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RESEARCH ARTICLE

## Health and Safety Challenges Among Post-Disaster Reconstruction Workers

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### Abstract

With the increase in the number of natural hazards in recent years, post-disaster reconstruction (PDR) efforts have become increasingly important to aid community recovery. Accordingly, a large body of recent research has focused on identifying the best practices for accelerating recovery and restoring impacted communities. However, relatively little attention has been devoted to the health and safety challenges experienced by reconstruction workers that aid post-disaster recovery and reconstruction efforts. The current investigation focused on addressing this knowledge gap by seeking to uncover the health and safety challenges that reconstruction workers experienced in the context of the 2015 Gorkha earthquake in Nepal – that was responsible for nearly 9,000 deaths and 22,000 injuries. The data collection effort involved in-depth interviews with several stakeholders, including construction workers, supervisors, site engineers, general

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contractors, homeowners, and governmental officials. This study enhances our understanding of the health and safety challenges experienced by PDR workers. The study also offers insight on how the obtained knowledge can be leveraged by government and stakeholders with supervisory roles to ensure proper health, safety, and wellbeing of the reconstruction workers. Additionally, the findings of this study contributes to the body of knowledge by identifying unique health and safety challenges in the post-disaster reconstruction context. Also, the study opens a door for future research efforts on reconstruction workers health and safety.

## Keywords

**Post-Disaster Reconstruction; Worker Safety; Gorkha Earthquake; Reconstruction Worker Safety; Construction Safety; Disaster Recovery**

## Introduction

The impact of natural hazards on the built environment and human life is catastrophic. The Emergency Events Database (EM-DAT) recorded more than 11,500 hazards over the last 40 years with an increasing trend ([UNDRR, 2020](#)). During this time period, more than 2 million people have lost their lives around the world and the economic loss is around 4.6 trillion US dollars ([UNDRR, 2020](#)). Natural hazards turn into disasters when there is significant loss of lives, damage to the properties, infrastructures, and built environment ([United Nations Office for Disaster Risk Reduction, 2015](#); [Homeland Security, 2022](#)). With the increasing number and significant impact of natural hazards on the overall built environment, post disaster reconstruction (PDR) efforts have become increasingly important to aid community recovery. PDR is one of the most important and crucial phases of recovery efforts following a natural hazard and its impacts ([Jha et al., 2010](#)). Although a concrete definition of PDR has been a topic of debate in interdisciplinary research for years, scholars agree that PDR efforts may consist of several activities that include but not limited to recovery planning, debris removal, demolition, restoration, repair and retrofitting etc. ([Attalla, Hegazy and Elbeltagi, 2004](#); [Lindell, 2013](#); [Mahdi and Mahdi, 2013](#); [Uddin and Pradhananga, 2019](#)).

Over the past two decades, PDR has gained much attention in the interdisciplinary research. A plethora of research has focused on identifying the best practices for accelerating recovery and restoring impacted communities. However, very less efforts have been made in understanding and investigating the health and safety challenges among the reconstruction workers who are the front line stakeholders in restoring the built environment after a disaster ([H Yi and Yang, 2014](#); [Uddin and Pradhananga, 2019](#)). Although a few studies have touched upon the health and safety risks associated with reconstruction efforts (e.g., ([Grosskopf and Hinze, 2008](#); [Lyons, 2009](#); [Brown, Milke and Seville, 2010](#); [Grosskopf, 2010b](#); [Shafique and Warren, 2016](#); [Pradhananga, ElZomor and Kasabdjji, 2021](#))), the health and safety challenges are largely unexplored in the interdisciplinary research literature. Recent studies have also demonstrated this knowledge gap and highlighted the importance of investigating the health and safety challenges among reconstruction workers with greater depth ([Uddin and Pradhananga, 2019](#); [Uddin et al., 2021](#)). This study is one of the first efforts to investigate the health and safety challenges among reconstruction workers during post-disaster reconstruction efforts. While previous studies established that post-disaster reconstruction efforts are significantly different from conventional construction in certain areas for example, debris management, workforce management, work environment etc., this study focuses on identifying specific health and safety challenges among the reconstruction workers.

To address the knowledge gap within the body of knowledge in the post-disaster reconstruction context, this paper emphasizes on exploring the health and safety challenges among the reconstruction workers. In achieving the objective of this research, we present a case study of Bhaktapur, Nepal in the context of Gorkha earthquake 2015.

## Background

Nepal was hit with a 7.8 magnitude earthquake on April 25, 2015. The earthquake caused toppling of multistoried buildings, creating landslides and snow slides in the Himalayan Mountains. While there were hundreds of aftershocks followed by the earthquake, another 7.3 magnitude earthquake hit after 17 days on May 12, 2015. Around 9,000 people lost their lives, 22,000 people got injured, and the economic damage was estimated to be around \$10 billion (NPC, 2015). The earthquake affected approximately 50 of the 75 districts in Nepal (Hall *et al.*, 2017). Among them, 14 districts were affected severely that include Gorkha, Dhading, Rasuwa, Nuwakot, Kathmandu, Lalitpur, Bhaktapur, Kavrepalanchowk, Sindhupalchowk, Dolakha, Sindhuli, Makawanpur, Ramechhap and Okhaldhunga (MoHA, 2015; Subedi and Bahadur Poudyal Chhetri, 2019). Among the severely affected areas, we chose Bhaktapur as our case study because of a few reasons. First, according to historical evidence based on previous earthquakes in Nepal, Bhaktapur has always sustained a high fatality rate and infrastructural damage due to the earthquakes in 1934, 1988, and in 2015 (MoHA, 2015; Shakya *et al.*, 2021) hence the location of Bhaktapur is critical to earthquakes damages and needs to be studied for reconstruction efforts. Second, during the time of the data collection, the area of Bhaktapur was going through reconstruction efforts in full swing and only 14% of the structures had been rebuilt or repaired (NRA, 2018). Although the reconstruction efforts in Nepal started right after the formation of National Reconstruction Authority (NRA), the reconstruction efforts were very slow in nature due to number of challenges including economic, political, societal etc. Third, we had a greater access to the reconstruction projects and different stakeholders in the area of Bhaktapur and finally, the research team witnessed damaged structures, rubble, waste, and debris along with several active reconstruction sites throughout the city, providing a firsthand view of the impact of the natural hazards and the progress of recovery efforts. The Gorkha earthquake caused heavy structural damage to the buildings, especially the old, non-engineered and masonry buildings (Hashash *et al.*, 2015). The buildings that were engineered (structurally designed properly) were also damaged due to many reasons such as poor construction, low quality materials or simply because of the strength of the earthquake (Subedi and Bahadur Poudyal Chhetri, 2019). Along with the residential and commercial buildings, many historic temples and monuments were also damaged due to the earthquake, for instance, Vatsala Durga Temple at Durbar Square was severely damaged and partially collapsed. The research team witnessed damaged structures, rubbles, wastes, and debris along with several active reconstruction sites all around the city while recruiting and interviewing the participants.

## Literature Review

### POST DISASTER RECONSTRUCTION (PDR)

The definition of post disaster reconstruction has been a subject of debate for many years. The term has been used interchangeably with the term “recovery” in the literature, and earlier studies on recovery have focused almost exclusively on reconstruction of the built environment (Mileti, 1999). In a previous, seminal study, Haas *et al.* (1977) clarified the distinctions between PDR and disaster recovery by noting that reconstruction was part of the larger and more comprehensive recovery process. The Haas *et al.* (1977) study was based on a comparison of the recovery process following four natural hazards: three of which were in the United States (i.e., 1906 San Francisco Earthquake, 1964 Alaska Earthquake, 1972 Rapid City Flood) and one was in Nicaragua (i.e., 1972 Managua Earthquake). The authors suggested that “disaster recovery is ordered, knowable, and predictable,” and they divided recovery into four overlapping periods (ibid: xxvii): (1) The Emergency Period, referring to the initial days or weeks after a natural hazard during which the community primarily copes with losses to life and property and injuries, as well as disruptions to everyday life; (2) The Restoration Period, during which the community’s major services and activities are more or

less restored to pre-disaster levels; (3) The Replacement and Reconstruction Period, during which the community rebuilds its capital stock, such as housing and infrastructure, to pre-disaster levels and restores social and economic activities to pre-disaster levels or higher; and, (4) The Commemorative, Betterment and Developmental Period, during which the community continues with reconstruction but focuses on building better for the future.

Several scholars have noted that although distinctions made by [Haas et al. \(1977\)](#) across recovery periods are helpful, the periods may overlap in a given community and different areas within a community may experience different stages of recovery—depending on their access to resources and power, among other factors ([Quarantelli, 1982](#); [Rubin, Saperstein and Barbee, 1985](#); [Philip and Timothy, 1997](#)). Other researchers have defined reconstruction as the rebuilding of different types of structures affected by a natural hazard and the process may include activities such as demolition, debris management, and retrofitting ([McKim and Attalla, 1998](#); [Attalla, Hegazy and Elbeltagi, 2004](#)). Over the years, different studies have focused on different issues within the domain of post disaster reconstruction such as planning for reconstruction ([Pearce, 2003](#); [Olshansky et al., 2008](#); [Stringfellow, 2014](#); [Cole et al., 2017](#); [Adamy and Abu Bakar, 2021](#)); governance of the reconstruction process ([Guarnacci, 2012](#); [Cho, 2014](#); [Dimmer, 2014](#); [Lassa, 2015](#); [Ganapati, 2016](#); [Curato, 2018](#)); involvement of stakeholders in reconstruction processes ([Davidson et al., 2007](#); [Ganapati and Ganapati, 2008](#); [Bouroufi and Lizarralde, 2013](#); [Sadiqi, Trigunaryah and Coffey, 2017](#); [Lu, Zhong and Zhang, 2020](#)). While others have focused on resource allocation and mobilization ([Freeman, 2004](#); [Chang et al., 2010, 2011](#); [Fetter and Rakes, 2011](#); [Athukorala, 2012](#); [Lindanger, 2012](#); [Sewordor et al., 2019](#)); sustainable reconstruction ([Opricovic and Tzeng, 2002](#); [Jigyasu, 2004](#); [Guarnacci, 2012](#); [Mannakkara and Wilkinson, 2014](#)); and resilience ([Chang et al., 2010](#); [Amaratunga and Haigh, 2011](#); [Gotham and Campanella, 2011](#); [Lam and Kuipers, 2019](#); [Dhakal, Zhang and Lv, 2020](#); [Xu and Shao, 2020](#)).

However, as specified in the above section, reconstruction workers health and safety has not been studied thoroughly in the disaster risk management literature. Although construction workers health and safety has been a topic an interest for the scholars for many years now, the health and safety of reconstruction workers have failed to gain much attention.

## RECONSTRUCTION WORKERS HEALTH AND SAFETY

Generally, construction workers health and safety has been a widely studied topic in the broader literature. Researchers have extensively described approaches to address health and safety challenges and to improve workplace safety in conventional construction sites over the past few decades. Some scholars, for example, have examined the safety climate and safety culture ([Langford, Rowlinson and Sawacha, 2000](#); [Bahn, 2013](#); [Sunindijo and Zou, 2013](#); [Albert and Hallowell, 2017](#); [Nadhim et al., 2018](#)). Others have studied the benefits of information technology ([Khoshnava et al., 2012](#); [Ergun and Pradhananga, 2015](#); [Teizer et al., 2015](#); [Zhang et al., 2015](#); [Jeelani et al., 2019](#)) and safety training ([Albert and Hallowell, 2013](#); [Sacks, Perlman and Barak, 2013](#); [Namian et al., 2016](#); [Subedi et al., 2017](#)). Still others have highlighted the importance of hazard recognition ([Carter and Smith, 2006](#); [Albert, Hallowell and Kleiner, 2014](#); [Jeelani, Albert and Gambatese, 2017](#); [Uddin et al., 2020, 2022](#)) and prevention through design ([Kamardeen, 2010](#); [Dewlaney and Hallowell, 2012](#); [López-Arquillos and Rubio-Romero, 2015](#); [Teo et al., 2016](#)).

Despite having a rich literature on workers' health and safety issues, recent studies have demonstrated that the reconstruction workers health and safety has not been widely studied by the scholars over the past few decades. For example, [Honglei Yi and Yang, \(2014\)](#) analyzed 88 research articles focused on PDR and identified 12 key issues that the researchers have dealt with over the years. However, reconstruction workers health and safety was not one of the key issues that has been studied. Later, [Uddin and Pradhananga, \(2019\)](#) conducted another systematic review of the literature in order to assess if reconstruction workers health and safety received much attention in the disaster risk management literature. They analyzed 177 research

articles and concluded that reconstruction workers health and safety is an existing knowledge gap in the literature that needs much attention. Although there are some studies that have touched upon the health and safety issues among reconstruction workers, these studies are very limited in number and the primary focus of these studies were not the health and safety of the reconstruction workers. For example, [Grosskopf, \(2010a\)](#) talked about the presence of possible hazards in the reconstruction workplaces and focused on the need of specialized safety training for the reconstruction workers. [Kennedy et al., \(2008\)](#) identified the involvement of unskilled workers during the reconstruction efforts and emphasized on the potential health and safety risks for the reconstruction workers. Studies have demonstrated that post disaster reconstruction workplace is significantly more hazardous for the construction workers compared to conventional construction workplace. [Uddin et al., \(2021\)](#) demonstrated that PDR operations are different from conventional construction operations in five broad ways i.e., debris management, workforce management, working environment, perceived urgency to complete reconstruction and safety risk perceptions. The study also emphasized on identifying health and safety challenges based on the differences between PDR and conventional construction. [Pamidimukkala, Kermanshachi and Jahan Nipa, \(2022\)](#) enlisted a number of hazards that are unique to PDR context such as chemical hazards, biological hazards, psychological hazards, use of unfamiliar equipment, lack of skill and training and so on. Based on the limited research on PDR operations in terms of workers health and safety, it is evident that there is a knowledge gap within the PDR literature. This study is one of the first empirical effort to bridge the knowledge gap by identifying health and safety challenges among reconstruction workers.

## Research methodology

### STUDY DESIGN

As discussed in the previous section, only a little knowledge is available in literature regarding the health and safety challenges among reconstruction workers, making it suitable for exploratory research. We conducted the exploratory study through in-depth semi-structured interviews. The semi-structured interviews allowed us to explore the interviewees' perceptions with a greater depth and unearth unique topics that may not be otherwise observed. We collected data in two parts. First, the demographics of the participants were recorded. Personal information such as name, age, or location was anonymized so that the participants cannot be traced back. The second part of the questionnaire had primary questions, follow up questions and discussion regarding the health and safety challenges among reconstruction workers. However, before starting the data collection for this study, approval was obtained from the Institutional Review Board (IRB) of the author's institution (approval number IRB-18-0416-AM01).

We formulated the questionnaire in English initially, however, since our targeted participants were local stakeholders of Bhaktapur, it was easier to conduct the interviews in their native language and this ensured that no information is lost due to the language barrier. Hence we translated the questionnaire to Nepali (Official language of Nepal) to conduct the interviews. We recruited local volunteers to conduct the on-field interviews. The volunteers worked under the direct supervision of one of the authors of this paper who is located in Bhaktapur, Nepal. The interviews were first audio recorded, and then transcribed and translated to English. Since two of the authors of this paper are bilingual (fluent in both Nepali and English), the quality of the translation and transcription was maintained. The transcribed responses were then analyzed by all the authors to explore and identify the health and safety challenges among reconstruction workers.

### PARTICIPANT RECRUITMENT AND DATA COLLECTION

We recruited a diverse group of construction stakeholders to make sure we get all different perspective from our study and conducted the interviews over a three-month period. We adopted a purposive sampling

Table 1. Demographics of the Participants

Demographic characteristics	Count	Percentage
<b>Participant Type</b>		
Homeowner	1	2.63%
Government Officials	2	5.26%
General Contractors	4	10.53%
Site Engineers	13	34.21%
Construction Supervisors	8	21.05%
Construction Workers	10	26.32%
<b>Gender</b>		
Male	29	76.32%
Female	9	23.68%
<b>Age Range</b>		
20-25	6	15.79%
26-30	15	39.47%
31-35	1	2.63%
36-40	2	5.26%
41-45	3	7.89%
46-50	7	18.42%
51-55	4	10.53%
<b>Education Level</b>		
Below higher secondary level	22	57.89%
Graduate or Post-graduate degree	13	34.21%
Associate degree or equivalent	3	7.89%
<b>Years of Experience</b>		
0-5	17	44.74%
6-10	5	13.16%
11-15	4	10.53%
16-20	3	7.89%
21-25	5	13.16%
26-30	4	10.53%

technique to recruit the participants. In order to interview the participants, the volunteers visited the reconstruction sites in Bhaktapur, Nepal and interviewed the participants. While most of the interviews were conducted on the reconstruction sites, some of the interviews were held at the office of the participants as well. [Table 1](#) shows the demographic of the participants. The participants include homeowner, general contractors, government officials, engineers, supervisors, and workers. In order to ensure the inclusion of diverse demographic, we recruited at least one female participants from each stakeholder category and ended up with 24% of female participants in total. We also ensured that we have participants with different educational levels so that we get different perspectives of the participants. Although a large portion of the participants had less than 5 years of experience, we made sure that they had at least one year of experience in the reconstruction projects. The identities of the participants were anonymized for their confidentiality and a code number (e.g., P1, P2, etc) was assigned to all the participants.

### DATA ANALYSIS PROCESS

The interviews were recorded using an audio-recorder during the interviews and then transcribed and translated from Nepali to English. Once the audio recordings were converted to textual data following verbatim method, the research team utilized NVivo software package to analyze the data. First, the data was categorized based on the demographics and then a word frequency analysis was conducted to identify words that were most frequently used by our participants. Previous studies have demonstrated that such initial analysis is helpful to understand certain patterns within the textual data ([Jackson and Trochim, 2002](#); [Onwuegbuzie and Leech, 2006](#)). Finally, the data was analyzed using first and second cycle coding techniques ([Saldaña, 2015](#)) to identify the health and safety challenges among the reconstruction workers during PDR efforts. To get better understanding and new insights on the topic, it was important to focus on the quality and significance of the data rather than quantity. Our analysis revealed eight health and safety challenges that are elaborated on in the findings section. The responses of the participants are presented word to word where deemed relevant and necessary.

## Findings

A total of eight health and safety challenges were identified from the responses of the participants. [Table 2](#) enlists the health and safety challenges along with the number of participants mentioning each challenges.

Table 2. No. of Participants Mentioning the Health and Safety Challenges

Health and Safety Challenges	Number of Participant Mentioned the Challenges	Percentage (%)
Inadequate Safety Equipment	32	84.21%
Employing Unskilled Workers	30	78.95%
Lack of Safety Training	29	76.32%
Working with hazardous debris and waste	29	76.32%
Faster Reconstruction Syndrome	29	76.32%
Mental Health of the Workers	27	71.05%
Participation of Community People	26	68.42%
Distraction	26	68.42%

The following sections discuss the health and safety challenges among reconstruction workers in detail and a summary of the findings is graphically presented in [figure 1](#). [Figure 1](#) represents the eight different health and safety challenges among the reconstruction workers and their causes in the third level of the figure. For example, issues such as limited resources, lack of knowledge etc. led to the inadequacy of safety equipment, which is one of the health and safety challenges faced by the reconstruction workers.

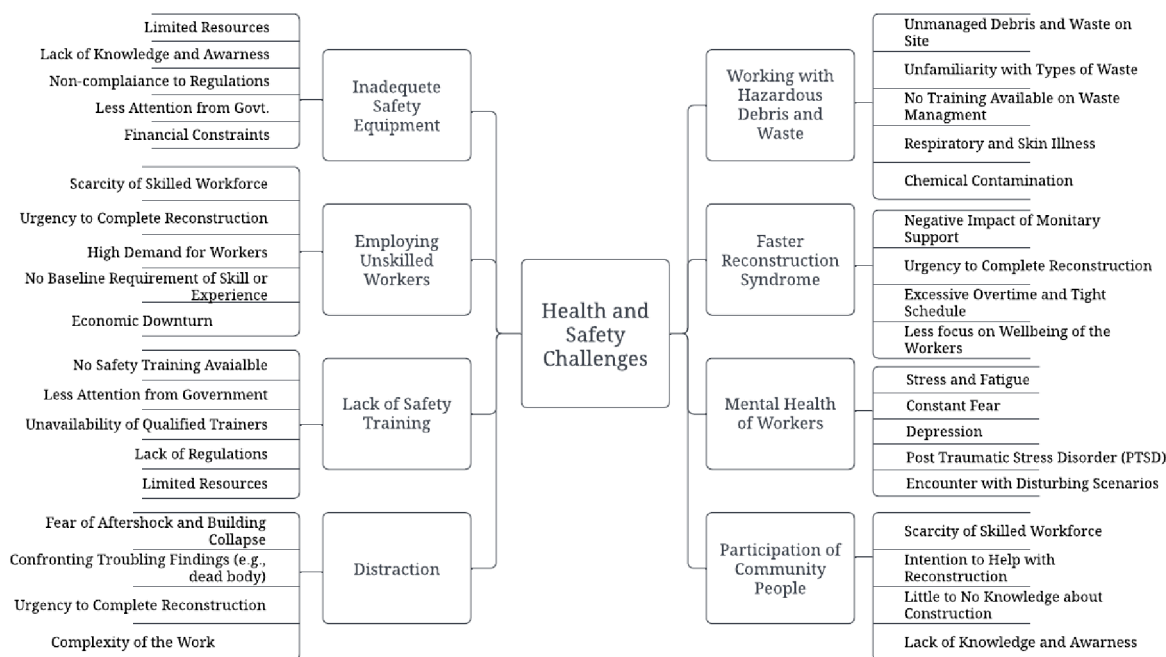


Figure 1. Summary of the Findings

## INADEQUATE SAFETY EQUIPMENT

We started the interviews with basic discussion on existing health and safety challenges among reconstruction workers. A majority of participants cited the inadequacy of safety equipment as a critical challenge. The interviews revealed that most of the participants were aware of common safety equipment such as hard hats, safety boot, gloves, safety glasses etc. However, despite being aware of the importance and significance, the workers were not accustomed to using safety equipment at the PDR sites and our field visits reflected the same (exhibit [Figure 2](#)). Our questionnaire had specific questions on whether the workers receive any safety equipment to work on the PDR sites and one of workers, P5, replied,

‘No, only big companies may provide safety equipment for big projects. We do not get such equipment in reconstruction sites. Especially after the earthquake, nobody really cares about our safety.’

We inquired about the safety equipment with other workers, who had experience working with bigger companies and general contractors. However, they also replied in the similar fashion that they did not receive any safety equipment. In order to get insight on this situation, we talked to the general contractors and homeowners, who are primarily responsible for hiring and providing resources to the workers. The general contractors and homeowners also responded that there was no practice of providing safety equipment to the workers although the discussion revealed their understanding of the importance of safety equipment. The homeowner (P38) said,



‘... Yes, I know it is necessary for everyone involved in reconstruction sites but we have not provided any safety equipment yet. We never compel the workers to work putting themselves in a physical risk. There might be a chance of accident, but one [the workers] should always be careful.’

The General Contractor (P32) also stated that the practice of providing safety equipment to the workers is not very common in Nepal and also pointed out Nepal’s struggle with regulations on using safety equipment,

‘No, we don’t provide the workers with the safety equipment... Safety is necessary. It is necessary for all workers and me. But no attention has been paid to safety here. Just like there is no specific regulation of using safety equipment in Nepal.’



Figure 2. Workers with no Safety Equipment in an Active PDR Site in Bhaktapur, Nepal

The other stakeholders whom we interviewed also showed a considerable understanding of the hazardous nature of PDR sites and the importance of using safety equipment, however, they also pointed out that the practice of using safety equipment is not customary in Nepal. One of the site engineers, P21, expressed his concern and said,

‘Obviously, safety equipment is important. They save us from injuries and save our lives sometimes. But over the years of my experience I have not seen much use of safety equipment in Nepal. The same applies for PDR sites. No safety equipment.’

The interviews show a trend of not using safety equipment during the PDR efforts in Bhaktapur, Nepal. While this issue (of not using safety equipment) has been in the Nepal construction industry for a long

time, it is now even more neglected after the earthquake ([Koirala, 2018](#)). Reasons include shifting the whole attention towards rebuilding Nepal as soon as possible, financial constraints, scarcity of resources and lack of awareness towards safety. A small contractor (P35) explained his financial constraints and said,

‘This [providing safety equipment] needs big financial investment and access to resources. Being a small-scale contractor, I do not have such affordability. However, I think the government and other private organizations should take action in this regard’

Our analysis reveals that despite having somewhat understanding of the potential health and safety risks, the employers (owner and general contractors) do not usually provide the workers with any safety equipment during PDR efforts. However, the Nepal Labour Act 2074 (chapter 12, section 74) states that “the employers are responsible for protecting workers from occupational hazards” ([Department of Labour and Occupational Safety, 2017](#)) which indicates towards non-compliance to the labor laws and regulations in Nepal.

### EMPLOYING UNSKILLED WORKERS

Following the natural hazard, Nepal faced a shortage of workforce to reconstruct and recover the built environment ([The Himalayan Times, 2017](#)). To get more insight on this, we enquired with the employers about the skill and experience of their workforce. The discussion revealed a trend of hiring unskilled and inexperienced workers to tackle the shortage of workers during the reconstruction and recovery efforts. One of the general contractors, P33, stated,

‘Yes. We hire people based on our demand. I have multiple reconstruction sites and I need more people; I hire people irrespective of experience or skill.’

In addition, both the general contractors had consensus on certain health and safety risks associated with recruiting unskilled and inexperienced workers for PDR efforts. However, they showed indifferent viewpoint. P32 said,

‘I know there are certain risks when I hire unskilled construction workers. They do not know how to tackle certain situations. But that is how they learn. With time, they get experience, and they learn.’

Among the ten construction workers we interviewed, four workers possessed less than 5 years of experience in the construction industry and all four of them started their construction career in a PDR site. In other words, they did not have any prior construction experience before starting to work at a reconstruction site. When we inquired about the health and safety related challenges they had been facing, one of the workers (P10) explained his compulsion in joining PDR work and reported his condition,

‘When the earthquake hit, my father got badly injured. I needed a job to support my family. So, I started working in this reconstruction site. I don’t know much about the risks. I try to be careful with the works I do. Sometimes I get hurt (e.g., cuts, bruises and sprains). Once I was trying to remove the rubble from one house and the pile came down on me and my left leg was hurt.’

The government officials also acknowledged the involvement of unskilled and inexperienced workers at the reconstruction projects. Both the government officials indicated towards scarcity of skilled workers (especially after the earthquake) and P37 said that it’s not in their jurisdiction to monitor if the hired workers are experienced and skilled or not. He said,

‘After the earthquake, we needed a lot of workers to work on the affected areas. Works such as debris clearing, making pathways, also repairing the houses. We were not aware if the workers were skilled or not. Even common people came forward to help. I admit these works are risky and anyone can

face serious accident but what else can we do. There was no time to train people or recruit skilled workers.’

The supervisors whom we interviewed also pointed out the involvement of unskilled workers in PDR projects. One of the supervisor, P15, having over 20 years of experience, said that he had seen unskilled workers in conventional construction projects too, but the number was significantly more when it came to PDR projects. Another supervisor (P17) discussed on the difference between skilled and unskilled workers,

‘...The unskilled or new workers have no idea what they are doing. Even if there is some hazard that can be avoided with common sense, they are ignorant of that. They need proper training before entering a hazardous job site like reconstruction works. There are more vulnerabilities in reconstruction site than regular construction.’

### LACK OF SAFETY TRAINING

Considering the complexity of the works related to PDR efforts, our questionnaire had questions related to safety training. We inquired about the available health and safety training programs, and the training status of the participants. Majority of the participants replied that they did not receive any particular training on health and safety. Although the National Society for Earthquake Technology – Nepal (NSET) has training programs for the masons and construction technicians, none of them addresses health and safety related issues. One of the engineers (P27) who received some training mentioned,

‘...I got training from NRA (Nepal Reconstruction Authority) but not on safety. I was trained on building [design and construction] earthquake resistant houses and training the masons. I do not think they offer any kind of safety training for the workers or other stakeholders working in PDR sites. It would be great if they did but unfortunately, they don’t.’

One of the supervisors (P11) also said he got somewhat training on basic safety and use of first aid kits, however, it was not related to construction workplace safety:

‘I did not receive any special training for PDR works. However, I worked together with the Nepal Red Cross Society for rescue and relief services after the earthquake and I got the basic safety education there.’

Once the participants indicated towards not receiving any safety training to work in a PDR site, we followed up the discussion with questions on who should be providing the required trainings. We received a mix opinion from supervisors and workers. Majority of the workers opined that the general contractors should be held liable for not providing the necessary safety training. On the other hand, the supervisors and engineers explained that the effort should come from the government since the general contractors often do not have the required resources to establish a safety-training program.

According to the Nepal Labour Act 2074 Chapter 12, which was passed after the mega earthquake in 2015, it is the responsibility of the employers to ensure the wellbeing of workers by providing necessary equipment and training. However, in most of the cases, the general contractors are not usually in a situation to offer extensive and specialized training programs. In these situations, the Government of Nepal (GoN) should step forward and formulate safety training programs and guidelines to ensure the safety of the reconstruction workers.

### WORKING WITH HAZARDOUS DEBRIS AND WASTE

Removal and management of debris and waste, produced during and after the natural hazard, is one of the vital component of PDR efforts. Our study revealed that the debris and waste management at PDR sites

has rather been poor (exhibit [figure 2](#)) and the participants expressed their concerns over the associated risks. P3, a worker, who had experience working with hazardous debris and waste, said,

‘It was a very bad and damaging earthquake. There was lots of debris here and there. We had to clean all the rubbles and debris to make clear pathways and to work on different structures. And I can tell you, it is not safe to work in. You don’t know which pile of debris is loose and when it is going to come down at you. You might step on a wrong place and face serious accident.’

Apart from the possibility of being injured by the debris itself, others brought up issues such as possibility of respiratory and skin related diseases due to getting in contact with hazardous wastes without any protection. Worker P6 said,

‘All the houses were destroyed in the area I was working. People were living in tents in open fields. When we were working on the destroyed houses to remove debris and waste, we got really bad smell of rotten foods from their fridges and kitchens. You can imagine how bad it felt. We had to clean those up as well. We didn’t know if those things were going to make us sick or not but we had to work anyways.’

Since the presence of hazardous wastes and debris on a PDR site is evident, we asked the recruiters (general contractors, owners, and government officials) if they had provided any specialized safety training to the workers. In their response, the employers pointed out issues such as lack of time, opportunity, and proper knowledge in their defense for not providing any safety training. Government official P36 said,

‘We don’t have such opportunities to train people about the debris and waste management. It is just a work that they have to do. Moreover, we don’t have right and qualified personnel who can train these workers.’

One of the engineers, P31, who had worked on reconstruction of a commercial establishment indicated towards the possible chemical contamination,

‘Everything was so devastated after the earthquake, only God knows what is there under the rubble. There might be different types of chemicals or infected water clogged somewhere. All these things are dangerous to human health. But I don’t see any way to get rid of these. We had to work among these risks and hazards.’

As we checked with the workers about their understanding of exposure to hazardous waste or chemicals, they demonstrated no significant knowledge or information. However, some of them complained of health issues such as shortness of breath, cough, and suspected the bad working environment responsible for that. Worker P8 mentioned,

‘There were lots of dust and bad smell in the air. We did not have any facemask while working in that condition. At nights, I used to cough a lot and I have had hard time breathing properly. I think that is because of those dusty areas where I used to work.’

The post natural hazard debris and waste management practice has been overlooked in Nepal after the mega earthquake in 2015 ([Pradhananga, ElZomor and Kasabdjji, 2021](#)). The focus of the GoN and employers seems to be on rebuilding the built environment but not adequately on properly and safely removing what was damaged. The workers and other stakeholders lack proper knowledge of handling debris and waste that are produced after the natural hazards take place. They get neither enough safety equipment nor adequate training and these issues may play a vital role in leading them to workplace hazards.



Figure 3. Unmanaged Debris and Wastes on an active PDR Site in Bhaktapur, Nepal

### FASTER RECONSTRUCTION SYNDROME

Following the natural hazard, the Government of Nepal (GoN) was providing financial support of Rs. 300,000 (Approximately USD 2,730) to the homeowners whose houses were damaged (NRA, 2016). The financial support was to be availed in three installments, each after completing a portion of the reconstruction (HRRP, 2018). Although this monetary support helped the affected homeowners rebuild their houses, it also created a tendency among the homeowners and general contractors to complete the reconstruction faster than usual. We labeled this phenomenon as “faster reconstruction syndrome (FRS)”. In order to receive the financial support from the government, the employers persuaded the workers to do overtime, work extra shifts, and finish the rebuilding as soon as possible, which in turn often led them to compromise with the health and safety of the reconstruction workers.

One of the supervisors brought up the negative impact of monetary support from the government and indicated towards the perceived urgency among the employers to finish reconstruction. He witnessed the homeowners and general contractors urging the workers to work long hours, overtime, and faster than usual. Worker P2 pointed out the rush they faced by their employers and indicated towards the potential negative impact on safety and as well as on the quality of the work,

‘Whatever is done in rush, it cannot be done perfectly. We were always pushed by our supervisors and contractors to finish the work early and even work excessive overtime. This puts a lot of pressure on us. As it’s not safe for us, it is also not safe for the future since the reconstruction work might have some fault.’

One of the engineers P27 supported the idea that monetary supports may add to the health and safety risk of reconstruction workers. He also believed that although these financial supports are for rebuilding the

houses, at least some portion of the funds should be dedicated to the health and safety of the reconstruction workers,

‘I know there are lots of funds coming from different organizations. But I don’t think those funds are used for the purpose of ensuring the safety of the workers. Mostly the funds are used for restoration and rebuilding the structures. But I believe at least some of the funds should be dedicated for the purpose of safety training and safety equipment.’

While the general contractor P33 argued about fair use and distribution of the financial supports and said,

‘I think the funds don’t even reach to the field level. Even if there is any fund for the safety and wellbeing of the workers, due to high level of corruption, most of the money is gone before implementing. So, we don’t even know if there is any allocated fund for the health and safety of the workers.’

Following the discussion with the participants, it seemed that the monetary aspect of the post disaster reconstruction has some negative effect on the health and safety of the workers involved. Although monetary help from the government and other organizations help accelerating the recovery process, it has its down sides as well. In order to receive the financial support offered by the GoN and NRA, owners and general contractors developed a tendency of rush to finish the works which might have exposed the reconstruction workers to potential construction hazards. Also, if people perceive that the administration in the government has significant level of corruption in the system, they do not feel the transparent flow and distribution of the financial support is ensured. When the money could be used for training purpose or enhancing safety of the workers in the job site, it goes somewhere else keeping the jobsite and workers with potential hazards that could have been tackled.

## MENTAL HEALTH OF WORKERS

The discussion with the participants brought up arguably one of the most under studied subjects in construction industry; the mental health of workers. Since construction is a stressful job by nature, the construction workers around the globe often suffer from different mental health challenges ([Kotera, Green and Sheffield, 2020](#); [Turner and Lingard, 2020](#)).

One of the female worker, P7, who is a mother of two, expressed her concern while working at the PDR site. She explicitly said,

‘I am staying away from my kids due to my job. It is not easy. I am always worried about them... I am just thankful to god that my family and I are safe from the hazards. But I keep worrying about their safety all the time.’

This scenario was common among other reconstruction workers as well who showed symptoms of being worried, stressed, and terrified all the time. Some expressed their concern about the wellbeing of their family members and some others were concerned about their own safety. One of the worker mentioned that he had to keep working despite being scared since he had to provide for his family. Supervisor P18 stated how he had witnessed workers being depressed on the reconstruction jobsites.

‘I have been working on reconstruction projects since almost the beginning. For the first couple of years, it was really hard for all of us. We all were affected in one way or another. I saw people depressed, worried, scared, and sad all the time. Some had lost their houses, and some lost their loved ones. How could it be easy?’

Engineer P31 also echoed in a similar manner and explained that it may take a longer period of time to recover physically and emotionally from the impact of this earthquake. He said,

‘We all were in a shock. We were afraid of sleeping at our houses for a long time. Wherever we were, we were always worried and scared. I believe the workers who have to keep working day and night in the affected areas are also the same.’

Another engineer, P22, also mentioned about the stress and challenges that she used to get from the workplace. She remembered sleeping in a tent instead of a house and she mentioned that she got depressed very often soon after the earthquake. She said,

‘There were many challenges when I was away from my family; it was the time after the earthquake that I was working in Bhaktapur. There were no proper houses as almost every house was devastated. So, I had no options except sleeping in tents and I felt so insecure at that time as a girl & missed my home. That was a kind of mental torture... Obviously, yes, I got depressed. There were many challenges dealing with those who are affected by the earthquake.’

Upon asking about the same issue to the general contractors if they pay attention to their workers being depressed due to post disaster trauma, general contractor P35 replied,

‘We are all going through the same situation here. I understand how difficult it can be to work under these conditions. We always try to take care of our workers and provide any help they need anytime. But we also have our limitations and restrictions. We are doing the best we can.’

The discussion clearly shows that in a post disaster situation, workers are usually under a lot of mental pressure and post-traumatic stress disorder (PTSD) may play a vital part in leading them to potential workplace hazards and accidents. The debris and waste removal practice also seems to be affecting the mental state of the workers since there is always a chance of facing unpleasant situations (e.g., finding dead bodies or heavily injured bodies).

## PARTICIPATION OF COMMUNITY PEOPLE

The discussion with the participants revealed that there was scarcity of skilled construction workers during the PDR efforts in Bhaktapur. While one of the ways to tackle this was employing unskilled workers, we inquired if there were any other aspect to this. The participants pointed that the community people had also been helping voluntarily in the reconstruction efforts. However, this involvement of the community people is not without potential safety risks.

The government officials mentioned that they usually encourage the participation of local people in reconstruction and renovation. This is another way to deal with the shortage of workforce that Nepal had faced after the earthquake. However, upon asking about the safety issues, government official P37 replied,

‘Construction work is always risky. If you don’t have enough experience, you are more exposed to hazards. That is true for these people (community people) as well. But here, I have seen so many times, that the owners do their own small repair and other works by themselves. They want to save money and don’t hire professionals. It is not safe, but they keep doing it anyways. So why not now? This is the time when we need as many hands as possible. We encourage them to come forward and assist on rebuilding.’

While discussing about the potential safety risks of community people getting involved in reconstruction efforts, engineer P27 shared his experience of a near miss accident. He described,

‘The owner of the house was trying to help us by moving some tools from one point to another. She was wearing traditional dress [saree]. She was walking reluctantly and suddenly her dress was stuck under some brick and she got unbalanced and tripped over. She hurt her shoulder and back. It was not life threatening, but it could have been.’

Another engineer also responded in the similar fashion thus strictly discouraging the involvement of community peoples for the sake their own safety. He, P29, said,

‘I have seen community involvement in reconstruction work. But obviously it’s not safe for the common people to get involved in reconstruction works. As I said earlier, construction work is itself very dangerous let alone reconstruction work. So, I believe the involvement of common people to the reconstruction sites and work should be limited.’

From the interviews, it also came up that the people not only want to help in the work, but they also want to help the workers who are trying to restore their houses. A number of workers explained how the community people were helpful and kind to them while they were working in a community. P9 said,

‘...they used to provide us with food and water all the time. And we tried our best to complete their houses fast. There was a good mutual understanding among us. But they [community people] don’t have any idea about the construction work; if they try to help, I think it slows down the work even more.’

On the other hand, supervisor P16 claimed that since the reconstruction site is even more hazardous than the regular construction sites and only skilled and experienced workforce should be involved in the reconstruction efforts. In his words,

‘People participating in their own building construction work is not safe. I think the construction works should only be done by the skilled and experienced people.’

Construction work has been identified to be one of the most stressful work both physically and mentally. The work involved in reconstruction efforts require a specific skillset and at least some experience in order do their work safety. However, the community people having no skillset or knowledge are highly prone to construction hazards and accidents. Instead of accelerating the progress by involving community people in reconstruction efforts, sometimes it slows the work down.

## DISTRACTION

Our study reveals that distraction plays a vital role in safety performance, especially in the post disaster context. Firstly, through the interviews, participants brought up the issue that how distracted they remain in the workplace. Then, some of the follow up questions revealed the participants’ perception on the effect of distraction on safety.

One of the female workers P4 mentioned that she has been working on the construction site after the earthquake, but her children were not with her. So, she was always thinking about them and their safety. Engineer P21 pointed out that soon after the earthquake they were always worried about the potential aftershocks and its effect. These thoughts and fear used to keep him distracted during his work. He said,

‘After the hit, I was in a kind of fear that what’s going to happen next. When will be the next hit? As you know, there are potentialities of aftershock after a major earthquake. I used to be paranoid almost all the time.’

Apart from the mental distractions, physical distractions also seemed to exist at the PDR sites. The participants reported factors such as lack of working space, urgency to complete the reconstruction,



overlapping works, tight schedule, complexity of the work and unpredictable outcome of the task as major distraction factors in the PDR jobsite. Worker P2 said,

‘...we always have a pressure from the employer to finish the work early. But in these situations where we do not have proper working space, time is limited and there are lots of work to do, you can imagine how difficult it is for us. And in these circumstances, safety is easily neglected. We keep thinking about how to finish the work on time... Yes, these things keep us away from thinking about safety.’

Another worker P9 stated in the similar manner,

‘There are so many things to do starting from rubble removal to rebuilding the houses. And after an earthquake like this, works are not the same anymore. They get more complex. We have to take care of our families also. I have seen a worker who lost his own house in the earthquake, but he had to work on other project to earn money so that he can rebuild his own house.’

While distraction is a difficult parameter to measure, it does have a significant effect on the health and safety of the workers, especially in a complex situation like PDR. Many of the workers are also the survivors from the earthquake and they get easily distracted by so many mental and physical distraction factors. And this compromises their safety on the PDR workplace.

## Discussion

As discussed in the findings section, our study revealed eight challenges that affect the health and safety of the reconstruction workers. Among the eight, some challenges can also be experienced in a conventional construction workplace (non-disaster time). For example, (1) inadequate safety equipment, (2) employing unskilled workers (3) safety training, and (4) distraction have been identified to be experienced often in conventional construction as well. However, these challenges exacerbate in post-disaster contexts. For instance, our study concurs with previous studies in terms of the importance of using *safety equipment* and offering specialized *safety training*. Using safety equipment alone can prevent approximately 25% of the work-related injuries and is one of the fundamental elements of safe workplace practices ([Sawacha, Naoum and Fong, 1999](#); [Gibb et al., 2005](#); [OSHA, 2016](#)). The findings of this study revealed that there were no regulations on using safety equipment in Nepal while studies have shown that establishing regulatory environment significantly improves workplace health and safety ([Umeokafor, Evangelinos and Windapo, 2020](#)).

The importance of *safety training* in construction has also been well studied in the literature. Numerous research efforts have focused on developing training programs and interventions in order to help the workers understand the work environment and work safely for example, OSHA's Construction Fatal Four program ([OSHA, 2011](#)). However, our study shows that despite feeling the necessity of specialized training programs, the reconstruction workers in the area of Bhaktapur, Nepal did not receive any sort of training on health, safety, and wellbeing. The responsible parties such as the government, general contractors, and the owners were also indifferent in providing necessary safety training citing challenges such as scarcity of resources, financial constraints, and unavailability of trainer and so on.

*Employing unskilled workers* at construction workplaces is one of the critical challenges to health and safety of the workers ([Tam, Zeng and Deng, 2004](#)). Employing unskilled workers in order to tackle the shortage of workers or to expedite the reconstruction process has been observed in previous studies ([Kennedy et al., 2008](#); [GFDRR, 2014](#)) and in mass media ([The Himalayan Times, 2017](#)). Our study shows that neither the employer nor the government officials paid much attention if the workers are skilled enough to work in PDR workplaces. Employing unskilled workers in addition to having no specialized

training, makes them extremely vulnerable in PDR workplaces and exposes them to numerous hazards that the workers may not have any knowledge about. One way to tackle this situation is to train the workers beforehand about the PDR operations (especially in the natural hazard prone areas). It is an investment that the governments need to make to keep the workforce safe.

*Distraction* at workplace and its relation to safety is a very broad topic of study. Distraction at workplace might seem inevitable and it can cause severe safety issues for the workers ([Cohen, Larue and Cohen, 2017](#)). Previous studies have demonstrated how distraction can lead to poor safety performance at workplace ([Namian, Albert and Feng, 2018](#)). By definition, distraction can be defined as anything that directs an individual's attention away from something else ([Merriam-Webster, 2015](#)). Past studies divided construction workplace distraction mainly in two sections, internal or mental distraction and external or physical distractions ([Seevaparsaid-mansingh and Haupt, 2008](#); [Nnaji and Gambatese, 2016](#)). Our study reveals that workers are both mentally and physically distracted at post disaster reconstruction workplaces. The fear of aftershocks, physical stress of the work, fear of finding unwanted things (e.g., dead body or body parts) under the rubble, worrying about the health and wellbeing of other family members and many other factors play major role in distracting the workers at PDR workplace. Also, these issues may lead the workers to mental health related problems such as anxiety, stress, or PTSD.

Apart from the health and safety challenges that are experienced in conventional construction operations, our study suggests four more challenges that are rather unique to the context of PDR efforts i.e., (1) working with hazardous debris and waste (2) faster reconstruction syndrome (3) mental health of workers and (4) participation of community people.

In terms of, *working with hazardous debris and waste*, our observation and analysis show that the reconstruction workers in the area of Bhaktapur, Nepal were working actively in hazardous environment. The presence of debris and waste produced during and after the natural hazards make a workplace more vulnerable and dangerous ([Grosskopf, 2010b](#)). And we found that most of the participants were not aware of possible risks associated with the hazardous debris and waste. The participants mentioned of challenges such as working in confined space, lack of knowledge, awareness, and training about hazardous debris and waste materials, possible chemical contamination, respiratory illness etc. and all of them are interlinked with hazardous work environment they work in. These conditions are not usually observed in the conventional construction workplaces because there are more control over conventional construction projects in terms hazard management compared to PDR. The GoN and regulatory bodies should step forward in order to develop and offer safe practice regulations for the safety of the reconstruction workers.

The *faster reconstruction syndrome* is another unique contribution of our study. Although prior studies have touched upon the potential challenges generated from the need to recover quickly ([Ganapati and Ganapati, 2008](#); [Ganapati and Mukherji, 2014](#); [Platt and So, 2017](#)), our study specifies this as a safety challenge and shows the need to deal with this issue on the ground level. The interviews revealed how the workers were pressurized to work overtime, under stress, and quickly to rebuild the damaged houses, which in turn led them to a more hazardous work environment and culture. This study confirms that attempts to accelerate the recovery process often lead to compromising with the health, safety, and wellbeing of the reconstruction workers.

*Mental health* of the construction workers is arguably one of the understudied topics in the literature. We often neglect the mental health issues or even sometimes, the victim does not even realize they are being exposed to mental health challenges. Despite being one of the most stressful industries ([Petersen and Zwerling, 1998](#)), mental health related issues have not been discussed as much as they should within the construction industry. Reports suggest that construction workers are two and half times more likely to commit suicide due to poor mental health than other professionals ([Kölves, Kumpula and De Leo, 2013](#)). Our participants revealed throughout the interview that they are always tensed and worried about issues

such as aftershocks, wellbeing of self and family, financial security etc. Stakeholders also reported about their coworkers being sad, depressed, and distracted on the workplace. In addition to that, it's also worthwhile to notice that none of the respondents directly admitted having mental health challenges, mostly because they are not even aware that they are having mental health related issues and also because of social shame. This behavior shows that we need more awareness in overall society about the mental health issues.

The *participation of community people* in PDR has always been encouraged by the governments, regulatory bodies, and scholars to expedite the reconstruction and recovery process. Our study also shows that the community people of Bhatapur, Nepal were actively involved in the PDR efforts since the beginning. However, through the interviews and discussions, we observed that this involvement could often make the workplace hazardous for both the volunteers and the regular workers. Understandably, the local community people and volunteers do not possess the required skill or experience to work in an active construction site hence they are always vulnerable to the existing construction hazards. Moreover, they are not only vulnerable to physical safety risks, but also to mental health risks being the survivors of the natural hazard. In many cases, mental health issues among construction workers lead to suicidal thoughts and attempts ([Wang et al., 2013](#)).

Our study highlights the health and safety challenges among reconstruction workers in the context of 2015 Gorkha earthquake in Nepal. The findings are both consistent with the previous natural hazards and offers insight on unique health and safety challenges. Our study demonstrates the need for proper safety training and adequate safety equipment for the reconstruction workers. Moreover, this study helps in understanding the working condition of the PDR projects, mental health issues, and other contributing factors in the health and safety challenges.

## Contributions, study limitations and suggested future research

Construction workers health and safety has been studied widely over the past few decades. However, the literature provides only a little knowledge on the health and safety situation and challenges among the reconstruction workers. The objective of this paper was to address this gap in the literature and to investigate the health and safety challenges experienced by the reconstruction workers. The findings of this study are based on the field observation and semi-structured interviews conducted with 38 stakeholders from the area of Bhaktapur, Nepal following the mega earthquake in 2015. The qualitative analysis of the semi-structured interviews reveals eight challenges that potentially affect the health, safety, and wellbeing of the reconstruction workers.

The finding of this study advances the theoretical knowledge in the area of reconstruction workers health and safety. First, our study strengthens the arguments from previous studies that post disaster reconstruction efforts are significantly different from conventional construction in terms of workers health and safety. Although there are some overlaps in health and safety challenges, there are unique health and safety challenges for reconstruction workers. Second, our study highlights the importance of further research on delicate issues such as mental health of the workers, faster reconstruction syndrome, involvement of community people, and presence of hazardous debris. This study is one of the first stepping-stone to future researches on these topics that will advance the theoretical knowledge within the disaster risk management context. Finally, our study questions the availability of necessary resources (e.g., safety equipment) in Nepal and the focus of GoN on health and safety of the reconstruction workers. The study suggests that GoN should play a vital role in providing safety equipment and implementing specialized safety training for the workers involved in PDR operations, especially in hazardous debris and waste management practices. Training on hazard recognition and handling chemical waste will help the workers in managing post disaster hazardous conditions. Training interventions can also be used in enhancing the safety performance. The mental health of the workers is also an important topic of discussion. There should

be counseling and support centers for the workers and community people too to overcome this shocking situation. The practicing professionals of Nepal may use the findings of this study to develop new policies and practices which will help them minimizing the workplace hazards and improving safety performance. Among other challenges, distraction and mental health of the workers are rather important since most of the reconstruction workers are also the survivors of the natural hazard. This post disaster trauma affects the safety practice and performance significantly. On top of that, use of unskilled workers, faster reconstruction syndrome, and participation of community people play vital role in the health and safety situation of the reconstruction workers.

Despite the strengths and implications of the study, this study has some important limitations that need to be addressed in future research efforts. Due to the exploratory nature of this study, it is possible that additional safety challenges, not identified in this study, exist. The findings of this study are based on the perception of 38 stakeholders of PDR in the area of Bhaktapur, Nepal. Although the findings of this study cannot be generalized and is based on a case study, the knowledge is transferrable to similar conditions. Additional limitations of the study include uneven participants from alternative perspectives, possible errors of translation from Nepali to English, lack of verbal cues for interpretation, and un-reflected bias of the interpreter of the results. Future research efforts can focus on exploring the health and safety challenges for different natural hazards such as floods, wildfires etc. since different natural hazards produces different hazards. Additional, similar studies can be conducted in different geo-locations since a number of factors play role in the health and safety management such as economic condition of the nation, governmental and non-governmental aid, impact of political situation and so on.

The findings of this study can be utilized by the government of Nepal and other countries who are prone to natural hazards, in order to prepare their workforce for any future natural hazards. Implementing the findings of this study in developing specialized safety training programs, proper waste management practices, using proper safety equipment, and taking care of the physical and mental health of the reconstruction workers can make the workforce more resilient in facing future natural hazards. Finally, the findings of this study can be incorporated with future studies in order to develop more techniques in managing health hazards during post disaster reconstruction efforts.

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