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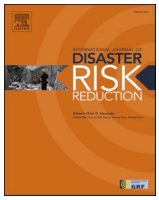

The role of social capital in disaster resilience in remote communities after the 2015 Nepal earthquake

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ABSTRACT

Social capital is widely regarded as a key element in recovery from and resilience to disasters. Yet, little attention has been paid to the specificities of what supports or undermines remote rural communities' social capital in disasters. Here, we examine how bonding, bridging, and linking social capital operated after the 2015 earthquake in three remote Nepali communities of Sindhupalchok and Gorkha Districts, which have varying degrees of access to infrastructure, relief and recovery programmes. We draw on community-based qualitative research conducted in 2018 (including data from Participatory Videos, Focus Group Discussions and Key Informant Interviews) to show how different forms of social capital 'matter' more in different phases of recovery. Immediately after the earthquake, high levels of bonding and bridging social capital among residents reduced barriers to collective action and helped efforts to rescue and support affected individuals. This dissipated, however, once external relief arrived. Already-marginalised groups with low social capital of all types were less able to access relief items and funding for rebuilding compared with those of higher social status or with political links. Pre-existing socio-cultural inequalities, including those driven by weak bonding relationships in families, gender inequalities and the remoteness of villages, further undermined communities' social capital and their resilience to the earthquake. Disaster relief programmes should target women and the elderly to improve the resilience of marginalised communities to future disasters. For long-term resilience, disaster programmes should consider social capital in terms of power and pre-existing inequalities, so that linking capital would not just serve elite groups.

1. Introduction

Disasters cause substantial loss of life every year. Between 1994 and 2013, an average 68,000 people were killed and 218 million people were affected each year with the largest impact (80%) in Low- and Middle-Income Countries (LMICs) [1]. Nepal, one of the least developed nations in South Asia, regularly faces disasters such as landslides, flooding, and droughts, yet the 2015 earthquake remains the most destructive disaster in recent history. The 2015 earthquake killed 8979 people, injured more than 22,000, and destroyed more than 800,000 houses, affecting close to a third of the population (8 million out of 28 million in total) [4]. Although the severity of the earthquake was relatively uniform across mountain and hill districts, the poorest populations in rural regions, who lived in houses built with mud and stone, suffered the most harm [2,3]. It is estimated that an additional 2.5 to 3.5% of the population (at least 700,000 people) fell below the poverty line as a result of the earthquake [4].

Following the 2015 earthquake, the Nepal Government developed Disaster Risk Reduction (DRR) policies and guidelines – the Nepal DRR Management Act (2015) and the Post Disaster Recovery Framework (2018) – in line with the Sendai Framework for DRR 2015–2030 [59]. These guidelines emphasised that a key approach to DRR is building 'community resilience' [4]. This can be defined in different ways but is commonly understood as the collective ability of a community or geographically-distinct area to deal with stressors and resume everyday life through cooperation after disasters [5,6]. In principle, DRR frameworks emphasise community resilience as understanding the drivers of risk at the local-level, empowering people to reduce their risk and

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vulnerability to disasters, and enhancing social cohesion [4].

Yet, in practice, DRR programmes in Nepal have often been criticised for being unidirectional and 'top-down' in orientation, without involving communities in strengthening their own resilience in a 'bottom-up' way [3,7,8,9,11,56] . For example, after the 2015 earthquake, humanitarian organisations and the National Reconstruction Authority in Nuwakot and Dhading Districts did not consult affected communities in the rebuilding process [3,11]. As such, community resilience remains mainly a conceptual goal and is far from the everyday realities of many Nepalese people, as their views and understanding of resilience are often ignored [9,11]; . Indeed, much like wider evidence on natural disasters, too little attention has been paid to the specificities of what can support or undermine particular communities' resilience in practice [10–12], including the role of social capital.

Social capital has been recognised as a key component of community resilience in DRR by social scientists researching disasters (see for example, [6,10,12–18,57] . Literature has focused on the strength of social networks and leadership in disaster recovery [16]; gender roles in disaster response [19]; the simultaneously positive and negative influence of social capital in disaster response [13,20,21]; and the need for context-specific cultural understandings of disaster response [12,21]. This is because social capital in disasters seems to have differential effects for different people, depending on the particular socio-cultural context [12,13,21,61]. Therefore, studies of social capital should consider both the 'downsides' in terms of exclusionary practices and negative consequences, as well as the benefits within the local context.

Yet, there are relatively few studies conducted in remote regions of developing countries [22,23]. We found only four studies of social capital in disasters in Nepal [22–25] (details shown in section 2). These studies mainly focused on the relief phase, and in the capital city or more developed communities, lacking a nuanced analysis of how social capital operates in the longer-term, including the experiences of resource-poor rural and marginalised communities living in and through a major disaster [22–25]. These studies also lacked in-depth analysis of how different forms of social capital influenced communities vulnerable to disasters.

Our study aims to fill this gap. We draw on findings from an in-depth community-based participatory study to explore how different forms of social capital (bonding, bridging and linking) operate over time across three villages in Nepal. The central questions guiding the research included: How have different forms of social capital operated across remote populations groups over time in relation to this major disaster? What was the role of social capital in supporting or undermining remote, poor and marginalised communities' resilience to disaster in practice? By answering these questions, our study fills a major knowledge gap in academic research and development practice, contributing to disaster resilience studies on vulnerable populations in very low-income contexts that have limited financial and government aid [26,27]. Additionally, our use of participatory research methods provided an opportunity to bring previously unheard voices into view and into policy discourse (3.5), and also identifies potential research questions for future research (5).

Next, we present our understanding of social capital; explaining three types of social capital (bonding, bridging, and linking) in relation to disaster resilience as we use these concepts in our data analysis. We then present the study methodology (3), followed by results (4), discussion (5) and conclusion on the roles of social capital over time in the disaster response (6).

2. Social capital (bonding, bridging and linking ties) and disaster resilience

In this study, we define social capital as being about social relationships, and as the ability of actors (individuals, groups or communities) to use these relationships to access financial, emotional, physical or other resources to fulfil survival and recovery needs [28]. Indeed, social capital has been described as central to Nepalese society (section 3.2), including in disasters [23,25]. Literature also suggests that distinction between bonding, bridging and linking forms of social capital corresponds with Nepalese concepts and practices [22,23,25], hence we use these concepts in this paper. Below is a brief description of each of the three types of social capital, with examples drawn from previous studies of disaster resilience in Nepal and elsewhere.

First, bonding social capital connects individuals who are similar in terms of their socio-financial position and demographic characteristics (for example family, relatives, kinship groups) [29]. As these groups have a relatively high degree of homogeneity, bonding has been argued to facilitate immediate rescue and early recovery of in-group members in disasters, as seen in Nepal [22,24,25], India [18], Vietnam [10], Japan [16] and the United States [30]. Yet, bonding has been criticised for conveying advantages only to in-group members, or increasing the likelihood of group members being held back and prevented from forming relationships with sources outside the group [31–33]. For example, in Southern India following the Indian Ocean tsunami of 2004, individuals with deep attachment to their community did not follow the recovery measures , thereby lowering their chances of disaster resilience [34] and women and socially disadvantaged members of the community could not form ties with other groups, thus delaying their recovery [13].

Second, bridging social capital refers to connections between people who are not family, relatives or kin, but who have similar financial status and political influence [29]. As a result of bridging, people from across social divisions within a community or neighborhood come together, irrespective of their ethnicities, geographical or occupational backgrounds. For example, also following the 2004 Indian Ocean Tsunami in Tamil Nadu, bridging social capital reduced barriers to collective action for members of a village council, thus speeding up their recovery. Yet, in that case, gender and caste remained divisive: women and Dalits (formerly untouchable groups who were socially excluded, and were already vulnerable to disasters, could not benefit from relief, thus further marginalising them in the recovery processes [13].

Third, linking social capital refers to connections between groups and people in positions of power (whether as a result of political position or financial resources), and includes vertical links to formal institutions, such as governmental organisations [29]. For example, linking social capital facilitated management of earthquake waste in Japan [35] and eased relief distribution efforts by non-governmental workers in Nepal after the earthquake [23]. Yet, Dalits and the rural poor often lacked linking ties and were less likely to benefit from relief programmes - as seen in Nepal [56] [23], India [5] and Bangladesh [36]. Thus, linking social capital seems to reinforce existing systems of discrimination [37], allowing the (relatively) privileged to access resources while harming, or excluding, those on the edges of society [14,23].

Finally, we provide a brief overview of studies of social capital in disasters in Nepal. Out of four studies identified [22–25], two were conducted after the 1934 and 2015 earthquakes in the Kathmandu valley, the capital city, among the ethnic indigenous Newar population, who are considered to have a high level of social capital. Both studies reported early community recovery after the earthquakes, which was attributed to the social capital of the Newar people, who worked collectively through their social networks; shared resources and information; and supported each other emotionally [22,24]. Newar people mobilised local volunteers through guthis, defined as 'living together in mutual trust and self-service' [22] p.319). While Devkota et al. [24] involved mainly educated male respondents (85%) in the relief phase, both studies lacked in-depth analysis of how different forms of social capital influenced communities vulnerable to disasters.

The third study, conducted among non-governmental organisation (NGO) workers, revealed that the pre-existing networks of NGO staff and trust influenced where and how they worked and distributed relief after the 2015 earthquake. As a result, NGOs served residents in Kathmandu through increased access to financial or material resources and underserved those living in remote communities in Gorkha [23]. Finally, a

recent quantitative study of social capital after 2015 earthquake by Rayamajhee et al. [25] measured the effect of participation in community activities. The study showed a crucial role for bonding social capital – for example family, relatives, kinship groups – in boosting mutual trust among group members and promoting mutually-beneficial post-disaster collective action. Yet, the study also showed that bridging and linking social capital do not have this effect.

The above studies in Nepal mainly focused on the relief phase, lacking a nuanced analysis of how different forms of social capital operate over time after a major disaster, including the experiences of resource-poor rural communities living in and through the 2015 earthquake. Our study fills this gap, and also includes analysis of what supports or undermines remote communities' resilience to future disasters in relation to the 2015 earthquake.

3. Methodology

As discussed above, social capital and disaster resilience is context-based and it is important that we understand the research context well, so that findings can be interpreted. Here, we provide a brief overview of the context of the rural Nepalese communities in which the study was carried out. In particular, we highlight the socio-cultural status of the study populations, geographic accessibility, livelihood, migration and gender – all issues that, as the literature suggests, show distinct differences to urban communities in Nepal. We then move onto introducing the study areas in more detail.

3.1. Study context: rural communities in the hill districts of Nepal

Our study population mainly comprised of Tamang, Gurung and Dalits (3.3), who are thought to be more vulnerable to disasters than others, as a result of longstanding social, political, economic and cultural inequalities [4,56]; . They have been historically marginalised as they were classified low in the hierarchy of Nepal's Hindu caste system [38]. Although caste discrimination has now been formally outlawed, it remains pervasive in practice [56]. People belonging to these ethnic groups generally have little access to formal education, often cannot speak fluent Nepali (the language of the political elite), and have less access to networks of power which are often located in the district headquarters or in Kathmandu [23,39].

These communities often lack adequate road networks and have limited access to external development services, which are crucial in building resilience after a major disaster [23,40]. Particularly, Tamang and Dalits remain impoverished, often relying on manual subsistence, and with limited ownership of land. They often do not earn sufficient income, and are unable to make a living. Many male adults from these communities are forced to seek employment abroad, mainly as migrant labourers in low-skilled and low-wage work in India or Middle Eastern countries [38,41].

The increasing trend for rural males to seek employment abroad has left families split, and in many villages female-headed households (with the husband/father working overseas) are increasingly common [42]. Although remittances are crucial [43], migration remains a key social factor increasing the vulnerability of rural communities in times of disaster [26]. For example, after the 2015 earthquake, women in rural communities were worst affected, as they could not access material or financial support for rebuilding as shown in 3.2 [11,44].

3.2. Nature of social relationships

Social capital has been described as central to Nepalese society, which is structured by informal social relations [45,46]. As with many agrarian communities in South Asia, rural Nepalese communities are considered to operate on a collectivist social model. Across communities, collective action is more profound among similar kinship groups or the close family circle, recognised as 'afno manchhe' [45,46]. This family circle comprises immediate family members followed by close extended family and close friends, who are also treated as family [46]. Additionally, according to cultural traditions, people from our study communities (3.3) often get married with their close relatives or within extended family relations. In some way then, the whole community is connected.

When a villager is seeking help after a disaster or in times of crisis, the first individual they approach is often a relative or friend. If a friend has a connection with someone who is influential, such as in a powerful social position, then they are more likely to get help. Indeed, one of the strategies adopted by people in remote areas to access relief resources to cope with the 2015 earthquake was to create relations with those who were more privileged or powerful [23]. Yet, this does not guarantee access to resources for women, who often have low social status [11].

In Nepal's predominantly male-dominated rural society, it is often men who form social relationships with outsiders. Women's movement outside their households or farms is often restricted due to traditional norms, thereby inhibiting them from building the relationships required to access resources [47]. Therefore, understanding of socio-cultural practices and how they can influence social relationships within communities is crucial in order to improve resilience and recovery of vulnerable groups in case of future disasters.

3.3. Study areas

We selected Gorkha and Sindhupalchok districts (Fig. 1) for three main reasons. First, both districts were severely affected by the earthquake. Second, we wanted to inlclude communities with different degrees of accessibility to road/transport. Finally, our collaborating NGO, PHASE Nepal, was working at the grassroots level with poorer and more marginalised groups in these areas, which facilitated the adoption of participatory approaches (research methods 3.5).

These districts are significantly less developed (as measured by the Human Development Index (HDI) and poverty index) compared to the capital city Kathmandu. Table 1 compares the two study districts with the capital city Kathmandu, with reference to the post-disaster severity index, human development index, and poverty index [2] P.15.

Anecdotal evidence suggested that some rural communities in Nepal were not being supported to rebuild their homes following the 2015 earthquakes. Relief and reconstruction support relied heavily on communities' access to road and transport [40]. Therefore, we selected three villages with varying access to transport facilities: Hagam and Jalbire (known under Nepal's new government structure as Jugal Rural Municipality Ward 7 and Balefi Rural Municipality Ward 2, respectively) in Sindhupalchok District; and Keraunja (now known as Dharche Rural Municipality Ward 2) in Gorkha District. There is relatively easier road access to Jalbire (3 hours' drive from Kathmandu) than Hagam. Hagam is accessible by motor vehicle only in the dry season, and is connected by a muddy track to Jalbire.

Keraunja is an even more remote community, without access to roads, and the 'least developed' in terms of material resources available to residents. The topography makes the village at high risk of landslides. The 2015 earthquakes and subsequent aftershocks, followed by heavy monsoon rainfall, caused landslides and the entire position of the village has shifted. People continue to live there despite ongoing risks of landslides and seismic activities. With access only on foot, visiting Keraunja requires three to five days' walk from the nearest road at Gorkha bazar, where district authorities and administrative services are located. Almost all houses in these villages were destroyed, except for the few concrete houses that existed prior to the earthquake.

In terms of population, Jalbire is ethnically mixed, but Hagam and Keraunja are more ethnically homogeneous, with most residents belonging to minority caste ethnic groups: Tamang in Hagam, and Gurung in Jalbire, as well as Dalits in both villages (as seen among our PV participants in Table 2).

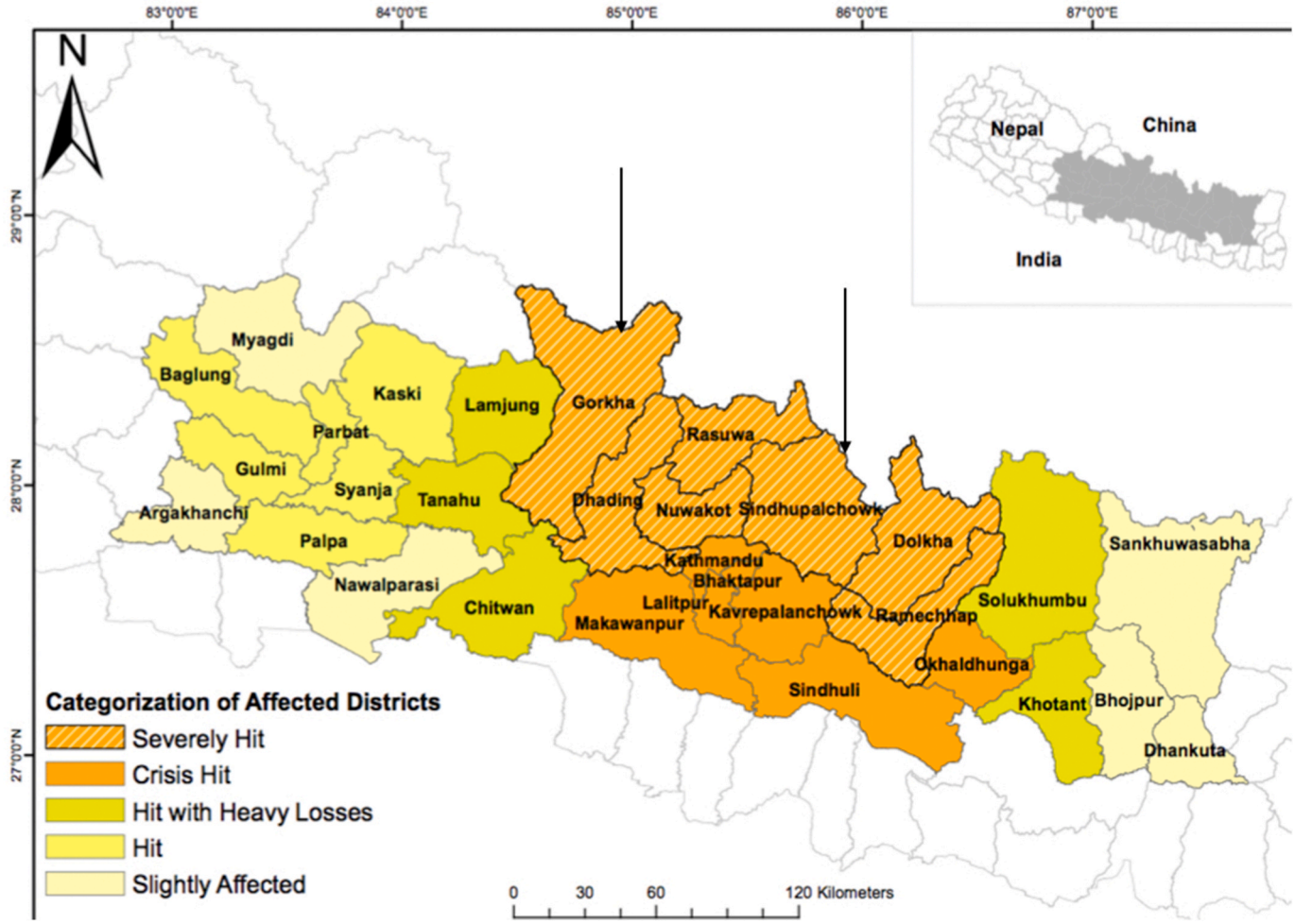

Fig. 1. 2015 Earthquake affected districts in Nepal with arrows indicating the two severely affected study districts, Gorkha and Sindhupalchok[11].

Table 1
The severity index and poverty index of study districts relative to the capital city, Kathmandu.

Villages	Sindhupalchok	Gorkha	Kathmandu (capital)
Post-disaster severity index	0.78	0.67	0.13
HDI (Human Development Index)	0.455	0.48	0.63
Poverty index	38	39	22.5

3.4. Study partner

This study was carried out with an NGO partner – PHASE Nepal (JK is the founder and and Executive Director of PHASE Nepal). PHASE Nepal aims to improve the health, education and livelihoods of people in remote communities through their work with local authorities and the government (https://phasenepal.org). Some research team members (SP, SR and JB) at the University of Sheffield have a well-established relationship with PHASE Nepal, and worked together (over a two-year period) to co-develop the wider research project on which this current paper is based.

The involvement of this local partner was crucial to implementing the research in these remote rural areas. PHASE Nepal is well-known in the villages, and the partnership was useful in engaging members of the local communities in the research. Yet, the role was as an intermediary – creating space to conduct participatory research through connecting researchers with communities and local government officials. PHASE Nepal staff informed villagers about the research through local meetings and written advertisements. They did not have a direct influence on the research findings. The first author (SP) was not linked to PHASE Nepal, and ensured that a wide variety of community members participated. Besides, community members themselves selected the research topics, including issues of disaster resilience, thus fulfilling our aim of listening to people who were previously unheard.

3.5. Research methods

We used multiple qualitative methods: (Participatory Video (PV), semi-structured Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs)) in order to explore issues 'with' the communities affected by the 2015 earthquake. This paper is based on findings from the project 'Resilience policy making: giving voice to communities,' which was about sensitising policy-makers to the experiences and realities of community members by using PV. PV has been praised for its ability to strengthen the agency of marginalised individuals and communities: giving them a means to recognise and voice their own issues [48], as well as engaging in policy processes through public and policymaker screenings [58]. Despite its wide application elsewhere, PV has been rarely used in Nepal. We used PV to enable people to express their views about relief, recovery and reconstruction activities, including, for example, the significance of their social relationships, and how they accessed the resources they needed following the 2015 earthquake.

We used FGDs in the research in order to offer other opportunities for people to participate, including those who cannot read or write, and to

Table 2
Demographic information about study participants, including the impact of the earthquake on their family and livelihood.

Village	Participant No.	Age	Gender	Ethnicity/caste	Education	Occupation	Effect of earthquake
Jalbire (Balefi Gaupalika 1)	1	30	Male	Dalit, Nepali	12	Tailor	Lost home and a baby
	2	20	”	Kshatri, Khatri	”	Student	Lost property
	3	40	”	Kshatri, Thapa	10	Agriculture	”
	4	27	Female	Janajati, Shrestha	Graduate	Social work	”
	5	24	”	Janajati, Tamang	10	Agriculture	”
	6	47	Male	Janajati, Shrestha	12	Technician	”
	7	22	Female	Janajati, Shrestha	”	Student	”
	8	24	”	Kshatri, Khadka	”	”	”
Hagam (Jugal Gaupalika ward number 6 & 7)	1	27	”	Tamang	Literate	Agriculture	”
	2	23	”	Shrestha	12	Business	Minimal loss
	3	21	Male	Tamang	10	Driver	”
	4	23	”	”	Literate	Sales man	”
	5	22	”	”	12	Real State	Lost house, property
	6	28	”	”	”	Painter	”
	7	24	”	Shrestha	”	Business	”
	8	23	”	Tamang	”	”	”
Keraunja (Dharche Gaupalika ward number 1 & 2)	1	20	Female	Gurung	8	Domestic servant	”
	2	23	”	”	12	Agriculture	”
	3	19	Male	”	”	Marketing	”
	4	26	”	”	10	Reconstruction worker	”
	5	20	”	Dalit (Sunar)	8	Agriculture	”
	6	18	Female	Dalit (Bika)	”	”	”
	7	28	Male	Ghale	Literate	”	”
	8	28	”	Gurung	10	”	”
	9	23	Female	”	12	Student	”

create a space to encourage discussion. The FGDs were designed as an opportunity to engage people who might otherwise have been reluctant to be interviewed on their own, especially women [49]. We used KIIs with influential people at different levels of governance to capture stakeholder perceptions as well as to discuss recommendations emerging from the PVs. In KIIs, and in the FGDs, we used a semi-structured topic guide to ensure that the key research questions were addressed (section 1). This covered topics such as their views of major disasters in their community, their responses to disasters (in this case it was the 2015 earthquake), and the kinds of support they received (or did not receive) from the government and other stakeholders to cope with the disaster.

At first, the field researchers (JK and SP) held a consultation meeting in each village with local NGO staff and local government officials, including some residents. We informed the meeting attendees about the purpose of our study, and asked them to help us find potential local residents for the PV training using the following criteria: a) a mix of genders and ages, b) representation of the most vulnerable and marginalised sections of the communities (such as women, members of ethnic minorities, Dalits), and c) representation of each community unit, known as a ward.

For the PV, we recruited participants with at least basic literacy, as they would be approaching and interviewing other community members as well as performing tasks such as creating interview guides.The participants' confidence and ability to express their views would clearly benefit their communities, because they had to make the videos and screen them to policy makers and officials at local, regional and national levels. Therefore, we selected people with a reasonable level of education when possible, but also ensured representativeness in terms of inclusion of village unit, gender and marginalised caste and ethnic groups.

On the second and third day of field visits, JK and SP interviewed potential PV participants using the above selection criteria. In case of many eligible participants, we selected them based on their interview performance, which included their ability to identify key risks within their communities, ability to speak up, and years of schooling - it was important that the participants could speak up as many women in rural Nepal are hesitant to speak up [49]. We then facilitated the PV training over the next 10 days in which the participants were trained in using cameras, microphones and computer editing software; worked in groups to explore local issues around disasters and resilience; interviewed other local residents on camera; and finally produced short films addressing issues of disaster risk and resilience in their communities.

The topics covered in the videos were: 1. what are the major disasters they have come across in their community? 2. How did they respond or cope with the most recent disaster event (in this case it was the 2015 earthquake, except one group in Jalbire who made an additional video about landslides)? 3. What support did they get from the Government and other stakeholders to cope with the earthquake? 4. How will they manage future disasters? 5. What support do they need from the Government and other stakeholders to be able to cope with future disasters. Except for a group in Jalbire, all groups produced videos on earthquakes. All of the videos are publicly available [60].

Although JK and SP trained the community participants in film making and how to conduct an interview, the participants were encouraged to develop their own thinking around issues of resilience, reconstruction and disaster support. They approached the project using their own ideas and questions rather than those pre-prescribed by the research team. It was the community members who collected the data and made films about disaster issues that were directly relevant to their communities. Therefore, the researchers did not have any direct influence on the specific research topic chosen by the participants in each village.

In total, 25 local residents participated in the PV training programmes: eight in Hagam, eight in Jalbire, and nine in Keraunja (Table 2). The number of male (15) to female (10) participants was high. This is because we could not find four women participants who met the study criteria in Hagam. Table 2 shows an anonymised list of PV participants with their village, age, ethnicity, education, occupation and the impact of the earthquake on their families.

In addition to PV, we held four FGDs with a total of 21 community members: 18 females and 3 males ranging in age from 20 to 59 years old. The participants included female community health volunteers and local residents.

Finally, we held 22 semi-structured KIIs with officials in the villages and respective district headquarters. The following were identified as key informants: teachers, female ward representatives, social service

[1] Source: Government of Nepal/Ministry of Home Affairs as of 21 May 2015 (National Planning Commission (NPC) 2015)).

workers, health workers, ward chair, business owners, and local shopkeepers. At the village level, we conducted 14 KIIs with 11 males and 3 females between 31 and 66 years old. At the district level, we interviewed eight officials who had a role in local disaster management in the study villages, which included: Chief District Officers, representatives of the Nepal Reconstruction Authority, a District Educational Officer, a District Public Health Officer, an Officer of Women and Children's Welfare, and officers from JICA (Japanese International Cooperation Agency).

Data from the PVs, FGDs, and KIIs were transcribed and translated into English, with transcripts imported into NVivo for Mac 11.4.3. We analysed the data thematically [62]: first coding the entire dataset, then arranging the codes to reflect the role of social capital over time following the 2015 earthquake. We considered how the three types of social capital (bonding, bridging, and linking) manifested in the data, including how social relationships were influenced by factors that have an important role in pre-existing social inequalities: families with weak bonding, gender inequalities and the remoteness of the villages.

Nepali speakers (SP and JK) independently coded the data, and returned to original recordings for clarification in cases where the English language transcription was unclear. Data was triangulated across research methods (PV, FGDs and KIIs), study villages (Keraunja, Hagam and Jalbire), and participants (local residents and key informants). The convergence of themes across different groups of participants, places or methods enhanced the validity of the research findings [63].

Ethical approval was obtained prior to data collection from the Nepal Health Research Council (Registration number 449/2017) and from the Research Ethics Committee of the University of Sheffield (Reference number 016530).

4. Results

Our findings are presented in relation to the three forms of social capital described in the first section of this paper and are also arranged chronologically, given that we identified these three dimensions of time as key within the disaster response: 1) collective community rescue and relief efforts immediately after the earthquake (through mobilizing existing bonding/bridging forms of social capital and over-coming differences); 2) exclusion of marginalised groups after the arrival of outside aid (by weakened bonding/bridging, particularly for these groups); and 3) social capital as useful in the rebuilding phase, but reinforcing inequalities.

4.1. Collective community efforts immediately after the earthquake

When the earthquake hit the villages, as well as losing lives, many lost their animals, housing, food and food storage. Many participants across the villages thus shared similar experiences, in the sense that they found it extremely challenging to meet basic survival needs, as explained by this man:

> We were unable to think. We were just panicked. We were terrified finding that all the nearby houses had collapsed. We were worried whether we would survive, as we didn't have anything to eat, to drink, or to put on. We didn't even have a shelter. The day when our houses fell down, we spent that night under a tree (PV, Jalbire).

Pre-existing bonding relationships (e.g. relationships between family members, sisters, neighbours) were crucial to saving lives, as people mobilised these relationships to mutually support each other. Residents across all three villages described how family members, relatives and neighbours worked together immediately after the earthquake on the search and rescue of people and recovery of bodies from under the rubble with a sense of urgency. A majority of people in interviews, FGDs and the PVs, expressed collective language such as, 'we worked together to rescue', 'we helped each other', in order to show their collective effort after the disaster. For example, this woman described her experience:

> I was confused whether to save my children or to save myself. I came running and started shouting, children come out fast, come out fast. My neighbour's children were watching television and all came out of the house. My sister and her elder daughter were on the other side, they called us there. We started running. While running, a metal sheet from [the roof of] the house fell on the head of a woman. She started to bleed, then I somehow managed to take her as well as the children to the other side (Female Ward Representative, KII, Hagam)

People also tried to console each other and provide emotional support after the earthquake:

> We tried to console the locals who were badly injured. Those who were mentally and physically fit helped in various work by going from one place to another in search of rescue and relief materials. In the case of buried victims, the whole community tirelessly pulled them out and checked for signs of life. We put a huge effort into looking for resources to support living beings - humans and animals (Male adult, KII, Jalbire).

However, in Keraunja, a woman, reported a different experience, illustrating how challenging collective rescue efforts are when people are panicked about their own lives. The woman explained how it had not been possible to save her cousins, who died in the earthquake:

> I didn't know that it was an earthquake. Two children of my aunt were playing inside the house. They were one and three years old. They got buried under the house in front of my eyes and I could not do anything. They were under debris. I asked for help, but the villagers were so terrified that no one could help. My parents were on a farm far from the house. I requested young boys from the village to pull the children out, but they replied, "Our life itself is at risk, how can we save them?" I stood there watching and listening to them from under the rubble. After some time, the sound stopped (Female health volunteer, FGD, Keraunja).

The woman also described how she and her aunt shared in their grief later that night, showing how bonding relationships provided some means of immediately coping with the loss of the children:

> We didn't have anything during the night. I was crying because I lost my two cousins. My aunt was crying, remembering her children (Female health volunteer, FGD, Keraunja).

Across all three villages, people expressed how they searched for food in the debris and under rubble, and whatever they found they shared with each other. People also described how they cooked, ate and lived together for a couple of nights. A local resident reported that they had no choice but to share in order to save lives:

> There was nothing to eat. We searched in a shop and found some beaten rice. Everyone ate a few gulps of the beaten rice and waited … To save lives, people had to share. No one had houses, so everyone shared the food with each other (Female, FGD, Hagam).

These bonding relationships were also crucial in the building of temporary shelters and in bringing out dead bodies from under the rubble.

> There were dead bodies all over the places. We were informed that police would come to take the dead bodies but they didn't come for 6–7 days … It was the worst time. The dead bodies were rotten and started to smell bad, as they were still under the rubbles. We were not able to take out the bodies from the debris. On the 7th day, we all gathered together, cleared the debris, and took out the dead bodies (Female, FGD, Keraunja).

In all three communities, in the absence of outside help, the villagers

were left with no choice but to work together to save lives: they were each others' only immediate resource available in the villages after the disaster.

Yet bridging relationships were also important. Bridging relationships reduced barriers to collective action among community members, helping residents to act across socio-economic differences and speeding-up search and rescue. Study participants described how males and females from different families and villages worked together to build temporary shelters, and lived together in communal groups, usually in the open or under tarpaulins/tents, until relief materials arrived. In Jalbire, up to 45 people lived together under one tarpaulin and prepared communal meals:

> For nearly a month we had a kitchen for 40–45 people from 7 families. We shared the same kitchen. We stayed together during the time of disaster and even those neighbours with internal conflicts in the past stayed together in harmony. The event taught us the importance of cooperation (Male, KII, Jalbire).

Many participants admitted that previous conflict or competition was set aside for the benefit of the greater good. As one male Ward Chair explained, residents who were members of different political parties, ordinarily in competition with one another, worked together to rescue survivors and provide them with food and shelter.

We, however, found that these pre-existing bridging relationships particularly benefitted people such as teachers, health workers and village officials, as they tended to have higher social status and a larger social network. For example, an ex-school principal in Jalbire acknowledged that he had been able to convince local shopkeepers to sell essential food items to him. His social status gave him additional leverage, allowing him and his close relatives access to food:

> For 2–3 days after the earthquake, the situation remained uncertain. There was nothing left. Roads were blocked. The market was closed. People didn't even sell their goods. We convinced a few shopkeepers to sell us goods and brought food from the market (Male, KII, Jalbire).

Irrespective of social hierarchy, social bonds between residents led to mutual aid: for example, a health worker reported that many people in Keraunja had survived by eating food that had been stored by a local shepherd (Male, KII, Keraunja).

In these ways, then, both bonding and bridging social capital were evident in the immediate aftermath of the earthquake across all three villages, with people assisting both within kin and family groups, and across socio-economic divides and with residents from different villages, to mobilise and access human and material resources. However, as we describe in the next section, such mutually-supportive approaches dissipated soon after outside aid arrived in the villages.

4.2. Exclusion of marginalised groups after the arrival of outside aid

Participants across all three villages described how, when aid arrived from NGOs and humanitarian organisations (for example, UNICEF, Care Nepal, and Oxfam), the mutually-supportive activities that had been mobilised in the immediate aftermath quickly stopped. People competed for limited relief materials such as tarpaulins, blankets and clothes. Those with stronger bonding relationships (often families with adult males) and linking relationships to those with local power (also usually males) could more easily access the limited relief resources, while those who were less well-connected (with less social capital) were left out. The relief distribution across all three villages was described as chaotic, where everyone competed for limited resources:

> As part of the initial relief there were about 30–35 sacks of rice, 15–20 bundles of tents, 20–22 sacks of beaten rice. We couldn't distribute relief materials because there were so many victims. There was chaos among the people. We tried to get help from Jalbire Police station, but the telephones didn't connect. People started to fight. Some of those who could fight snatched the beaten rice. Others took away tents. And those who couldn't, hurled stones at others (Male, PV, Hagam).

In one case, while trying to collect relief items, a man was severely injured and needed hospitalisation:

> People were fighting and were all screaming and shouting for the things. Some gathered enough of the things, while some were left with nothing. Those who were physically powerful and clever looted relief items. They attacked my husband and injured him badly (Woman, FGD, Hagam).

Across all three villages, women and the elderly often could not compete with men to obtain relief materials, as shown below:

> Different organizations sent us relief materials, but I was unable to receive those because there wasn't a male member in my family. I was alone with an infant. People who were physically able received the relief materials (Woman, PV, Jalbire).

Additionally, families with elderly members and female-headed households often also lacked the linking relationships with government or non-governmental agencies, and as a result could not seek external assistance to secure relief materials or funding. For example, PV participants across the villages reported:

> Those residents who had connections with local offices or NGOs were often able to access materials such as zinc sheets, tents, blankets, buckets, rice sacks, noodles, utensils, food, and medicine, relatively quickly. Yet, those without such connections could not access relief items (PV, Jalbire, Hagam, and Keraunja).

However, connections outside the villages, and the active efforts of local political representatives, wereuseful in securing material resources for the villages:

> We friends collaborated together, and went in search of relief. At a very early stage, the World Food Programme has managed to bring 3–4 vehicles of food items and relief materials. The food items were not allocated for Hagam, but we managed to get 1 vehicle full of food for Hagam. Then the Nepal Government and the Army brought relief material to Chautara [the district headquarter]. We went there to bring the relief materials and distributed them to every single household in the village (Male, KII, Hagam).

Similarly, the presence of local NGOs in some villages before the earthquake helped mitigate some of the potential inequalities to some extent, as even 'ordinary people' without political or other connections had some linking relationships with local NGOs and could access relief materials from them. For example, in Hagam and Keraunja, many participants reported how their links with PHASE Nepal (as described above, a Nepali NGO with a permanent base in the villages, which was also the NGO partner for our study) was a way for them to access relief items:

> PHASE Nepal helped us a lot immediately after the earthquake. They provided us with tins [metallic sheet] so that we could made a roof for shelter (Male, PV, Keraunja).

> We went to the grounds of the school, the families of 14 houses all lived there. Sir from PHASE Nepal brought some tents. We managed to settle under the 2–3 tents. We lived under those same tents for 15–16 days (Female , KII, Hagam).

Yet, relief resources were often distributed in or around village centres, which meant that residents who lived in the more remote parts of the villages could not access them.

> We saw helicopters dropping food materials, but people from remote areas could not get the resources (Female, PV, Hagam).

Our findings above suggest that people who had pre-existing bonding social capital, mainly due to the presence of male adults within families, or those with pre-existing linking relationships with government or non-government agencies, benefited more from the relief operation than those without such forms of social capital. In contrast, members of the communities who were elderly, widows and/or single women benefited less from relief efforts. This reflected pre-existing socio-economic and cultural inequalities in the villages, which continued – and were further reinforced – in the rebuilding phase, as shown below.

4.3. Strong social capital as useful in rebuilding, but reinforcing inequalities

Our PV interviews and FGDs across the villages reported that all kinds of social capital (bonding, bridging and linking) were important in the rebuilding phase. Bonding and bridging capital werecrucial to accessing the human resources needed to build new (in some cases earthquake resilient) houses. For example, in Keraunja, people worked in a group of 20–25 to build earthquake-resilient houses. Similarly, in Hagam, men from different ethnic groups (for example, Shrestha and Tamang) exchanged free labour to put roofs on new earthquake-resilient houses:

> If we help others during difficulty, we will also get help in return. Now most of the people have completed building houses in our village by helping each other (KII, Male, Hagam).

Although a majority of residents in the three villages had already rebuilt their houses at the time of data collection in 2018, 3 years after the earthquake, some households still lacked access to the material or financial resources necessary for rebuilding. As in the relief phase, their prior family experiences of weak bonding relationships combined with gender inequalities and/or physical remoteness of the villages also weakened their linking social capital, which was crucial for longer-term recovery, as illustrated below.

In Nepali culture, it is men who usually form bridging and linking relationships with people outside of the family, and who seek financial or material assistance for rebuilding. In the absence of adult men in the family, women and the elderly often could not draw on or establish the relationships or skills needed to rebuild their houses. As one female community health volunteer explained:

> Men can go anywhere. They can move to different places, can earn money, but being a woman, we face difficulties. I am unable to build a house. I don't have the skills for stone breaking. Those families who have males have already reconstructed their houses. But I don't have any support (Female, FGD, Keraunja).

We also found that across the villages, some elderly people were still, in 2018, living under a tarpaulin sheet or in a hut surrounded by metallic zinc sheets after losing their houses in the 2015 earthquake. These families did not know who to approach for help or whether they would receive any funding or material support from the government for rebuilding their houses. These families not only felt left out of reconstruction assistance, but also constrained by a lack of choice and control, as expressed by this elderly man:

> Aftershocks are still hitting now [2018]. The Government suggests that we build a house. We don't have money; how can we build houses? I built a shed with borrowed money. People say that we get grants, but we haven't received any money yet. We are not able to decide whether to stay in this terrible condition or move out. It's been a terrible tragedy (Male, PV, Hagam).

The remoteness of the villages meant ordinary residents often could not communicate their housing needs with the government located at the centre, in Kathmandu, or at the district headquarters. For example, the Ward Chair of Hagam described the difficulties faced by ordinary residents in accessing the government disaster fund:

> The government of Nepal has established the 'Disaster Management Fund.' But there are three levels of governments to deal with in order to access that fund. How much can the villagers do? (Male, KII, Hagam).

The elected Ward Chair of Keraunja also agreed that the government's policies had been discriminatory, with some people receiving a grant for reconstruction, and others not, which disproportionately deprived people in remote areas.

As in the relief phase then, we found that pre-existing bonding, bridging and linking relationships were useful and could be mobilised in the rebuilding phase. Yet, primarily female-headed or elderly families experienced difficulties in mobilizing or forming the types of relationships needed to access materials, funding or human resources for rebuilding their houses.

5. Discussion

Our main finding suggests that the three different forms of social capital all matter; but that some matter more than others in the different temporal phases of a disaster. Immediately after the earthquake, community members mobilised pre-existing bonding and bridging relationships, which facilitated working together to save the lives of kin, friends and neighbours, including sharing food and building temporary shelters. Such mutual cooperation was important for 'survival' immediately after the disaster in the absence of outside help, as also seen in previous studies of earthquakes in Nepal [22,25,49,55], India [16,18] and Japan [5,16]. Community members in this phase did not care about social differences and worked based on immediate recognition of needs and reciprocity, crucial elements of self-help at the local level, as seen in Kamaishi, Japan [50] and Indiana, USA [51]. However, what we found in the immediate rescue phase contrasted with the relief and longer-term reconstruction phases: although communities pulled together in the immediate aftermath, that dissipated once relief arrived.

Once relief materials arrived in the villages, we found that linking social capital became more important, and that bonding, bridging and linking social capital primarily benefitted particular socio-economic, geographic and cultural groups who had pre-existing links with government or non-government agencies, often helping those with status (e.g. teachers, government and non-government officials, political representatives). In contrast, socially and geographically marginalised groups, such as women and the elderly, and those living far from the village centres, did not have and could not form social capital required to access human, material or financial resources for relief or rebuilding, and were initially excluded from disaster relief and rebuilding programmes. Similar results have been reported by Hillig and Connell [23] who noted that aid providers excluded the most marginalised victims in remote areas, while over serving the easily accessible areas, such as the Kathmandu valley. This was replicated at the village level, where relief materials (when they eventually arrived) were generally distributed centrally, favouring those living close to the village centres. These findings also resonate with studies of social capital in disasters in India [13], Bangladesh [36] and Haiti [21]. Thus, social capital seemed to benefit some, while further marginalising women and the elderly in remote regions by hindering their access to resources for relief and rebuilding.

We also found that families without adult males, particularly single women, experienced weak bonding relationships across the villages. These families also often did not have (and could not form) bridging and linking relationships with community members and government or non-government officials, which were crucial in accessing resources for

rebuilding. These findings are consistent with earlier studies that have shown women could not benefit from social relations following the earthquake and many were left vulnerable to disasters after losing their houses in the earthquake [11,44]. In this predominantly male-dominated society, it is often men who form linking relationships, as traditional cultural norms restrict women's movement, and prevent them from building linking social capital [47]. Similar findings for women have been reported in India, Taiwan, Turkey and the USA [5,13,37,64,65]. Thus, women-headed households tended to be most disadvantaged after the earthquake as they were denied resources for rebuilding, thereby undermining their long-term resilience to disasters.

5.1. Recommendations

Based on the discussion above, we make the following recommendations. First, future relief practices should ensure that socially excluded groups – including people living in remote areas, female-headed households, and the elderly – should gain access to relief support as well as long-term support for rebuilding after a major disaster. DRR programme planners and implementers have a responsibility to ensuring that relief distribution does not follow the "rule of relative advantage" which happens due to one's embeddedness in groups, political influence, and social position [22,52]. One way is to use pre-existing local NGOs to identify the most vulnerable populations to disasters . Yet, caution is necessary to ensure that these organisations are not used by social elites to capture resources [23,66], since this exacerbates already prevalent inequalities.

Second, for improving emergency response and building long-term disaster resilience, DRR programmes should consider the role of different forms of social capital in each phase of disaster, and the way it is shaped by pre-existing socio-cultural, gender and geographic inequalities. Both government and humanitarian agencies working in DRR programmes should harness the social capital of communities in an equitable way and ensure that linking capital would not just serve elite groups or those with social status. One way could be holding local governments accountable for their actions to support vulnerable groups, women and the elderly, after a disaster [11,44,53]. Another way could be supporting women to form bonding, bridging and linking ties (e.g. with other local women, local NGOs and locally elected leaders), which can help them to access necessary resources in times of disaster, as seen in Ethiopia [54] and Turkey [19].

Future research should explore more critical and nuanced understandings of social capital in disasters, as this will be unique to different communities (even within Nepal, let alone across countries). For example, research is needed to understand whether social capital has been identified and addressed in local DRR policies and programmes, and how it has been understood and used by various levels of government (federal, province and municipality) in practice. Research should also explore how government representatives view the role of linking social capital in disaster resilience. Similarly, researchers should consider using technology, such as PV, to engage with remote communities as they are mostly underrepresented in accessing and participating in research despite their high vulnerability to disasters. Such multiple community-based participatory approaches over time to identify and explore the role of social capital within and across communities have potential to enhance rural communities' recovery and resilience to future disasters, including earthquakes.

There are some limitations to our study. The three study villages are not a representative sample of all earthquake-affected communities in Nepal. Yet, all our study villages were severely-affected by the 2015 earthquake and they were selected based on their different degrees of remoteness (see 3.3). To date, this is the first study of its kind which has been conducted in remote villages in Nepal using community-based participatory approaches to demonstrate how different forms of social capital operated over time across remote populations in different phases of a major disaster. We expect that many of the findings are transferable across geographically remote regions.

Another limitation is that we collected data at a single point in time, and we may not have captured the effects at the 'right time', and the data we collected may not therefore represent the full picture of the experience of the villages. For example, aftershock sequences can result in populations undergoing repeated impact-response-recovery cycles, which was not possible to document in this research. Such research would require a more immediate and longer study period to document the experiences of people living in disaster prone areas over years including how social capital shapes and contributes to their disaster resilience.

Additionally, the passage of time between the earthquake and the data collection could have led to altered perceptions or recollections, thus causing recall bias. However, members of the research team (JK and SP) spent two to three weeks in each village and used multiple community-based participatory approaches (PVs, FGDs) to collect comprehensive information relating to disasters and resilience.

Finally, there might be a positive response bias in relation to NGO support to the study villages. One member of the research team (JK) is also the founder and Executive Director of PHASE Nepal, our local research partner, which was one of the NGOs providing relief in the villages - and he was known to at least some residents in that capacity. This could have influenced the data in relation to that NGO's support to the villages. However, as described in section 3.4, the NGO mainly facilitated the the set up phase of the participatory research.

6. Conclusion

Overall, we found that the resilience of rural communities to disasters is a more complex process than suggested in common policy discourse in Nepal and in much of the existing literature on social capital and disasters. Our findings suggest that social capital of all types (bonding, bridging and linking) matters and is a crucial determinant of the ability of individuals and communities to access the resources needed for relief and recovery after a major disaster. However, different types of social capital matter more within different temporal phases of recovery after a major earthquake and also vary across individuals, families, and communities, often reflecting the interplay of power and pre-existing inequality within a given context.

We found that immediately after the earthquake, high levels of bonding and bridging social capital among residents reduced barriers to collective action, and helped efforts to rescue and support affected individuals. This dissipated, however, once external relief arrived. In the relief and longer-term reconstruction phases, linking social capital often benefitted those with socio-cultural status or political links, and hindered access to resources by women and the elderly, who are already marginalised, thus compromising their long-term disaster recovery and resilience. Their resilience is further undermined in the absence of adult men within the family, as women often could not form bridging and linking relations required to secure resources after a disaster. We also found that linking social capital could not benefit more remote villages compared to villages close to the road, as residents could not communicate their needs to the government, which is located far away at the District Headquarters - or even further away in Kathmandu, where resources were usually held.

We conclude that government, non-government and humanitarian agencies working on DRR policies and programmes in Nepal should acknowledge resilience and social capital in terms of power, and consider who has links to power and resources, and who can mobilise and access them, and who cannot. DRR programmes should ensure that linking capital does not just serve the social elite and it should also recognise that pre-existing inequalities (socio-cultural, gender and geographic) may produce unequal social capital across individuals and communities after a major disaster, thereby undermining their long-term resilience to future disasters.

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Author contributions

Sarita Panday, Simon Rushton, Jiban Karki and Julie Balen conceptualised the study. Sarita Panday and Jiban Karki conducted the field work and analysed the data. Sarita Panday prepared a first draft of the manuscript and invited co-authors to contribute. Simon Rushton, Jiban Karki, Julie Balen and Amy Barnes revised the manuscript, provided feedback and comments, and wrote part of the manuscript when required.

Data availability

Data related to this article can be found at the result section (4) of this manuscript.

Declaration of competing interest

As reported in the study, JK was one of the founders, and is currently Executive Director of PHASE Nepal, the NGO partner for this study, which provided post-earthquake relief in all three of the villages.

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