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Factors Influencing Post-Earthquake Emergency Shelter Choice – A Case Study of Gorkha Earthquake 2015

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Abstract
Shelter is one of the most basic human needs and one of the priority concerns in the aftermath of a disaster. Most research on emergency sheltering focuses on shelter location planning. Pre-disaster contingency planning and evacuation planning address the need for arranging public sheltering in advance. However, the experience of various disasters illustrates that a majority of the affected population do not seek public shelter and generally consider public sheltering to be a last resort option. This study aims to identify the damage and non-damage related factors that influence the emergency shelter choice of affected households. Various damage and non-damage related socio-demographic factors were shortlisted after a thorough literature review. The study then utilizes HSS data from the 2015 Gorkha Earthquake to verify the correlation between the shortlisted factors and shelter choice. The study shows that the sheltering behavior of households is highly contextual with a stark difference observed between the households of urban and rural areas. Furthermore, it has been observed that the shelter choice of the households changes as they progress through the emergency phase and that shelter decision is not a one-time fixed decision but, a continuous and dynamic choice the households are confronted with every day following an emergency. The analysis reveals that the sheltering behavior of urban households is influenced by building damage grade, and household size and that in rural households is influenced by building damage grade, presence of elderly, level of education, income, reliance on agriculture as the primary source of income, and ownership of livestock. The findings of this study would be useful in making a more accurate estimation of shelter demand in a disaster scenario. Further research in this area could look into how weather conditions, time and severity of earthquakes affect shelter demand, or accessibility and accommodations in emergency shelter spaces for people with chronic health conditions, disabilities, children, and pregnant and postpartum women.

Keywords
Emergency Shelter, Shelter Decision, Household Shelter Choice

1. Introduction

Hazards such as distant tsunamis, flooding, hurricanes, snowstorms, and volcanic eruptions are largely predictable and allow time for authorities to issue official warnings and evacuation measures. However, the sudden onset and unpredictable nature of earthquakes mean planned evacuation is not possible and the decisions to evacuate will be made after the onset of the event, mostly after the initial shaking has stopped [1]. Thus, earthquake evacuation must rely on identifying and providing suitable areas for emergency shelter before disasters unfold.

Most research on shelter support focus on shelter location planning. Various studies in shelter location planning have also been carried out in Nepal. In 2012, the International Organization for Migration (IOM) and Ministry of Home Affairs (MOHA) identified 83 open spaces for humanitarian purpose in Kathmandu Valley [2]. Anhorn and Khazai (2015) proposed a methodology utilizing both qualitative and quantitative evaluation criteria to rank the suitability of open spaces for contingency planning and placement of shelter in the immediate aftermath of a disaster. This methodology was utilized to rank the suitability of available open spaces in Kathmandu Metropolitan City [3]. Similarly, Trivedi and Singh (2017) utilized data of the Gorkha Earthquake to illustrate the effectiveness of a hybrid decision model based on fuzzy analytic hierarchy process (AHP) and technique for order preference by similarity to ideal solution (TOPSIS) to evaluate potential locations for displacement sites [4]. While these studies are suitable for identifying spaces that can be utilized in an emergency, they fail to consider whether the population whom these spaces were meant to serve would opt to shelter there. Thus, the aim of this study is to identify and understand the various factors that influence the affected population's decision on shelter choice.

1.1 Problem Statement

The 2014 shelter response plan for a scenario earthquake in Kathmandu Valley estimated that only 5% of the affected population would shelter in open spaces near their homes and the remaining 95% would seek shelter in designated shelter spaces. However, in the aftermath of the 2015 earthquake, although 16 planned shelter sites were immediately established in Kathmandu, they were sparsely populated and most of the affected population sheltered in numerous spontaneous makeshift shelter camps [5]. Shrestha's (2016) study 'Effectiveness of Allocated Open Spaces of Kathmandu Valley in Gorkha Earthquake 2015' also found that a majority of the affected people did not use the designated shelter spaces [6].

Similarly, in a post-earthquake study in Taiwan following the

1999 Chi-Chi earthquake, only 20% of evacuees chose to go to a public shelter and most would prefer to camp in nearby open spaces or stay with family or friends. However, in case of bad weather up to 38% of evacuees opted for public shelters [7]. Following the 2010 Haiti earthquake, the affected population relied on the support of their family and friends [8]. It can be seen that public sheltering is often considered a last resort and the affected population regard in-place sheltering as more favorable as they prefer to stay close to their homes, food reserves, livelihoods, and social ties.

Furthermore, even though many models exist to estimate the number of injuries and fatalities in a scenario earthquake, methods for accurately estimating displaced population are still scarce [3] and they mostly calculate displaced population only as a function of building damage and fail to consider the effect of the various socio-economic factors that influence the shelter choice of the affected population [9, 10]. In the absence of accurate models to estimate the displaced population, contingency plans may severely underestimate the number of affected people or even fail to identify their needs.

1.2 Research Objective

The objective of the research is to identify the factors that influence the choice of emergency sheltering of the affected population in a post-earthquake scenario.

1.3 Research Questions

- What are the critical factors that influence emergency shelter behavior in a post-earthquake scenario?
- What demographics are more likely to self-shelter or shelter-in-place over seeking public shelter?

2. Literature Review

2.1 A Historical Perspective on Displacement

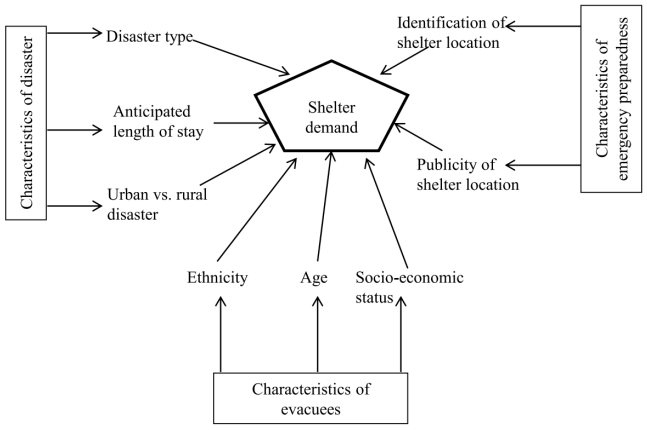

Figure 1: Factors affecting shelter demand based on Mileti et al. (1992) (Source: Nagarajan & Shaw, 2021)

Mileti et al. (1992) proposed a model to explain the use of overnight shelters in an evacuation. Within this model, the factors affecting the use of shelter during emergencies were grouped into three categories – characteristics of the disaster (disaster type, anticipated length of stay, urban or rural context, daytime or nighttime evacuation), characteristics of emergency preparedness (identification of shelter locations, publicity of shelter location), and characteristics of evacuees (ethnicity, age, socio-economic status). Analysis of this model based on the secondary data from 23 historical events in the United States concluded that only the characteristics of evacuees determine shelter use rates. The socioeconomic status and age of evacuees were found to be stronger indicators of shelter demand, and people without financial resources to self-evacuate and elderly people were more likely to seek public shelter during emergencies [11].

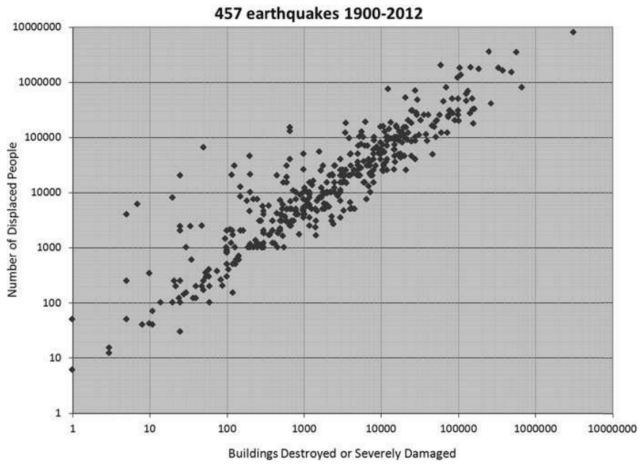

Figure 2: Relationship between severely damaged or destroyed buildings and displaced persons after earthquakes (Source: Khazai et al., 2014)

An analysis of 457 historic earthquakes from 1900 to 2012 [Figure 2] revealed a linear trend (on a logarithmic scale) of displacement and building damage [12]. The number of displaced persons is generally a little less than one order of magnitude larger than the number of destroyed or severely damaged buildings. However, the number of displaced people was too large to have only originated from collapsed or severely damaged buildings. This disparity between the number of occupants of destroyed or severely damaged buildings and the number of displaced persons has been explained by various shelter demand models [13, 1, 10] which are discussed in the following section.

2.2 Shelter Demand Models

2.2.1 HAZUS Methodology

The HAZUS methodology is the most widely used model for estimating the number of displaced households and the number of people requiring short-term shelter. The displaced population is calculated only from building damage and then it is multiplied by weighted factors that consider age, ownership, ethnicity, and income to obtain the number of people seeking public shelter. This model recognizes that not all households from damaged buildings would choose a public shelter and also some households will seek public shelter even if their homes have not been significantly damaged [14]. Although this model considers the various factors that influence the demand for public shelter, it

assumes that people of various socio-economic characteristics are uniformly distributed across all building types and building damage levels, and fails to recognize that the decision to evacuate or shelter in place is made at the household level [13].

2.2.2 Chang's Model (2009)

Chang et al. (2009) were the first to recognize the role of decisions made at the household level on shelter demand. Chang's model also utilizes building damage, loss of lifelines, and socio-economic characteristics of the affected households however, unlike its predecessors, this model does so within a household decision-making structure. In Chang's model, the decision of a household to stay at home, or to seek alternative shelter or a public shelter is assumed to be made through a series of four core questions as shown in the figure below.

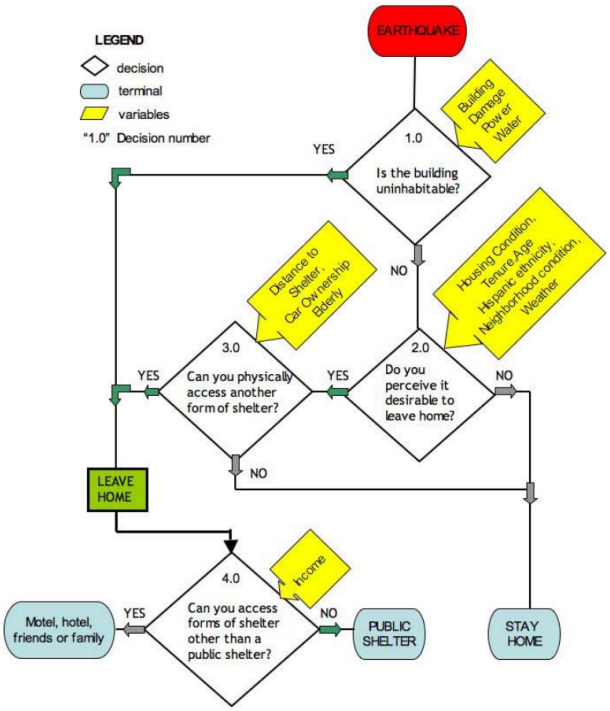

Figure 3: Schematic of Chang's shelter model (Source: Chang et al., 2009)

The first decision is assessing if the building is unhabitable. This decision is dependent upon building damage and the availability of electricity and water. If the building is habitable, the second decision is the desirability of the household to leave home. This decision reflects the risk perception of the household and takes into account the households that choose to evacuate even if it is not necessary to do so. The factors that influence this decision are housing conditions, tenure, age, ethnicity, neighborhood conditions, and weather conditions. If the household perceives it desirable to leave home, the third decision is the household's physical accessibility to an alternative shelter. This is dependent upon the distance to the nearest shelter, vehicle ownership, and the presence of elderly family members. The total displaced households are those whose homes are inhabitable and those whose homes are habitable but choose to seek alternative shelter for other reasons. Among these households, those without the means and resources to arrange a non-public shelter will choose a public shelter [13].

2.2.3 Wright and Johnston Model (2010)

Wright and Johnston developed a framework for estimating evacuation and sheltering needs for a major earthquake scenario in Wellington, New Zealand based on Chang's model. Within this model, the factors contributing to the household shelter decision-making are classified as – building structural safety, building functionality, household livability, and neighborhood livability. However, they point out that peoples' attitude may change over time. For example, in the absence of essential utilities for an extended period or in case of adverse weather conditions, more households may opt to move to a public shelter even if they had initially chosen to shelter-in-place. Conversely, the restoration of utilities can reduce the demand for public shelters. Furthermore, the restoration of transport links provides the opportunity for the affected households to evacuate outside of the affected region [1].

2.2.4 SYNER-G Project Shelter Demand Model (2014)

Similarly, Khazai et al. (2014) developed a logic model to estimate shelter needs based on Chang (2009) for a European context. The first decision step (D1) includes external factors like building damage, utility disruptions, weather conditions, and post-earthquake hazards which gives the number of displaced people due to non-habitable houses. The second (D2) and third (D3) decision covers the desirability to evacuate based on community and household vulnerabilities and shelter accessibility. Finally, the fourth decision (D4) represents the desirability to seek public shelter or an alternative shelter based on access to resources [9, 10].

2.2.5 Parameters Influencing Post-Earthquake Shelter Choice

Table 1 lists the parameters influencing post-earthquake shelter choice associated with each decision step within the household shelter decision-making structure.

Table 1: Parameters influencing post-earthquake shelter choice

DECISION STEP	FACTORS
BUILDING HABITABILITY	Building Damage
	Lifeline Disruptions
	Weather Conditions
DESIRABILITY TO LEAVE HOME	Housing status - Single / multi-unit housing - Home ownership
	Neighborhood Livability
	Belonging to a marginalized group
	Gender / Women-led households
	Presence of children
	Skills and education
ACCESSIBILITY TO AN ALTERNATE SHELTER	Vehicle Ownership
	Livelihood Occupation Ownership of livestock Being involved in agriculture
	Household size
	Elderly
	Disability
ALTERNATIVE TO PUBLIC SHELTER	Having strong social network Extended family / Friends
	Income

3. Methodology

The hypothesis of the study is that there is a correlation between the emergency shelter choice and the socio-demographic characteristics of the affected households. This research intends to verify this correlation between the various socio-demographic characteristics of affected households and emergency shelter choice. These factors are qualitative in nature and therefore, cannot be measured or quantified. Therefore, it falls under the post-positivist paradigm. Furthermore, this research is deductive in nature as it intends to test a hypothesis with specific data and observations.

The ontological claim of the research is that the emergency shelter choice of an affected household is dependent on its various socio-demographic characteristics such as housing status (owner/rented, single/multi-unit housing), household size, familiarity with neighborhood (number of years they have lived in the neighborhood), level of education, income and field of employment, belonging to a marginalized social group, presence of children, elderly, or disability, vehicle ownership, and social networks.

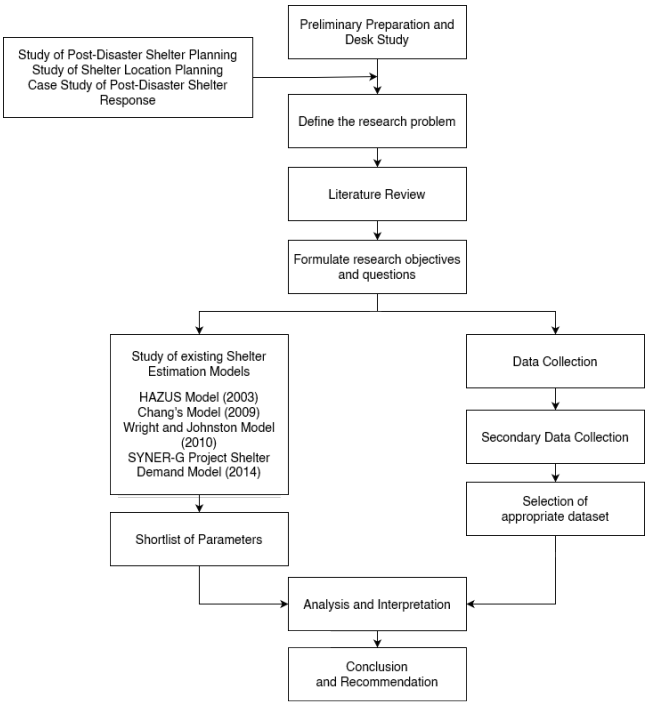

Figure 4: Research Methodology Flowchart

Post-emergency shelter data at the household level is perishable data. And since it has been several years since the emergency, any data collected through questionnaire surveys at the time of this research would not be valid. Therefore, this research relies on secondary data. In order to analyze the correlation between the shortlisted parameters and shelter choice this study utilized the Household Shelter Survey (HSS) data following the 2015 Gorkha Earthquake. The survey was designed by the Center for Disaster Management and Risk Reduction Technology – South Asia Institute (CEDIM-SAI) research team and consists of 49 questions divided into five basic parts: (1) household and demographic information; (2) earthquake impact; (3) shelter situation; (4) communication aspects; and (5) future intentions. The survey of 284 households was conducted from June 12 – 19, 2015 by 15 interviewers from Tribhuvan University and a local NGO (AAROH). The survey was conducted in 177 locations spanning 27 Municipalities/VDCs and 7 districts [5]. In order to test the correlation between shelter choice and the short-listed parameters, the Chi-square test of independence was carried out.

4. Analysis and Findings

4.1 Sheltering behavior across time

The survey recorded the various shelter options the affected population had opted for from the first day of the emergency till the day the survey was conducted. The shelter choices were recorded as (1) At home, (2) Beside home, (3) Owned land, (4) Family home, (5) Unmanaged, (6) Designated, (7) This shelter i.e., where the household was sheltering at the time of the survey. Data in (7) This shelter category was recoded to specify the camp type into: (7a) This shelter -official camp type, (7b) This shelter -other camp type.

Here, unmanaged refers to those shelters established on public or privately owned land without official support; designated refers to those open spaces that were pre-identified for their potential to be used for humanitarian purposes in the event of an earthquake; and official camps refer to shelter camps established with official support in designated public spaces.

The following figure illustrates the sheltering behavior of all (284) surveyed households on Day 1, Day 7, Day 14, Day 21, and Day 28, and the camp type at the time of the survey. Immediately following the earthquake most households sheltered in unmanaged shelter spaces (127 or 44.72%), and beside their homes (79 or 27.82%). In the days following the earthquake, the households changed their place of shelter upto 7 times before arriving at their shelter space at the time of the survey. The average number of shelters the households stayed in was found to be 2.34. Only 48 households (17%) were found to be staying at the same shelter space from Day 1 till the time of the survey. Therefore, it can be seen that most households change their place of shelter at least 2 times and that shelter choice is not a one-time fixed decision the households make following an emergency.

In the urban context, more households sheltered in unmanaged shelters (81 or 50%) than beside their homes (28 or 17.28%) immediately following the earthquake. In the early phases of the emergency until Day 14, some households were observed to have made attempts to move back into their homes however, most of them eventually moved out into shelter camps. At the time of the survey, most of the urban households (105 or 68.62%) were staying at official camps. While in rural areas, more households sheltered beside their homes (51 or 42.86%) than in unmanaged shelters (45 or 37.82%) immediately following the earthquake. At the time of the survey, only 36.52% of the rural households were staying at official camps.

The majority (82.6%) of the households in urban areas sheltered within 10 mins of their homes and only 1.33% of urban households traveled more than one day to find shelter.

However, in rural areas, 53% of households sheltered within 10 minutes of their homes, and 17.6% of rural households traveled one day or more to find shelter.

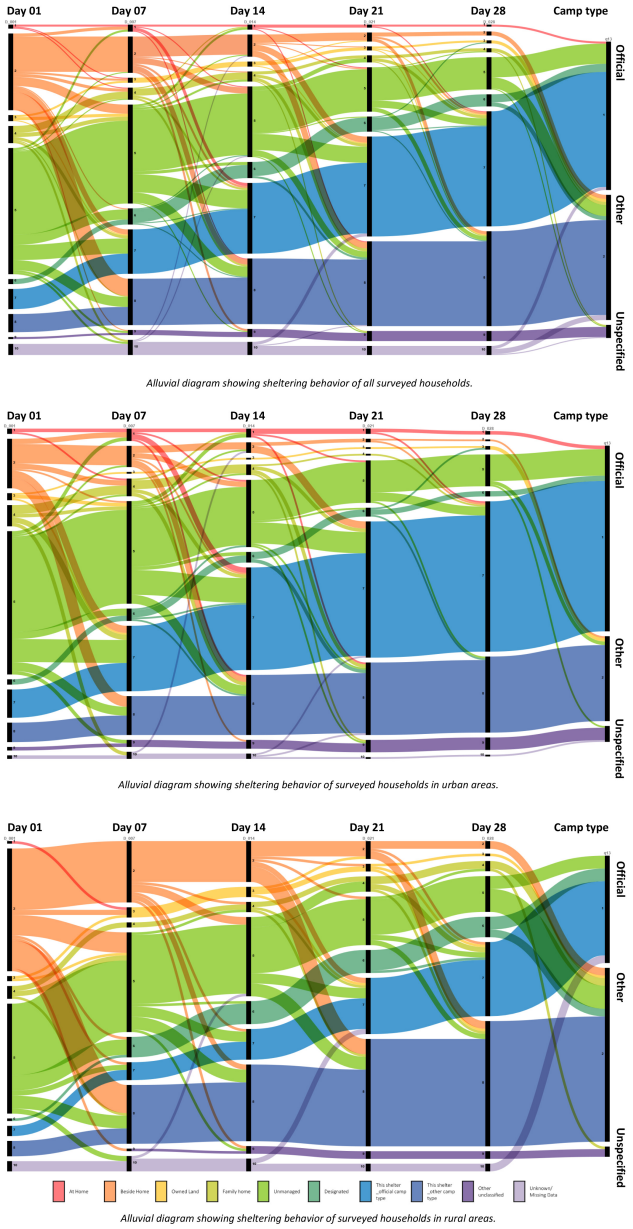

Figure 5: Alluvial diagram illustrating the sheltering behavior of all [top], only urban [middle], and only rural [bottom] households

4.2 Factors Influencing Immediate Shelter Choice

Immediate shelter choice refers to where the affected households spent the first night following the earthquake. It is classified as either at/beside their homes, or away from their homes. Only 19.62% of urban households sheltered at/beside their homes immediately following the earthquake and the remaining 80.38% sheltered away from their homes. This may be explained by the lack of open spaces in urban areas as 78% of urban households reported there to be no space for shelter beside their homes. Furthermore, 16% of households sheltered at or beside their homes in spite of there being no space to shelter there. However, among rural households, 45.22% of households sheltered at/beside their homes, and 54.78% sheltered away from their homes. The immediate shelter choice was studied against the various factors understudy to verify their correlation.

The most significant factor influencing the immediate shelter choice of the urban households was found to be building damage grade with the households suffering total collapse and severe damage least likely to shelter beside their homes.

For rural households, the most significant factors influencing their immediate shelter choice were found to be income and reliance on agriculture as the main source of income. The higher income group was observed to be more likely to shelter away from their homes (83%) than other groups (49%). And the households that do not rely on agriculture as their main source of income are more likely to shelter away from their homes (65%) than those who do (46%).

4.3 Factors Influencing Shelter Decision

The shelter choice of the surveyed households on Day 01, Day 07, Day 14, Day 21, Day 28, and at the time of the survey was reclassified into new variables to specify if they were staying at a Designated/Official shelter camp, or other unmanaged camps. Initially, most households (both urban and rural households) did not rely on official shelters, however, the households gradually moved into official shelters. By Day 21, most of the urban households were sheltering at official shelters. But in the case of the rural households, although some households did move into official shelters most of the rural households were still sheltering in shelters other than official shelter camps at the time of the survey. This shelter choice of households at various time points following the earthquake was similarly studied against the various factors understudy to verify their correlation. Chi-square test of independence was performed to test their correlation.

4.3.1 Availability of Utilities

Table 2: Presence of Utilities v/s Shelter Choice

Availability of utilities * Shelter Choice		Official		Other		p-value
		No.	%	No.	%	
Urban						
Drinking Water	Yes	39	41.49	23	53.49	0.190
	No	55	58.51	20	46.51	
	Total	94	100.00	43	100.00	
Electricity	Yes	45	47.37	32	72.73	0.005*
	No	50	52.63	12	27.27	
	Total	95	100.00	44	100.00	
Rural						
Drinking Water	Yes	16	45.71	24	34.29	0.256
	No	19	54.29	46	65.71	
	Total	35	100.00	70	100.00	
Electricity	Yes	11	31.43	44	65.67	0.001*
	No	24	68.57	23	34.33	
	Total	35	100.00	67	100.00	

The availability of electricity at home was found to be strongly correlated with shelter choice in both urban and rural areas. In urban areas, households without electricity were more

likely to shelter at official shelters. Whereas, in rural areas, the households with electricity were more likely to shelter at other unmanaged shelters. However, the analysis did not find evidence of a statistically significant correlation between water supply at home and shelter choice. This finding confirms that the decision to evacuate is influenced by building habitability and availability of utilities as suggested by the various household shelter decision-making models.

4.3.2 Building Damage Grade

The most significant factor influencing the shelter choice of urban households was found to be building damage grade. Households with total collapse and severe damage were more likely to attend an official shelter while those households with moderate, minor, or no damage were more likely to not shelter at official shelters.

The shelter choice of rural households was also correlated with building damage grade. However, households that reported total collapse or severe damage to their homes were more likely to shelter at an unofficial shelter than an official one.

4.3.3 Household size

The household size was classified as : Households with 1 to 6 members, and Households with more than 6 members. Initially, regardless of the household size, most urban households did not shelter in official camps or designated spaces. However, in the following days, the smaller households (with 1-6 members) were observed to move to official shelters in greater proportion than the larger households. This is verified by the significant association between household size and shelter choice on Day 14, Day 21, and Day 28. This may be because larger households face greater logistical difficulties when traveling to a shelter, or they may be more hesitant to travel to an unfamiliar shelter as there might not be enough space or resources to accommodate larger households so they may prefer staying together in a familiar space than face separation in an unfamiliar shelter. However, by the time of the survey, the association between household size and shelter choice was lost. This suggests that household size is not an indicator of the final shelter decision but, it does influence when households arrive at official shelters with the larger households, generally, arriving at official shelters later than the smaller households.

Table 3: Household size v/s Shelter Choice at various time points in urban areas.

Household size * Shelter Choice		Official		Other		p-value
		No.	%	No.	%	
Day 01	1 to 6	12	63.15	90	64.75	0.892
	> 6	7	36.84	49	35.25	
	Total	19	100	139	100	
Day 07	1 to 6	32	72.72	66	60	0.138
	> 6	12	27.27	44	40	
	Total	44	100	110	100	
Day 14	1 to 6	47	73.44	51	56.67	0.033*
	> 6	17	26.56	39	43.33	
	Total	64	100	90	100	
Day 21	1 to 6	61	74.39	38	52.78	0.005*
	> 6	21	25.61	34	47.22	
	Total	82	100	72	100	
Day 28	1 to 6	63	71.59	36	54.54	0.029*
	> 6	25	28.41	30	45.45	
	Total	88	100	66	100	
Final	1 to 6	70	66.67	29	60.42	0.453
	> 6	35	33.33	19	39.58	
	Total	105	100	48	100	

4.3.4 Presence of Elderly

The rural households with elderly were less likely to shelter at an official shelter than those without. Furthermore, there is a significant association between the presence of elderly in the household and shelter choice from Day 07 to Day 28. This suggests that the households with elderly decide to shelter at an official shelter much later than those households without elderly. This may be because the elderly, generally, have chronic health issues and may require assistance when evacuating, and they may feel that they may be more comfortable in a familiar space than face the uncertainties of an unfamiliar space. Thus, households with elderly may be more hesitant to evacuate.

Table 4: Presence of Elderly v/s Shelter Choice at various time points in rural areas.

Presence of Elderly * Shelter Choice		Official		Other		p-value
		No.	%	No.	%	
Day 01	Yes	0	0.00	45	40.91	
	No	5	100.00	65	59.09	
	Total	5	100.00	110	100.00	
Day 07	Yes	2	13.33	42	43.30	0.027*
	No	13	86.67	55	56.70	
	Total	15	100.00	97	100.00	
Day 14	Yes	3	14.29	40	44.44	0.011*
	No	18	85.71	50	55.56	
	Total	21	100.00	90	100.00	
Day 21	Yes	6	19.35	37	45.12	0.012*
	No	25	80.65	45	54.88	
	Total	31	100.00	82	100.00	
Day 28	Yes	8	21.62	35	46.05	0.012*
	No	29	78.38	41	53.95	
	Total	37	100.00	76	100.00	
Final	Yes	12	28.57	33	45.21	0.078
	No	30	71.43	40	54.79	
	Total	42	100.00	73	100.00	

4.3.5 Level of Education

The analysis found a significant association between the level of education and the shelter choice of households in rural areas. The rural households with level of education below SLC were less likely to shelter at an official shelter than those households with level of education above SLC. This may be because the households with more education have greater knowledge and greater access to information.

Table 5: Level of Education v/s Shelter Choice at various time points in rural areas.

Level of Education * Shelter Choice		Official No.	Official %	Other No.	Other %	p-value
Day 01	below SLC	1	20.00	55	50.46	0.183
	SLC and above	4	80.00	54	49.54	
	Total	5	100.00	109	100.00	
Day 07	below SLC	2	13.33	52	54.17	0.003*
	SLC and above	13	86.67	44	45.83	
	Total	15	100.00	96	100.00	
Day 14	below SLC	5	23.81	50	56.18	0.008*
	SLC and above	16	76.19	39	43.82	
	Total	21	100.00	89	100.00	
Day 21	below SLC	10	33.33	45	55.56	0.038*
	SLC and above	20	66.67	36	44.44	
	Total	30	100.00	81	100.00	
Day 28	below SLC	11	30.56	44	58.67	0.006*
	SLC and above	25	69.44	31	41.33	
	Total	36	100.00	75	100.00	
Final	below SLC	13	31.71	42	58.33	0.006*
	SLC and above	28	68.29	30	41.67	
	Total	41	100.00	72	100.00	

4.3.6 Average Monthly Income

Similarly, the analysis found a significant association between the average monthly income of the households and shelter choice with the lower-income households least likely to shelter at an official shelter than others.

Table 6: Average Monthly Income v/s Shelter Choice at various time points in rural areas

Average Monthly Income * Shelter Choice		Official No.	Official %	Other No.	Other %	p-value
Day 01	below 5,000	1	20.00	43	43.43	0.336
	below 20,000	2	40.00	40	40.40	
	more than 20,000	2	40.00	16	16.16	
	Total	5	100.00	99	100.00	
Day 07	below 5,000	1	7.69	42	47.19	0.014*
	below 20,000	7	53.85	34	38.20	
	more than 20,000	5	38.46	13	14.61	
	Total	13	100.00	89	100.00	
Day 14	below 5,000	3	16.67	41	49.40	0.006*
	below 20,000	8	44.44	32	38.55	
	more than 20,000	7	38.89	10	12.05	
	Total	18	100.00	83	100.00	
Day 21	below 5,000	7	25.93	37	49.33	0.022*
	below 20,000	11	40.74	29	38.67	
	more than 20,000	9	33.33	9	12.00	
	Total	27	100.00	75	100.00	
Day 28	below 5,000	8	25.00	36	51.43	0.028*
	below 20,000	15	46.88	25	35.71	
	more than 20,000	9	28.13	9	12.86	
	Total	32	100.00	70	100.00	
Final	below 5,000	10	28.57	33	48.53	0.050*
	below 20,000	15	42.86	27	39.71	
	more than 20,000	10	28.57	8	11.76	
	Total	35	100.00	68	100.00	

4.3.7 Livelihood - Reliance on Agriculture and Livestock

There is a significant association between reliance on agriculture as the main source of income and the shelter choice for households in rural areas. Rural households that rely on agriculture as their main source of income are less likely to shelter at official shelters than those who do not. Similarly, there is a significant association between ownership of livestock and shelter choice for the households in rural areas on Day 07, Day 14, and Day 21. Rural households that own livestock are less likely to shelter at official shelters than those who do not. This may be because the households feel that they may be disconnected from their livelihood and source of income when they choose to shelter at official shelters.

Table 7: Reliance on agriculture as the main source of income v/s Shelter Choice at various time points in rural areas

Main Source of Income Agriculture * Shelter Choice		Official No.	Official %	Other No.	Other %	p-value
Day 01	Yes	0	0.00	61	55.45	
	No	5	100.00	49	44.55	
	Total	5	100.00	110	100.00	
Day 07	Yes	2	13.33	57	58.76	0.001*
	No	13	86.67	40	41.24	
	Total	15	100.00	97	100.00	
Day 14	Yes	4	19.05	56	62.22	0.000*
	No	17	80.95	34	37.78	
	Total	21	100.00	90	100.00	
Day 21	Yes	9	29.03	52	63.41	0.001*
	No	22	70.97	30	36.59	
	Total	31	100.00	82	100.00	
Day 28	Yes	12	32.43	49	64.47	0.001*
	No	25	67.57	27	35.53	
	Total	37	100.00	76	100.00	
Final	Yes	16	38.10	46	63.01	0.010*
	No	26	61.90	27	36.99	
	Total	42	100.00	73	100.00	

5. Conclusion

Emergency shelter support is one of the primary concerns in the immediate aftermath of a disaster. However, most shelter contingency plans assume that a majority of the affected people would comply with official evacuation directions and shelter at designated shelters and fail to consider the impact of household choice on shelter demand. Therefore, this study was initiated to identify the factors that influence the choice of emergency sheltering of the affected population in a post-earthquake scenario. This study utilizes the Household-level Shelter Survey (HSS) data collected by CEDIM-SAI following the 2015 Gorkha Earthquake to verify the correlation between the shelter choice and the various damage and non-damage related factors.

This study found that sheltering behavior is context-specific as there is a significant difference in the sheltering behavior of households in urban and rural settings. Urban households were found to be more likely to attend an official shelter whereas, rural households were more likely to not shelter at an official shelter.

The households were observed to change their place of shelter several times before arriving at their current shelter at the time of the survey. This shows that the shelter decision is not a one-time fixed decision but, a continuous and dynamic choice the households are confronted with every day following an emergency. The findings also confirm that the shelter choice of households is a function of both damage and non-damage related factors. The shelter choice of urban households was found to be influenced by building damage grade, availability of electricity, and household size. And in the rural context, households that have suffered severe damage to their homes, households with elderly, low level of education, low-income households, and those that rely on agriculture and their livestock were most likely to not seek shelter at an official shelter.

It should also be noted that not sheltering at an official shelter does not always reflect a lack of desire to do so. Even when households do wish to evacuate, they may not be able to do so. This may be due to a lack of transport or resources to travel, having members who require assistance, or logistical difficulties of traveling in larger groups. For households that rely on agriculture and livestock, traveling to an official shelter to receive assistance might mean leaving their farm and cattle unattended which would disrupt their source of income.

The following recommendations are extracted from the result of the research: Most shelter estimation models calculate the displaced population only from the number of damaged or destroyed buildings. These models should be updated to reflect the impact of household choice on shelter demand in order to make a more accurate prediction of shelter demand.

Most shelter contingency plans assume that the majority of the affected people will comply with official evacuation directions and that most of the affected population will seek official shelter.

Shelter contingency plans should be updated to account for households that self-shelter or shelter in unmanaged camps. Shelter contingency plans should also include strategies to reduce shelter demand by prioritizing the restoration of utilities and transport networks.

Shelter location planning should be carried out at the local level prioritizing smaller camps with shorter travel times rather than larger camps and also ensure that the affected population is not disconnected from their livelihood.

Emergency planning should also include strategies to provide evacuation assistance to those who need it such as single-parent households, households with small children, elderly, and disabled.

Further research in this area could look into how weather conditions, time and severity of earthquakes affect shelter demand, or accessibility and accommodations in emergency shelter spaces for people with chronic health conditions, disabilities, children, and pregnant and postpartum women.

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