Female community health volunteers proved their efficiency with respect to maternal and neonatal health care, especially in rural areas where health care is scare. FCHV are first-line aid workers; however, due to their position and availability in the community, FCHV could provide essential advice and basic health care during and after the earthquake (41). A recent study demonstrated their value after the 2015 earthquake by fulfil tasks such as health promotion, facilitate transport and offering psychological support. However, it also showed that FCHV were confronted with requests from the population that they could not fulfil, due to a lack of specific training in providing care during or after disasters. Maternal and neonatal health is one of the areas for which FCHV requires additional knowledge, if it is to better handle requests from pregnant women and mothers in future disaster events. The FCHV also prefers to collaborate and integrate their aid efforts with that of external agencies (whether governmental or NGOs), as such collaboration happened only on a limited scale after the 2015 earthquake (13).

Involvement of local organizations was also found to be valuable in disaster preparedness and response. Local organisations know the local culture and are able to appropriately anticipate incidents and clarify cultural differences between local, national and external organisations. Local organisations are also able to identify local social assets and resources within the communities. In addition, local organisations have infrastructure adjusted to the local context which complements their disaster resilience (42).

Maternal and neonatal health in Nepal are promoted through community-based programmes (43). These programmes are lacking regarding disaster management, and response activities were provided ad hoc following international MISP guidelines (27). Community resilience in Nepal can be strengthened through the identification of available resources in the community, as well as by the involvement of local organisations and FCHV in disaster preparedness and response (42)(13).

Social and economic well-being

Disasters cause damage to infrastructure, property, economy and human life. Loss of property and loss of lives can be prevented by preparedness. However, to prepare, people need to be aware of the threats of local hazards. Appropriate messaging and education in preventing these losses and maintaining health could improve disaster resilience (25). Nonetheless, people live in disaster-prone areas for cultural and socio-economic reasons, and do not have the financial option to relocate taking into account that there is no government system to provide financial backing (44). Nevertheless, socio-economic status influences the ability to cope with the effects of disaster in terms of resources (25). The World Bank expected the earthquake to increase poverty by 2.5-3.5%, with the lowest two quintiles being the most affected. Moreover, this increase was expected to occur predominantly in rural areas, which were already in weaker positions than urban areas prior to the earthquake(19). Concerning maternal and neonatal health, multiple studies conducted prior to the earthquake identified wealth as an important factor with respect to access to maternal and neonatal care. Women from the lowest quintiles are disadvantaged, because particular costs such as the cost of travel time are not covered by government packages, and they have less access to services (45)(11)(46)(47)(39).

Psychological health

Prior studies report associations between disaster experience and pregnancy(48)(49). The experience of a disaster during pregnancy is associated with adverse perinatal outcomes—such as pre-term birth and low birth weight, intra-uterine growth restriction and premature rupture of membranes (48)(49).Both the lack of access to necessary maternal and

new-born services and the stress pregnant women experience during and after a disaster have an impact on pregnancy outcomes and mental health (50). Depression and post-traumatic stress disorders (PTSD) are higher in pregnant women with earthquake experience compared to pregnant women without earthquake experience (51). Other factors like socio-economic status and employment prior to the disaster are also associated with depression.

A recent study of psychological health in pregnant women from Nepal showed that 85% percent of the study population experienced severe fear during the earthquake. In the aftermath, 73.6% of the pregnant women received some form of social, practical or emotional support. Only 2.6% received professional psychological support. Factors identified to worsen mental health outcomes after the 2015 earthquake include not receiving any overall support, whether practical, emotional or psychological, lifetime emotional physical or sexual abuse by their partner, and living in a joint family. A qualitative study (2017) also identified that having partners working abroad, which is common in Nepal (3), increased the stress levels among pregnant women during and after the 2015 earthquake (6) Factors associated with less psychological stress after the 2015 earthquake include having an income, being in a positive and supportive relationship, and having adaptive, communicative and problem-solving skills (52). In general, mental health in Nepal is offered in hospital settings; however, after the 2015 earthquake, mental health was mainly offered by private organizations, NGO's or international organizations who emphasized community-based programs. The engagement of the community in mental health programmes resulted in active detection of people in need for referral (53).

4.2 Education

The second lever of the framework focuses on providing ongoing information to the population about disaster preparedness, risks and resources prior, during and after a disaster, which leads to effective risk communication and social connectedness(25).

Despite many efforts to raise awareness about disasters, including school programmes designed by the government and NGOs, Nepali people lack information about precautions, risks, adaption and actions for disasters (54). People were aware of disaster awareness programmes at the local level, but 30% of the respondents were anxious about all types of natural disasters, and could not differentiate the risk and impacts for their community. Seventy-five percent of the respondents were not aware of the risk for large-scale disasters in their communities (54).

A prior study in Nepal showed that education is found to be associated with less death and fewer losses due to disaster. A one-year increase in

the mean years of education results in a 42% decline in death and loss after floods and landslides. The interventions identified by this study to reduce deaths and losses include creating or increasing awareness, providing information about the disaster, and taking action to mitigate disaster (55). Besides formal education, other forms of education have also been found to be effective, such as informal education through community members and parental education for taking precautions in disaster preparedness (56)(57).

It is suggested that educated people are better able to access information and communicate their messages to partners/partnerships within the community or to higher authorities. This ability in turn facilitates empowerment and leadership within a community. It also influences the socio-economic status of a household, as more educated people are more likely to receive a higher salary, money is earned in less traditional jobs (which diminishes the risk of losing income on only one type of labour) and people are less vulnerable to losses (55).

Education has been found to be an important determinant in utilising maternal and neonatal care (45)(46)(47)(39) and in disaster preparedness (56)(57)(55). Educating the community is essential, so that people know where to turn to for help—not only for themselves but also for community members (58). Concerning maternal and neonatal health, FCHV fulfil an important role in educating women in healthy behaviour. However, FCHV lack knowledge about maternal and neonatal health in disaster settings. Additional training for FCHV that is focused on maternal and neonatal health during disasters could increase community resilience in this specific area of health care (13).

Overall, educated people in general have a broader social network and level of social participation (also known as social capital), which emphasises the importance of social networks and social structures (53). Concerning community resilience, these social networks can be used to exchange knowledge about disaster preparedness and risk factors and can in this way shape risk perception(56)(57). Risk perception can increase knowledge and awareness of the negative impacts of hazards and disaster. Previous studies show that previous experience with a disaster determines risk perception and increases awareness and preparedness for future disasters (56)(60)(61)(55). Increased knowledge contributes to improved coping mechanisms. An important tool for increasing knowledge about the danger of disaster and good behavioural practices is risk communication (62).

4.3 Risk communication

Several forms of risk communication are available, but their effectiveness and applicability depend very much on the context and communication structures (63).
In the aftermath of the earthquake, the media in Nepal were used to promote hygiene by offering instructions to help citizens prepare for injury during earthquakes. However, these messages were sometimes misunderstood and had the opposite effect, leading to harmful practices like ingesting chloride tablets before drinking contaminated water (33).

Innovative strategies using mobile phones and social media are gaining popularity, and could be used to spread and share information on a wide scale (63)(64)(65). This could be of use in Nepal, where access to technology is increasing. Some 73% of women and 89% men own a mobile phone (1). After the earthquake, downtime was noticed, but service providers were able to repair and restore their networks quickly. Internet, television and telecommunication are essential sources of communication (19). However, difficulties in communication systems between rural and urban areas were noticed. These resulted in delayed knowledge concerning needs (33).

Next to mobile phones, more recent communication sources (such as social media) play an important role in disaster preparedness, as they can facilitate social connectedness during and after disasters (66)(67)(68). In Nepal, 47% of the population has access to the Internet, although determining factors like socio-economic status, gender, geographical location and caste are of influence (69). The use of the Internet is the lowest among people without education who belong to the lowest wealth quintiles and live in rural areas (1). After the earthquake, a strong need existed to inform relatives about the situation. Thus, mobile phones and websites like Facebook provided effective ways to check on family well-being and to fulfil the strong desire to stay connected with family and friends. Such resources therefore contributed to mental well-being. Social media were also used for fundraising, by posting photos of affected areas and links for donations. In addition, they were useful for disadvantaged groups, who gained a platform through activists who advocated for their needs (69).
Data from WhatsApp were gained for study purposes and with approval among medical professionals and relief workers from an NGO. These data were analysed to identify needs in medical supplies and human resources, but were also valuable to identify barriers in transport or power (70).

After the 2015 earthquake Internet providers provided free WIFI, which resulted in an increased use of websites; however, this effect immediately disappeared after the free service was removed.

The use of mobile phones and the Internet offered people a platform on which to share their grief and trauma. It also contributed to the coping mechanisms of people in affected areas by helping them explore ways to meet their needs rather than waiting for help (69). However, the prevention of contradictory messages should be emphasised, so that people can make informed decisions during disasters (71).

Although websites may be valuable sources of information, illiteracy and language barriers are of concern (72)—especially among older people. In addition, people with lower socio-economic status lack their own devices to access the Internet (69).

Overall, multiple methods and resources are available for risk communication (63)(69)(65). These methods and resources should be used simultaneously to reach the whole population in Nepal with accurate and culturally appropriate information to increase community resilience (25)(63).

4.4 Social connectedness

Social connectedness can refer to informal relationships among family and friends and to professional relationships (25).
Social connectedness created by using the Internet increases the range of messaging beyond the national level, which broadens the scope of spreading and gathering information and uses the range of online platforms for fundraising and advocacy(69). Engagement can also increase social connectedness by helping people actively participate in community initiatives, which in turn can lead to cooperation with local NGOs or to effectively expressing needs and possible interventions at the district level (73).

4.5 Engagement and self-sufficiency

The lever engagement and self-sufficiency includes the promotion of decision-making, and individuals' and communities' responsibilities to prepare for disaster. This will lead to increased social connectedness, effective risk communication, and the opportunity to include agencies (governmental or external) in community programmes (25).
It is important to engage the community to build trust and gain understanding, so that the community owns the knowledge and is motivated to share it (44). In addition, local people are the first responders and can be effective in response activities—especially for vulnerable groups who are poorly included in disaster planning (74). Traditionally, disaster response in Nepal has been organised through a top-down approach (75). Thus, involving community resilience as a strategy requires a shift in thinking, as this requires a bottom-up approach (76).

Engagement before a disaster hits is recommended to create a common understanding about the disaster and to identify precautions to take, as well as possible challenges and risks, and capacity-building methods of increasing resilience (77). In Nepal, women are more vulnerable to the impacts of disasters than men are due to gender inequality, lower status, socio-economic dependency and traditional gender roles. As a result, women are less likely to have access to resources and participate in community activities, and have little say in decision-making (58). Advocating for the empowerment and engagement of women in policy planning at all levels is important. A popular way to improve community engagement in maternal and neonatal health is to involve women's groups (78)(79). Such groups provide a social platform and increase social capital. Although Nepal has several community-based programmes, such as the community-based child health, new-born, and safe-motherhood programmes, they rely predominantly on FCHV, where the role of women's groups is limited to managing members' contributions instead of discussing health issues. Community involvement in community-based maternal-neonatal and child-health programmes is realised at the level of home visits. There is no involvement in the process of analysing, decision-making, prioritising and cooperating. Women's groups in particular can be used to identify the needs of the community and to implement interventions (80).

Although engagement strategies have been implemented on a limited scale in Nepal (44), a few initiatives showed positive outcomes—such as a study in eastern Nepal that showed engagement of women in community groups and participatory decision-making, which resulted in saving and credit schemes. This offered them financial resources they could spend on priority needs. Furthermore, the groups offered an extension of social networks. This in turn offers a platform on which to exchange knowledge, skills and information in times of crisis. In addition, in this study, members of the group started a lobby for better services for the community at the local level and felt confident in doing so (73). In contrast, group members experienced difficulties meeting (local) authorities due to gender, ethnicity, culture and hierarchy.

Another example of successful engagement on a small scale is an Oxfam project that focused on forming women's groups in some parts of southern Nepal for disaster risk reduction, involving disadvantaged women. The groups advocated for mobile camps, which resulted in free health checks once a month. One group advocated for safe delivery. Community funds were also established by some of the groups to provide emergency loans to cover immediate costs related to the disaster, including free transport for pregnant women. These women's groups were also successful in expressing their needs to external agencies (58). This amplifies community involvement as a strategy to identify barriers and problems, and possible solutions related to maternal and neonatal health.

It also helps to create a platform for sustainable effects, and will likely better meet the needs (81). To improve engagement in community maternal and neonatal health, contact between women's groups CFHV and health facilities is required to offer quality health care and referral options. Engagement may also lead to increased contact with health facilities and to effective partnerships, with sustainable effects on the health system and community health (43).

4.6 Public private partnerships

This lever focuses on the development of partnerships with governmental and nongovernmental organisations, which will lead to the involvement of planning response and recovery and increase social connectedness (25). Building disaster resilience starts with the coordination of resources and by establishing a resilient infrastructure, social capital and education. This requires long-term planning and investments with sustainable political support (82). Partnerships involve different agencies, e.g. governmental organisations, NGOs, UN agencies, faith-based organisations, academic institutions and communities (82)(83).
Collaborations between governments and NGOs provide the opportunity for governments to use the NGOs' flexibility according to the regulations of their counterparts. These partnerships between governments and NGOs or other organisations can bridge the gap between the government and community, and for this reason encourage dialogues within all levels of society (84).

Establishing public and private partnerships (PPP) is a strategy that governments use to engage private organisations in delivering infrastructure and services that are normally delivered by the government. In non-disaster settings, this set up is used to improve access to quality care (85). One of the best-known examples of PPP in Nepal in the field of maternal care was the establishment of the Aama incentive scheme to reach MDG 5 (7). Other studies in PPP have also shown promising initiatives in building partnerships with academic institutions to increase the workforce, especially in rural areas. Successful PPPs were already established in TB surveillance and treatment in Nepal (86) (87). Public and private partnerships in disaster preparedness should mainly focus on the identification of risks and risk mapping, and on building infrastructure with a sustainable financial backing (88).

Disasters are responsible for economic catastrophes that are beyond the scope of governments' ability to cope, as in the case of Nepal, resulting in a higher need for financial and sustainable resources (88). However, financial assets are limited in LMIC (82). Private markets could offer solutions in the way of investments, initiatives, continuity and robust business plans.

Another efficient way of ensuring financial flows during difficult times is insurance; however, insurance coverage is low in LMIC (83). Development aid forms a substantial part of health finances in Nepal at both national and macro levels (84).

4.7 Quality

This lever focus on the collection, utilisation and analyses of data regarding community resilience and is cross cutting for all levers (25).

Data collection

Data collection in disaster settings is a challenge; nevertheless, the MOHP, in cooperation with developing partners, was able to complete a post-disaster needs assessment a week after the first earthquake (19). Identifying needs and monitoring response activities can contribute to improved response strategies—especially in a geographically, ethnically and caste-diverse country like Nepal (90). However, there is an overall lack of evidence-based research in the field of disaster management in Nepal (44)(33) due to a lack of coordination, resources and funding (2). Data collection on community resilience of a community is difficult since evaluation and monitoring tools are still under development (28).
In addition, research is needed to strengthen the health system with evidence-based interventions, which focus on maternal and neonatal health during disasters (41). Possible research collaborations with academic institutes were already in development in Nepal, and successful PPP improved the quality of maternal and neonatal care (7)(91).

Quality of care

After the 2015 earthquake, health facilities in general struggled with the influx of patients. In addition, there was a lack of ability to handle the influx of patients due to insufficient medical staff, equipment and medical supplies (33)(31). In some rural districts, the belief that the nearest health facility lacked quality was expressed in long waiting times and insufficient staff. Additional costs for referral and advanced care were also reported, and resulted in direct self-referral to district health facilities (31). At a community level, FCHV mentioned lacking knowledge about basic health care in disaster settings (13). In addition, it was hard to refer patients from rural areas to higher levels of health care because of blocked roads due to landslides (33). Transport in general was lacking. After the earthquake, ambulances were largely unavailable or charged distance-related fees (31).

4.8 Efficiency

Efficiency focuses on leverage resources for multiple use and maximal effectiveness and is cross cutting for all levers (25).
Together with the UN and international agencies, the government of Nepal formed the national strategy for disaster risk management and the Nepal risk reduction consortium (2009) to reduce vulnerability to disaster (2). Targets were set for sustainable disaster risk management (2). Hospitals and schools were declared priority buildings, but action by the government was slow due to political unrest and a lack of national disaster-risk-reduction planning (22) and funding (2). In addition, the existing disaster planning was focused on the urban area of Kathmandu, but there were no plans for rural areas, which were already fragile due to infrastructure and geographical location. The UN agencies, NGOs and the government provided mapping independently. However, there was no accurate plan to deploy an available or additional voluntary workforce (92). Moreover, the authorities did not succeed in translating disaster-risk-reduction documents into day-to-day actions for communities, such as disaster drills or storage of materials and training in disaster response (93). This may be a result of differences in policies and guidelines between the planning and local development sectors, which prioritized their own sectors and thus caused problems in the coordination (2). Nevertheless, the Nepalese government recognised the need for local capacity and involvement of the community in disaster risk reduction.

Directly after the earthquake, the international community offered humanitarian aid. The disaster relief involved various actors, including governmental agencies, UN agencies and NGOs. Coordination of efforts in the chaotic environment of a disaster is a challenge—especially when many different external agencies are present, all with their own standards (44). After the earthquake, over 300 agencies were present in Nepal, 30 of them working in the field of SRH. Effective coordination and cooperation at all levels—local, district, government and external agencies—can prevent gaps and overlaps in efforts (41). However, there were difficulties in coordination in Nepal, which indeed enhanced overlap and gaps in providing aid and supplies. Additional difficulties in communication between urban and rural areas due to damages and inaccessible areas where the identification of needs was difficult further hindered aid. Tourist areas were prioritised, and in affected areas where NGOs were present prior to the earthquake, aid was mobilised more quickly (33).

Chapter 5: Lessons learned from other countries

This chapter presents best practices and strategies from other LMIC regarding community resilience, as well as community resilience focused on maternal and neonatal health. When no research was available from LMIC, research from high income countries was included. Again, RAND's conceptual framework for building disaster resilience is used to analyse and connect the data.

5.1 Wellness (promotion of pre- and post-incident health access)

Post-disaster health care utilization in Bangladesh was influenced by multiple factors. People from the highest wealth quintiles were more likely to seek care (OR: 2.66 CI: 1.47-6.0), as were people who had benefitted from some education (OR 1.79 CI:1.31-4.24). The distance to a health facility was also an influencing factor; people living more than five kilometres away from a health facility were less likely to utilise services (OR:0.17 CI: 0.12-0.88) (94). To reach populations further away from facilities in rural areas, mobile health clinics were introduced after the 2004 tsunami in Aceh Indonesia and the Kashmir earthquake in Pakistan (95)(96). Results from Pakistan showed higher rates in patients with disaster related trauma (18% P0.01) in mobile clinics compared to permanent facilities (10% P0.01) (96). In Aceh mobile clinics were utilised because of the low distance, and health care was offered at relatively low cost (95). Gender difference was seen in Pakistan, where 65% of those utilising mobile clinics were women. Conservative cultural beliefs in rural areas were suggested to be a possible explanation for this (96).

5.2 Education

Positive associations between education and disaster preparedness were found in Thailand. The study also shows that villages with a high proportion of women have less disaster preparedness, as they are less likely to have access to resources. If women are educated, the level of preparedness rises and, due to stronger connections within the community compared to men, information is spread efficiently(57).

Ardalan et al. showed that Iran has an increased awareness (relative change 2.94 in the intervention group, compared to -0.08 in the control group P0.01) and readiness (relative change 5.52 in the intervention group compared to 0.56 P0.01) for disaster after implementing its educational package in three selected provinces, which are exposed to similar disaster threats and have similar socio-economic status. The package included discussions on household consequences, risk mapping, household emergency planning, emergency kits, emergency plans

(including plans for vulnerable individuals of the household), a personal information card and drills (60).

After the Wenchuan earthquake in China, health information was identified as a basic need. Health promotion, education and communication campaigns were implemented in the most affected areas. Periodic training on hygiene and waste handling was provided, and was used to increase knowledge and skills in local health workers. These interventions resulted in increased hand washing practices (from 34.1% to 45.5%), increased proportions of people refusing to drink un-boiled water (from 41.6% to 80.5%), and increased knowledge of infectious diseases (97).

Although education is found to be an effective strategy in both disaster resilience and maternal and neonatal health, only one study was found that combines these factors, and specifically targets pregnant women and disaster preparedness. In Japan an intervention study provided an educational programme for women pregnant of their first child with and without disaster experience. Improvements were found for primipara without disaster experience on the identification of birthing facilities from 52.5% to 68.7% (P:0.02) evacuation from 47.5% to 67.7% (P:0.004) and explaining currant pregnancy status 86.9% to 97% (P:0.009). The ability to contact family increased form 46.5% to 70.7% (P:0.000) (61).

Risk perception influences disaster preparedness and can be shaped by education, risk communication and prior disaster experience (57). A study from Thailand notes that awareness and risk perception positively influence the motivation to be involved in early warning, search and rescue, first aid, monitoring of disaster hazards and traffic control during evacuations from a community perspective (73). In contrast, the risk perception of pregnant women from the Philippines during typhoon Haiyan was influenced by prior disaster experience resulting in late evacuation. In sequence, contractionary information was spread from multiple sources, which caused confusion about actions to take concerning the disaster. This in combination with a lack of knowledge about abnormal signs in and a lack of access to health care for pregnant women caused stress and anxiety to lose the baby (71).

5.3 Social connectedness

After the earthquakes in New Zealand, community members emphasised the importance of social networks like family, friends and neighbours. These connections made it less difficult to adapt to the circumstances the disaster caused by exchanging experiences, skills and resources. Pre-existing community organisations were identified as important in social connectedness (98). In Jialan, a village in Taiwan, religious groups, youth groups and women's groups were associated with quicker and more efficient recovery than other groups exhibited after typhoon Morakot.

Religious groups were effective in collecting and spreading disaster information and offering counselling and emotional support. Youth groups helped in evacuating vulnerable people. Women's groups cared for others and spontaneously formed self-help groups with the help of influential citizens, who played important roles in reconstruction activities. All groups facilitated psychological healing (99).

Prior studies in the Philippines and Thailand identified social capital as an important factor of influence in disaster preparedness, by using it as a platform on which to exchange knowledge and skills (56). In the Philippines, pregnant women from the same community or neighbourhood gathered and shared resources, sanitation methods and other skills with each other after typhoon Haiyan (65). More specifically, it was also found that pregnant and displaced women in Thailand who received social support during a flood were associated with higher infant birth weight (100).

5.4 Risk Communication

Effective risk communication by authorities is most applicable if accessible and appropriate sources are used to spread the information. In addition, the information needs to be adjusted to the information needs of the community. Research from Hong Kong shows that, during disaster, the information most needed concerns medical assistance, evacuation plans, shelter and information about casualties (66).

Information can be spread by culturally sensitive promotion materials, such as flyers and posters—as was done in Iran and China prior to and after the earthquakes (60)(97). In Iran, educational programme posters were provided that illustrated preparedness activities with the aim of placing them in a high-traffic location. Households that received posters were found to score higher for changes in disaster readiness (53.75 vs 10.53 $P < 0.01$) and awareness (21.05 vs 5.97 $P < 0.01$) (54).

In the aftermath of the Wenchuan earthquake, information was spread with the aim of increasing hygiene and avoiding disease outbreaks. Slogans, billboards, fact cards and flyers were displayed in (public) places that people visited frequently (97).

In Indonesia, mobile phones have proved to be useful in maternal and neonatal health. Providing mobile phones to midwives—especially in rural areas—has improved access to information for community members and has reduced delays in receiving care. It has also offered improved opportunities to consult a specialist remotely, which has improved inter-professional relationships and communication between different levels of health care (101). Furthermore, mobile phones are an important means of maintaining social connections between family members.

Social media could be of use for health promotion and messaging concerning disaster-preparedness interventions and evacuation plans, and offer a platform for social connections (66). Facebook was used in the

Philippines after typhoon Haiyan. The site was established by the WHO Philippine region office and had links with other health cluster partners for response and priorities in affected areas. The site was also used to spread health promotion messages (65).

5.5 Engagement and self sufficiency

Women's groups are found to be effective in disaster-risk reduction, as they identify needs and offer a social platform in several countries (102)(103). As mentioned under social connectedness, studies from Thailand and New Zealand show that community groups have a strong voice in creating awareness by using community knowledge and skills, by identifying hazards, and by creating early-warning systems and infrastructure for capacity building (98)(73).

5.6 Public private partnerships

In disaster settings, PPP can be valuable to overcoming the negative impacts of disasters on health care (85). In India, micro-insurance services are provided on a small scale as part of local disaster preparedness programmes in collaboration with NGOs (who pay part of the premiums to facilitate the set up) and funds from insurance companies, which are obliged to share provisions with low-income clients over time. Coverage for risk of natural disasters is offered through organised women's groups, resulting in insurance being offered to about 100 vulnerable families (104).
Another example from India regarding disaster preparedness shows a partnership between all ambulance-service providers in the state of Kerala and the engagement of state and local officials and hospital administrators, resulting in one emergency network. This partnership has resulted in broader access to emergency care in rural areas. Outreach programmes, participation in disaster drills, and training programmes in basic life support for community members were developed and rolled out (105). A small-scale example from India after a major school fire shows that the private and cooperate sector offers support in the form of free telephone lines, treatment for victims, and free education for siblings of victims (106).

In Turkey, which is earthquake prone, earthquake policies are implemented and a national insurance pool is created. These policies oblige urban and wealthier property owners to pay fees based on risk-reduction measures taken to a privately administered public fund. The poorer rural population still receives disaster assistance from the government, resulting in earthquake coverage for the country (104).

However, not all initiatives have had positive outcomes. In Bangladesh, the demand for flood insurance was explored. This study has identified

limited financial resources, illiteracy and disagreement with the terms and conditions as the main barriers that prevent people from participating in the flood-insurance scheme. On the provider's side, a conflict in interest between the two bodies that should cooperate in this particular situation was noticed. Profit-making insurance companies—as opposed to micro-credit providers, who claim social objectives as their main motivation to participate—did not manage to collaborate in a partnership for flood insurance (107).

5.7 Quality

Community participation in research is difficult during times of disaster, as it is not prioritised by disaster victims (77). It is desirable to identify vulnerable groups beforehand, to establish lists of vulnerable people and their places of residence and to regularly update this list. Mapping can be of assistance for this purpose (66).
Evidence from the U.S. shows that community participation research has resulted in improved education and training in community-based programmes, improved outreach initiatives, manuals for community-health workers, and screening and treatment for those in need (77). However, research in LMIC involving the community has mainly been focused on health-promotion efforts, not by identifying the needs of the population but by identifying the best way to implement health-promotion programmes. The involvement in information systems, supply chains and governance was even more scarce. The communities that were involved in governance and service delivery improved with respect to accessibility, acceptability and availability (78).

5.8 Efficiency

Pre-disaster identification of community leaders is commonly thought to be valuable (98)(66). Community leaders living in the community are able to identify needs and map vulnerable groups. Due to their positions, they are able to communicate the needs of the community to external partners and authorities in a higher echelon (98), but they are also important in disseminating correct information to the community. Governmental leadership lacks trust due to corruption in many countries, including Nepal; in turn, this lack of trust can be a motivation to become involved in community initiatives (73). In the hectic and stressful environment of disaster response, shared efforts in coordination are needed, as health and other factors like nutrition, hygiene, education and socio-economic situation are linked and cannot be seen separately. Disaster-response policies need to be synchronised to enhance a multi-sector approach (108).

Chapter 6: Discussion

A need assessment executed by the Nepalese government identified maternal and neonatal health needs with regards to damaged health facilities and infrastructure. UN agencies and international agencies also published reports on this topic. Yet scientific articles were scarce until 2017, possibly due to the recent character of the 2015 earthquake. However, articles have been published recently. Prior studies in health and disasters identified maternal and neonatal health as vulnerable due to the ongoing need for antenatal care, obstetric care and postnatal care (16)(18). No studies have been found that showed direct health outcomes of pregnant women or new-borns after the earthquake in Nepal, except for one study about mental health outcomes. However, studies from other countries showed health impacts (48)(49) disaster have on maternal and neonatal health, and the WHO reported an increased MMR for 2015 (8).

After the earthquake, maternal and neonatal health in Nepal was influenced by multiple factors besides a severely damaged health system, such as food security and destroyed houses, leading to insufficient housing and destroyed latrines. It was also suggested women form the lowest wealth quintiles living in rural areas being the most vulnerable. Multiple studies have advocated for local people to be the first to respond after disasters strike (74)(44)(33).
Building community resilience is a way to increase peoples disaster preparedness and coping mechanism to better withstand the effects of disaster (25).Despite discussions about the concept of community resilience, multiple articles emphasise the importance of community involvement in disaster risk reduction and preparedness, but do not describe the concept as a whole applied in a disaster context. Strong evidence exists regarding improved maternal- and neonatal-health outcomes in community-based programmes (43)(37). Community-based programmes are widely implemented in Nepal, including a widespread network of FCHV.

FCHV provided important first aid and health promotion activities in the aftermath of the earthquake without additional training (13), particularly in rural areas, where they are the only source for healthcare. Based on their experiences after the 2015 earthquake, additional training regarding health care during disaster settings and maternal and neonatal health was requested. These trainings can increase the knowledge and the workforce within the community. Additional knowledge about the use of reproductive health kits could further enhance maternal and neonatal health. Likewise, improved knowledge how to use of existing resources and infrastructure in the community and extended storage of supplies and equipment complements disaster resilience.

In addition, FCHV do house visits in the community on a regular basis (80). During these visits, needs and vulnerable people within households can be identified. Information about disaster preparedness (including disaster preparedness for maternal and neonatal health) can be provided during these visits, and can include all household members. In sequence FCHV may also be in the position to map vulnerable households within the community, and be the point of entrance for external or governmental aid organisations to collaborate in times of disaster.

Evidence was found regarding the relationship between education and disaster preparedness. As a disaster-prone country, Nepal introduced educational programmes about disasters, including school programmes. Awareness is identified with decreased levels of loss after a disaster in Nepal (54). To involve local communities, educational programmes should be adapted to the local knowledge and levels of education and include practical information. Educational intervention programmes on individual and household levels including disaster drills, evacuation plans, home safety and plans to stay in contact with relatives were effective in Iran and Japan (60)(61).

Effective risk communication is vital in disaster readiness. Technology offers new ways to quickly spread messages (69). Social media platforms such as Facebook were beneficial in recent disasters in the Philippines and Nepal (65)(69). To adequately disseminate information, and to build a followers' base, social media sites for disaster management have to be established in non-disaster settings, and in collaboration with health cluster partners and the Ministry of Health (65). Moreover, technology can also be used to provide remote medical advice, and to improve quality of care by providing access to technology for FCHV.
However, technology is accompanied by socio-economic barriers, educational barriers and, in case of disaster, environmental barriers in damaged infrastructure (69).To overcome such barriers, technology must be used in combination with other traditional strategies such as posters, easily understandable images can bridge the illiteracy gap. In addition, identification of local leaders can be helpful to spread information to the community. Information can also be spread through social networks such as women's groups.

Women's groups are a known strategy to engage women in maternal and neonatal health (79)(78) Nepal has also introduced women's groups and community-based programmes to improve maternal and neonatal health. However, these programs are managed externally and do not include community engagement through women's groups. Strengthening the position of women's groups by connecting them to FCHV can improve their position (80) in identifying needs, educating each other and in health promotion activities. Implementing disaster-related topics into women's groups (like early warnings, knowledge of disasters and preparedness) can make use of local knowledge, which might lead to beneficial solutions

for maternal and neonatal health in disaster preparedness and response including the establishment of emergency funds (73). Women from vulnerable groups (e.g. lower socio-economic or ethnic groups) should be represented in women's groups to help to overcome equity gaps. Women's groups enhance social connectedness, and can provide a platform to exchange disaster experiences, express grief, and find informal psychological support. These networks may also be used to establish PPP and can be beneficial in the establishment of for example local (emergency) transport and emergency funds.

The consequences of a disaster on the scale of the 2015 earthquake go beyond the capacity of the government of Nepal to cope. Nepal clearly received much disaster relief from international agencies. However, difficulties were found in coordination (33). Up to date and complementary disaster guidelines for government and local level can be of help. As well as the transformation of protocols and guidelines into practical documents for day-to-day use. Adjustment of guidelines to the local context and including local knowledge may improve efficient disaster preparedness and response. Identified local leaders can be of help along this process. By outsourcing the mandate to use local resources at the local level, and to strengthen the local health system by education, engagement and pre-established PPP could overcome barriers in coordination and increase access to quality care and community resilience.

The RAND framework used to analyse the literature illustrates the conditions needed to build community resilience. The connections illustrated in the framework between levers and core components are found in the literature. Some connections between elements of community resilience were clearly expressed in the literature, such as education and risk communication and the lever including PPP. The connection between engagement and social connectedness was also found, but social connectedness as a component was rarely described.
The levers can be seen as pre-conditions needed to build community resilience. In this framework the levers are not connected to each other, although they are placed in sequence. Connections have been found in the literature between education and engagement, and social connectedness, engagement and PPP.
Community resilience is used as an outcome in the framework, however community resilience is hard to measure and seen as an ongoing process. Tools to monitor and evaluate this process are under construction, which is also mentioned as a limitation of this study.

This study complements existing studies because it approaches the community resilience concept as a whole for a LMIC, Nepal, exploring gaps and strategies in the levers and core components to build community resilience, with a focus on maternal and neonatal health.

Limitations

Although community resilience is seen as a promising way to reduce the effects of a disaster, only a few articles from LMIC have been published on this topic, with each article describing independent components of community resilience rather than the concept in total. To better understand the effectiveness of strategies concerning community resilience in LMIC, further research is required. Many studies emphasise community resilience in their recommendations; however, community resilience is hard to measure.

The term community resilience is used as an outcome in the framework and is not broken down into measurable variables, which makes monitoring complicated.

Data collection during disasters is challenging and not often prioritised. There is a shortage of studies with a strong design. Another factor that influences research in disaster-affected areas is the availability and reliability of data.
Additional research for data-collection tools is needed to improve the concept of community resilience. Research is also needed to establish efficient monitoring tools for community resilience.

Chapter 7: Conclusion

This study shows that the 2015 earthquake in Nepal threatened maternal and neonatal health by causing major damage to the health system, housing and water supplies. It also resulted in food insecurity. It takes time for a country and the international community to respond to the consequences of disaster. This becomes even harder in a geographically and politically complicated country like Nepal, which causes additional delays in reaching people in need. Local people are first responders after a disaster strikes, and building community resilience can foster efficient disaster response.

This study has revealed a lack of focus on building community resilience in Nepal. However, it also revealed opportunities to further build on, such as the identification of resources and prepositioning of supplies on strategic locations. The involvement of local organisations and resources such as FCHV in the community can be strengthened for basic health care (including maternal and neonatal health), and for potential roles in disaster preparedness and health promotion. Strengthened women's groups can offer a platform for social connectedness and to exchange knowledge and identify needs (including disaster related topics), but also offer an opportunity to establish partnerships with the local health system.

There is a need to increase disaster awareness with programmes adjusted to the local knowledge and context. Multiple sources are available to simultaneously promote these programmes, and to communicate information prior and after a disaster to increase awareness. Technology offers a new range of possibilities in disaster preparedness and response. Prudence and caution are of the essence concerning risk communication. Information must be correct and made easily accessible for the whole population.

Guidelines for disaster management are available on government level however, to improve coordination in disaster preparedness and response, disaster guidelines for practical day-to-day actions adjusted to the local context are needed. Identified community leaders can help to implement, act upon and communicate guidelines to the community, but also to communicate the needs of the community to higher authorities.

Although many studies have pointed in the direction of building community resilience, only independent components of community resilience were studied. Building community resilience is a dynamic process, and additional research is required to further build on robust evidence regarding the role of community resilience in Nepal.

Chapter 8: Recommendations

In order to improve community resilience, including maternal and neonatal health, this study provides the following recommendations.

Create a central storages points for equipment and supplies on strategical locations. Strengthen water supply and food security, especially in hard-to-reach areas to increase access to resources and avoid time gaps for essential basic needs. Involve local organisations in disaster management, and make use of their infrastructure and resources to overcome cultural gaps.

Introduce disaster awareness campaigns that contain practical information adjusted to the local context, to increase risk perception and disaster knowledge. Engage the community in disaster planning (including disaster planning for maternal and neonatal health) through women's groups, and use social connectedness to spread information. Promote connections between women's groups and FHCV to strengthen the local health system.

Explore possibilities to include FCHV in disaster preparedness to increase access to healthcare, including maternal and neonatal health in the community. FCHV could map vulnerable households, adjust preparedness for these households, and improve their effective response. Identify the needs to fulfil this potential role, including the need for additional training.

Explore possibilities to use technology in disaster preparedness and response. Technology can improve social connectedness and be a source for medical back up during and after a disaster. To overcome barriers, technology can only be used in addition to traditional ways to communicate disaster messages.

Improve community resilience as part of disaster risk reduction programmes. Protocols and procedures regarding disaster risk reduction on government level should be complementary and transformed to practical documents, which can be used to develop and execute community-based programmes.

Support research initiatives to improve community resilience and data collection concerning community resilience and disaster in Nepal. Include pre disaster data on awareness and readiness and emphasize on data collection in the aftermath of disaster.

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