Refugees' Perception of Landslide Disasters: Insights from the Rohingya Camps in Cox's Bazar, Bangladesh

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Abstract

The Kutupalong-Balukhali expansion Rohingya camp provides shelter to nearly one million refugees in a landslide-prone area. The Rohingyas seeking refuge in the camps deal with annual landslide events. This study looks into the existing risk perception of landslides in this shelter-seeking refugee community. Using a structured questionnaire, we conducted a face-to-face survey of 400 Rohingya people from six selected camps in March 2022. We collected information about refugees' perceptions towards landslide disasters, exposure to hazardous events, mitigation measures, preparedness knowledge, and risk communication. Descriptive statistical analysis was carried out to find out the existing condition of the camps. A regression analysis (Proportional Odds Model) was applied to determine the perception of people at risk. We found that exposure to previous landslides, mitigation measure quality, and emergency managers' roles were crucial in defining people's risk perception compared to the demographic characteristics of the Rohingya population. A combination of integrated mitigation, preparedness, and inclusion of laypeople in the overall management process would reduce landslide disaster risk inside the camps.

Keywords

Landslides · Proportional odds model · Rohingya · Bangladesh · Disaster risk reduction

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1 Introduction

Landslide hazards have become an annual event for the hill tracts of Bangladesh in the monsoon. Kutupalong Rohingya camp lies in this hill tract regime (seismically active zone), providing shelter to conflict-fled Rohingya (Kamal 2013; Rahman et al. 2020). Despite being located in a landslide-prone site, an extensive area of the camp's terrain has been flattened to accommodate the enormous influx of these people. Rohingya cut the slopes and construct their bamboo-based makeshift shelters as they are allocated designated sites in the fixed camp. Unfortunately, these folks are contributing to more hazards. After the arrival of the Rohingyas in 2017, the camp repeatedly dealt with landslide events. There have been reports of landslide occurrence for four consecutive years (2018, 2019, 2020, and 2021) with casualties in the camp (Ahmed et al. 2018, 2020; ISCG 2018; Reliefweb 2018, 2019; Aziz 2021; Marie Giiespie 2021). The camp population, already living in a humanitarian assistance area, is trying its best to face these monsoon monsters. During any hazard, lay people's perceptions or thoughts towards the hazard play a significant role in managing that disaster. Risk perception is considered one of the predominant factors that govern the response and coordination behavior of the affected community towards risk management authority (Tulloch and Lupton 2003). The perception is often regulated by the decisions taken by the policymakers, such as non-structural measures, zoning guidelines, and directives. Therefore, for the management to be effective, the managerial authority must also acknowledge the locals' feedback. However, perception analysis is a challenging task. It demands information on social bonding, socio-cultural identities, and socio-economic status as prerequisites. Some researchers believe that risk is associated with uncertainty in understanding and managing the risk (Kasperson et al. 1988; Beck 1992; Lash et al. 1996; Lash 2000).

I. Alcántara-Ayala et al. (eds.), *Progress in Landslide Research and Technology, Volume 2 Issue 2, 2023*, Progress in Landslide Research and Technology, https://doi.org/10.1007/978-3-031-44296-4_25

2 Theoretical Framework

Risk perception is quite different from actual risk. While risk measurement involves quantitative (probability) or qualitative assessment, but risk perception ultimately depends on people's judgment. The judgment can vary from person to person (Sjöberg 2000). For example, lay people evaluate risk in a very different way than the experts. While it is common for experts to define risk in terms of the probability of hazard occurrence and the likelihood of its impact, the commoners mainly attribute this risk to their exposure history. While assessing the risk, experts remain very careful of the hazard, elements at risk, the vulnerability of the exposed community, and the assets; non-experts can choose to characterize the risk based on their appraisal of the hazard. This perception is often structured by the existing pattern of risk acceptance in society (Lichtenstein et al. 1978; Slovic and Fischhoff 1980; Siegrist and Gutscher 2006).

Understanding risk perception has become crucial because it can affect risk management efforts. Owing to the perceived risk, lay people can carry out self-evacuation or may shape their decision to cooperate with the responding agencies or emergency managers. Several researchers report that along with the hazard characteristic, Perceiver's particular characteristics define their reaction towards the risk (Renn and Levine 1991; Boholm 1998; Wachinger et al. 2013).

Social vulnerabilities are reported to direct risk perception, eventually reflecting lay people's capacity or willingness to practice adaptation strategies. People in direct exposure often perceive themselves in danger (Bickerstaff 2004). Demographic features of a community can be a mediating factor in risk perception. Age, gender, occupation, and education play a significant role in depicting risk perception. For example, people of different age groups (children, adolescents, and older adults) do not perceive the risk of a hazard similarly. Children and older adults may perceive a greater risk of hazards due to difficulties of mobilization. Unemployed and uneducated people perceive higher risk than employed and educated ones. Minority, cultural entity, and ethnicity can also affect risk perception (Flynn et al. 1994; Boholm 1998; Sjöberg 2000; Soori 2000; Greening et al. 2005; Burningham et al. 2008; Cutter and Finch 2008; Gyekye and Salminen 2009; Payne et al. 2017; Bhuiya et al. 2021).

Another determinant commonly found in several studies is the experience of previous hazards. The timeframe, recurrence, and severity of impact let the Perceivers rank their risk. People often rank their future risk as low of any dangerous hazard if they have experienced any negligible hazard, referred to as normalization bias (Mileti and O'Brien 1992).

Sometimes, Lay people who trust their preparedness, adaptation measures, and knowledge tend to perceive risk at lower levels. People's trust in emergency managers' efficacy also plays the role of a significant component in shaping risk perception. Emergency managers' efforts, activeness, honesty, and willingness to help build the trust of non-experts in the experts (Bostrom 1997; Lazo et al. 2000).

The number of studies investigating risk perception for natural hazards is limited. Researchers are recently shifting their focus to risk perception-related studies for hydro-meteorological hazards. These studies assess how people perceive their risk towards the hazards and how much they are willing to act accordingly to combat that hazard (Damm et al. 2013; Hernández-Moreno and Alcántara-Ayala 2017; Oliveira et al. 2017; Qasim et al. 2018; Antronico et al. 2020). The affected population is reported to be concerned and attentive to landslide hazard information, yet they are less likely to consider mitigation measures despite perceiving a higher risk. A population that repeatedly encounters landslide hazards is found to be more risk-informed than others. Additionally, the influence of risk mitigation measures on perceived risk is evaluated (Calvello et al. 2016). However, people willingly living on the hill slopes miscalculate their risk due to the lack of awareness. Negligence or underestimation of the risk can be detrimental to risk management efforts.

However, previous studies have only conducted risk perception assessments focusing on these parameters. There should be an investigation into how risk perception for a specific hazard is influenced in an environment where the residents are already distressed about their day-to-day living. Risk perception in a shelter camp for forcibly displaced people can vary dynamically due to the different restricted lifestyle patterns (housing, education, food, nutrition, exposure to hazards, mitigation measures, etc.) Therefore, there is a scope for exploring how people perceive their risk for a hydro-meteorological hazard attributed to them due to the restricted shelter space, how they respond to that hazard and their attitude towards the emergency management authority.

3 Methodology

3.1 Study Area

The shelter camp situated in Bangladesh for the violence fled stateless Rohingya (Muslim minority) of Myanmar is our study area. Kutupalong-Balukhali expansion camp, Jamtoli camp, and Hakimpara camps are closely situated in Ukhiya, Cox's Bazar. These camps shelter over 958,000 Rohingya people (as of January 2023) (UNHCR 2023). Camps 9, 10, 17, and 20 of the Kutupalong Balukhali expansion area, camp no 14 of Hakimpara, and camp no 15 of Jamtoli are shortlisted for the investigation due to high to moderate landslide susceptibility (UNHCR 2019). These camps are located in the hilly areas of Bangladesh, where the slopes

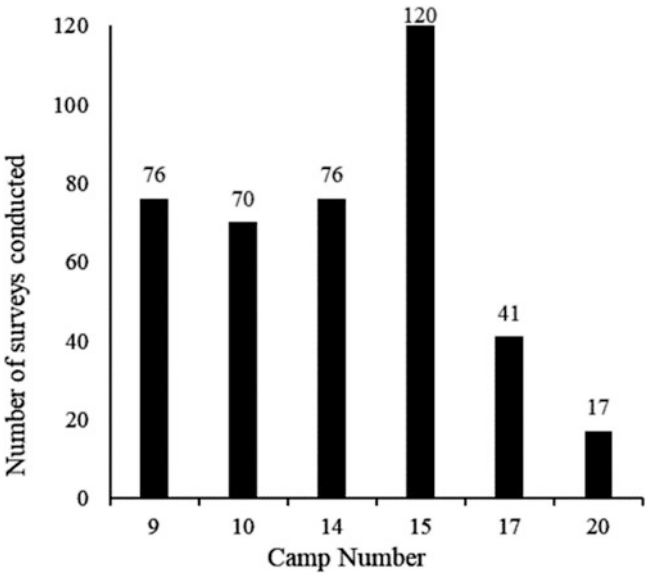

Fig. 1 Number of samples collected from different camps

become unstable during the monsoon. The camp population, repeatedly being affected by the landslide events, is trying its best to deal with the situation along with the emergency management authority. The area is already under the humanitarian response; therefore, the mitigation and response measures to landslide hazard is explicitly not similar to those of the regular residential area. Perception of the population and the determinants behind this perception should be identified to support better the management efforts required during the chaotic monsoon situation. Hence, the study aims to investigate this dimension.

3.2 Sample Size and Data Collection

The study conducted the face-to-face interview in March 2022 using a structured questionnaire among the Rohingya population (total of 400 surveys using random sampling technique) Fig. 1, where the population size of the six selective camps played a significant role. These six camps are selected because these camps have high to moderate landslide susceptibility, according to OCHA 2022. The questions and variables were developed through an extensive literature review. The study was also adjusted, modified, and adopted based on the local context. Since the study area is a specialized humanitarian support center, the investigation parameters are customized according to the requirement of the study. A pilot test of the questionnaire was carried out to establish the credibility of the variables. The questionnaire included dichotomous, multiple-choice, and statement-based questions with the response on the Likert Scale. An extensive literature review was employed to construct and support the questionnaire. The questions were amended, improved, and adapted following the local context (forcibly displaced Myanmar nationals' shelter camp perspective). The questionnaire comprised dichotomous response questions, multiple-choice questions, Likert scale-based responses, and open-ended questions.

3.3 Data Analysis

IBM SPSS Statistics 23 was used for digitizing and analyzing the field records. Frequency analysis, Pearson's Chi-squared test, and ordinal regression analysis were run on the response records. Descriptive statistical analyses were mainly run to obtain a comprehensive idea of the existing situation in the camp area. Regression analysis was run to identify determinants that shape the risk perception of the camp area and finally quantify their significance.

Research ethics The respondents were fully aware of the purpose of the data collection. We collected verbal consent from them, and the survey was anonymous. No respondents' personal information will be disclosed from the researcher's end. Formal high-risk ethical approval, fieldwork permissions and risk assessments were conducted following the institutional procedures.

4 Results and Discussion

4.1 Demographic and Socio-economic Context

The study findings differ from any other risk perception study as the study area differs from any other ordinary place in Bangladesh. The camp administration regulates the demographic scenario in the camp area. All the respondents reside in makeshift houses made of bamboo and thatched roofs. However, there lies a difference in the house's location on the slope (Top, Middle, and bottom). There is negligible diversification in the occupational status as all the respondents depend on the relief activities allowed by the camp administration. All the respondents belong to the same ethnic group, as the camp provides shelter to a common group. The comprehensive demographic and socio-economic variables are present in Table 1.

4.2 Landslide Exposure and Emergency Management Scenario

The existing hazard scenario must first be characterized to comprehend the respondents' perceptions. Exposure to landslides, their intensity, and emergency management

Table 1 Demographic profile of the respondents

Variables	Class/Group	Percent	Mean	SD
Gender	Male (1)	57	1.42	0.49
	Female (2)	43		
	Others (3)	0		
Occupation	Unemployed (1)	85.3	1.27	0.74
	Seasonal day laborer (2)	7.5		
	Shopkeeper (3)	2		
	Others (4)	5.3		
Age	16–20 years (1)	5.8	3.05	1.33
	21–30 years (2)	36.8		
	31–40 years (3)	28.2		
	41–50 years (4)	11.5		
	51–60 years (5)	12		
	61–70 years (6)	4.8		
	71 and above (7)	1		
Location at slope	Top (1)	33	1.84	0.69
	Middle (2)	50		
	Bottom (3)	17		
Years of education	No Education (0)	85.8	0.22	0.58
	1–5 years (1)	7.2		
	6–10 years (2)	6.3		
	11–15 years (3)	0.8		

condition are presented in Table 2. The respondents identified multiple adverse consequences of the last landslide (Damage to home 92.7%, self-injury 0.5%, household member injury 6.3%). The respondents were asked to rate their pre-landslide preparedness knowledge and post-landslide response measure's effectiveness. They identify shelter and slope strengthening as their preparedness measure. In the during and post-landslide response activities, they are found to adopt multiple measures:

- removing the debris that entered their shelter (61.4%)
- relocating or shifting household materials (32.8%)
- informing about the damage in the CIC office (94%)
- self-restoration of slope (74.9%)

Each camp has a separate CIC office designated with the management activity of the camp. Upon reporting to the CIC office, the members visit the site and propose slope mitigation measures if necessary. Respondents identify CIC, IOM, SMEP, and different NGOs as emergency managers who work in collaboration.

4.3 Mitigation Measure Scenario

Several infrastructural mitigation measures have been taken throughout the camp to prevent landslides. Respondents identified the mitigation measures available on the slopes they live at. In some cases, the slopes were not fully protected or given partial protection. Structural mitigation measures are Terrace of geotextile tubes, Terrace of geotextile tubes supported by bamboo fences, terrace of tin sheets supported by bamboo fences, layers of tarpaulin, plantation, terrace of bamboo fence sheets only, terrace of sandbags and concrete walls (Fig. 2).

4.4 Determinants of Risk Perception in the Proportional Odds Model

The dependent variable, respondents' perceived risk (response taken in ordinal format), was regressed against independent variables. The independent variables include age, years of education, gender, location of the shelter, the severity of the last landslide event, evacuation during the previous event, slope stabilization measure's coverage, mitigation measure material, structural measure building quality, activeness of emergency managers, adequacy of slope stabilization and shelter reinforcing material, trust in early warning) using Proportional Odds Model (POM). The independent variables were inspected for multi-collinearity. Only the "trust in early warning" variable showed this relation. The rest of the variables were used in POM. The results are exhibited in Table 3. The test result shows that variables like age, gender, years of education, occupation, location of the shelter, structural mitigation measure material (except terrace of sandbags), and sufficiency of shelter building materials are insignificant (sig $p > 0.05$). The severity of

Table 2 Landslide exposure and emergency management scenario

Variables	Class/Group	Percent	Mean	SD
Frequency of landslide hazard	Never (1)	0.5	3.15	0.58
	Once in the living period (2)	9.3		
	Once in every year (3)	64.8		
	Twice or more in every year (4)	25.5		
Severity of last event	Very low (1)	2	3.41	0.88
	Low (2)	12.5		
	Moderate (3)	36		
	High (4)	41		
	Very High (5)	8.3		
Accuracy of early warning during last landslide event	Very low (1)	0.3	3.38	0.61
	Low (2)	4.9		
	Moderate (3)	52.3		
	High (4)	41.5		
	Very High (5)	1		
Left house during landslide	Yes (1)	29.8	1.7	0.45
	No (2)	70.3		
Type of shelter facility	Authorized, mainly in learning centers and mosques (1)	8.8	1.9	0.28
	Self-managed in relative's house or secondary houses (2)	91.2		
Precautionary measure knowledge	Very low (1)	14.1	2.6	0.88
	Low (2)	24.4		
	Moderate (3)	49.5		
	High (4)	11.6		
	Very High (5)	0.5		
Effectiveness of post-landslide measures	Very low (1)	7.3	1.9	0.24
	Low (2)	19.5		
	Moderate (3)	54.9		
	High (4)	16.3		
	Very High (5)	2.0		
Precautionary measure taken	None	22	2.6	1.0
	Shelter strengthening	16.8		
	Slope strengthening	38.3		
	Both strengthening	23		
Activeness of emergency managers	Excellent (1)	1.5	3.72	1.14
	Very good (2)	18.4		
	Good (3)	18.4		
	Fair (4)	29		
	Poor (5)	32		
Adequacy of received slope building material	Excellent (1)	3.3	3.89	3.63
	Very good (2)	15.5		
	Good (3)	17.8		
	Fair (4)	15.3		
	Poor (5)	48.3		
Adequacy of received shelter building material	Excellent (1)	1.6	3.63	1.08
	Very good (2)	12.6		
	Good (3)	36.6		
	Fair (4)	18.9		
	Poor (5)	30.3		

the last event, evacuation during the previous event, slope stabilization measure's coverage, structural measure building quality, activeness of emergency managers, and adequacy of slope stabilization material play an influential role in determining the risk perception of the Rohingya population of the camp.

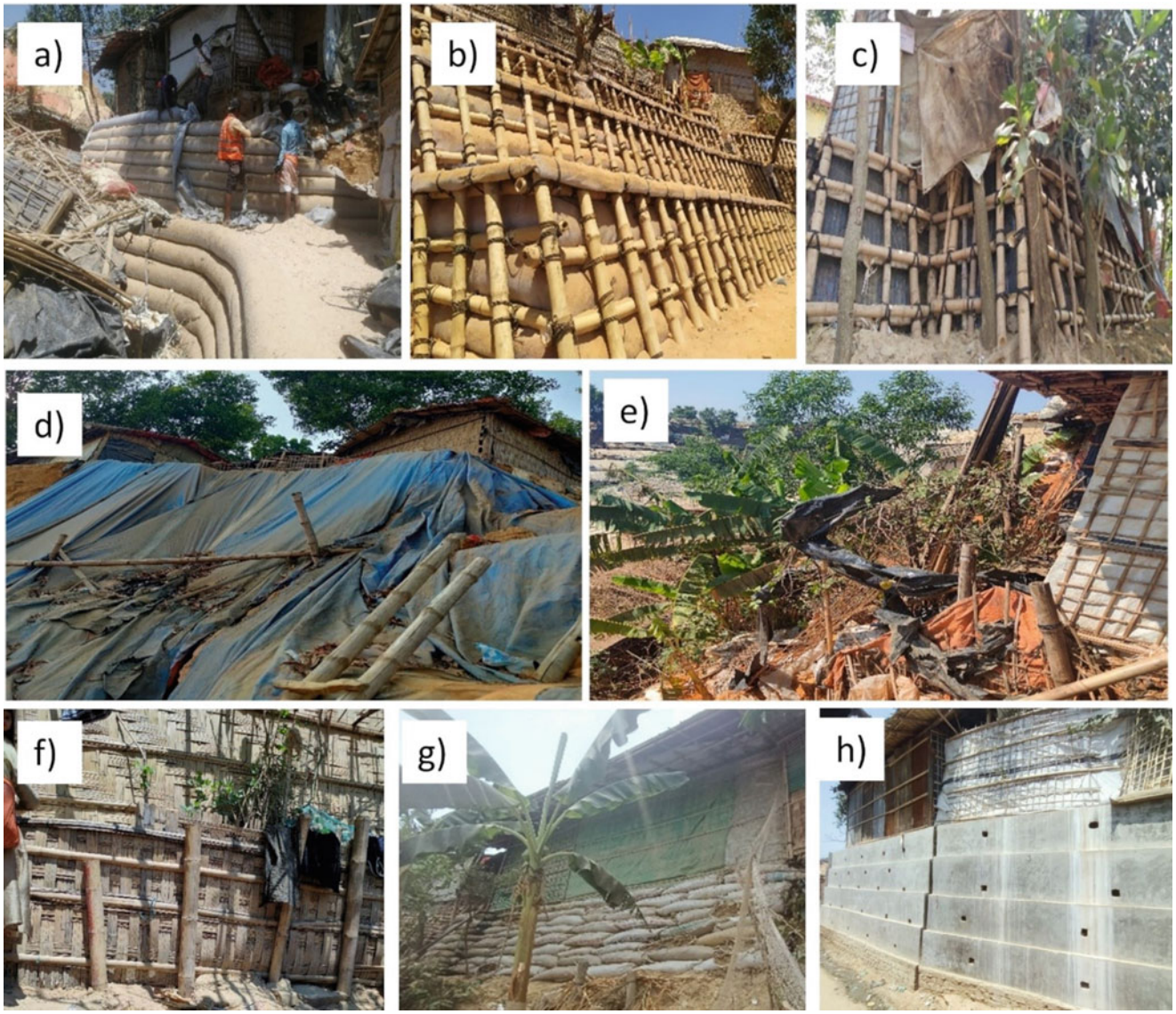

Fig. 2 Different types of structural mitigation measures exist on the slopes of the camp area (**a**) terrace of geotextile tubes, (**b**) Terrace of geotextile tubes supported by bamboo fences, (**c**) terrace of tin sheets supported by bamboo fences, (**d**) layers of tarpaulin, (**e**) plantation, (**f**) terrace of bamboo fence sheets only, (**g**) terrace of sandbags, and (**h**) concrete walls (double column width)

5 Conclusion

This study looked into how a group that already lives in a camp for people who had been forcibly displaced perceives the risk of landslides. The camp area is a landslide-prone region, so the displaced population knows this hazard. They are almost the annual victim of these slides in the monsoon time. Due to their residence in a restricted area, different demographic characteristics (occupation, years of education) are uniform for the entire population. Therefore, demographic characteristics are not playing the role of significant variables for defining risk perception. Although the camp is already run under some authorized monitoring, managerial skills significantly impact how much risk people perceive for the landslides. People living on slopes with total coverage slope protection mitigation measures perceive risk at a lower level than the others. The residents are found to believe that the emergency managers are providing them with quite an accurate early warning. They are more likely to trust the authority responsible for emergency management. Besides this, the severity of the exposure to previous landslide events affects the population's perceived risk. People who had to leave their own makeshift houses during the landslide perceived the risk as higher than those who did not have to go. Living here with recurrent landslide events, people have started to adopt some adaptive strategies and response measures along with the initiatives taken by the managerial

Table 3 Determinants of risk perception in proportional odds model

Variables		Categories	Estimate	SE	Wald	Sig.	95% confidence interval	
							Lower bound	Upper bound
Age			0.003	0.010	0.086	0.770	−0.016	0.022
Gender (Female as reference)		Male	0.160	0.261	0.379	0.538	−0.350	0.671
Years of Education			0.144	0.058	6.207	0.013	0.031	0.257
Occupation (Others as reference)		Unemployed	0.806	0.599	1.811	0.178	−0.368	1.980
		Seasonal Day laborer	0.254	0.693	0.134	0.714	−1.105	1.613
		Shopkeeper	−0.371	1.037	0.128	0.720	−2.403	1.660
Location of shelter (Bottom as reference)		Top	0.567	0.352	2.601	0.107	−0.122	1.257
		Middle	0.254	0.338	0.566	0.452	−0.408	0.916
Severity of last event (Very high as reference)		Very low	−4.550	1.189	14.639	0.000	−6.881	−2.219
		Low	−5.306	0.723	53.888	0.000	−6.723	−3.889
		Moderate	−3.296	0.577	32.644	0.000	−4.427	−2.165
		High	−1.938	0.525	13.603	0.000	−2.968	−0.908
Evacuation during last event		Yes	0.410	0.265	2.394	0.122	−0.109	1.246
Slope mitigation measure coverage extent (Partial coverage as reference)		Full coverage	−1.011	0.442	5.229	0.022	−1.877	−0.831
Mitigation measure material	Terrace of geo-textile tubes (No as reference)	Yes	−0.214	0.507	0.178	0.673	−1.207	0.779
	Terrace of geo-textile tubes supported by bamboo fences (No as reference)	Yes	−0.688	0.437	2.476	0.116	−1.545	0.169
	Terrace of tin sheets supported by bamboo fences (No as reference)	Yes	0.010	0.758	0.000	0.989	−1.475	1.495
	Layers of tarpaulin (No as reference)	Yes	−0.012	0.257	0.002	0.964	−0.516	0.493
	Plantation (No as reference)	Yes	−0.082	0.388	0.045	0.832	−0.843	0.678
	Terrace of bamboo fence sheets (No as reference)	Yes	−0.046	0.281	0.027	0.870	−0.597	0.505
	Terrace of sandbags (No as reference)	Yes	−0.534	0.260	4.218	**0.040**	−1.044	−0.024
	Concrete walls (No as reference)	Yes	0.022	0.471	0.002	0.963	−0.901	0.944
Structural measure building quality (Poor as reference)		Excellent	1.149	1.042	1.214	0.270	−0.894	3.192
		Very good	0.225	0.793	0.081	0.777	−1.330	1.780
		Good	0.106	0.678	0.025	0.875	−1.222	1.435
		Fair	0.501	0.500	1.005	0.316	−0.479	1.481
Activeness of emergency managers (Poor as reference)		Excellent	−6.701	1.629	16.921	**0.000**	−9.893	−3.508
		Very good	−4.613	0.894	26.642	**0.000**	−6.364	−2.861
		Good	0.415	0.556	0.557	0.456	−0.675	1.505
		Fair	−0.407	0.414	0.967	0.325	−1.218	0.404
Adequacy of slope stabilization (Poor as reference)		Excellent	−2.699	0.956	7.971	0.**004**	−4.573	−0.825
		Very good	−1.873	0.656	8.156	0.**004**	−3.159	−0.588
		Good	−1.433	0.519	7.621	0.006	−2.451	−0.416
		Fair	0.668	0.383	3.045	0.081	−0.082	1.418
Adequacy of shelter strengthening material (Poor as reference)		Excellent	−1.189	1.130	1.107	0.293	−3.404	1.026
		Very good	−0.776	0.550	1.992	0.158	−1.853	0.301
		Good	0.297	0.410	0.523	0.469	−0.507	1.101
		Fair	0.083	0.393	0.045	0.833	−0.687	0.852

Parallel line test: 0.0001, goodness-of-fit test of overall model: Deviance, p value = 1.00, Nagelkerke's $R = 0.705$, S.E: Standard error

authority. Based on the findings, the study would like to present some recommendations. These recommendations reflect the response from this study's respondents and the authors' observations. The camp residents are willing to participate in mitigation activities which can reduce the severity of their exposure to the hazard. These people should be actively integrated into the landslide risk management activities (mitigation-response-recovery) in a more organized way. Active community engagement in a more standardized way may add value to the response efforts of the camp's managerial authority, and these can eventually help this large, distressed population.

Acknowledgments The authors thank the Office of the Refugee Relief and Repatriation Commissioner (RRRC), Cox's Bazar, Bangladesh, for allowing fieldwork inside the Camp area.

Funding The Royal Society funded this study as part of the project, 'Resilient Futures for the Rohingya Refugees' (Award Reference: CHL\R1\180288), supported under the UK Government's Global Challenges Research Fund (GCRF).

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