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Where do Individuals Seek Opinions for Evacuation?
A Case Study from Landslide-prone Slum Communities in Mumbai

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ABSTRACT

Thousands of residents living in slums on small hillocks in Mumbai are at risk due to recurring landslides. The evacuation of these dwellers from the hills before the rainy season is considered essential to avoid the landslide risks. Although the city government has made several efforts to encourage residents to evacuate, few are willing to do so. The city government is, therefore, seeking effective risk communication strategies to encourage more slum dwellers to evacuate. Given this challenge, the present study examines the factors related to residents' evacuation behavior including their risk perception and evacuation intention. Unlike previous studies on household disaster preparedness behavior, which are predominantly cognitive modeling based and fail to address collective and social accounts of human behavior, the present study examines how various societal factors, such as social networks and group norms govern household evacuation decisions. Our findings corroborate the hypothesis that social networks do play an important role in the evacuation decision. The study found that residents' risk perceptions are shaped to a great extent by their neighbors and cohesive group partners with whom they have direct and strong interconnections. However, residents' intentions to evacuate are largely influenced by the people who are indirectly and weakly connected with them, such as the members of social groups based on religion, caste and language. Some policy implications related to the findings are discussed.

Keyword: Evacuation, Social Networks, Landslide, Mumbai

1. Introduction

In Mumbai, thousands of people living on small hillocks are at risk due to landslides. These hillocks are the residences of thousands of poor and socially marginalized populations who cannot afford formal housing in the financial capital of India. Dense, haphazard and unplanned construction as well as poor infrastructure cause soil erosion and hence enhance the risks of landslides, particularly in the rainy season. The evacuation of those dwellers before the rainy season is considered to be instrumental to reducing the life risks of thousands of people. The local government has exerted enormous efforts to evacuate people from hillocks before the rainy season, but in reality, few have agreed to follow the recommendation. The city government is struggling to produce effective risk communication strategies to address this challenge. Toward this end, a comprehensive understanding on the evacuation behavior of households is an urgent requirement.

Most studies on evacuation and other disaster preparedness behavior follow a cognitive or heuristic approach. Some of these prominent heuristic models are the Protection Motivation Theory (Rogers, 1983), Planned Behavior (TPB) (Ajzen, 1991), and Person Relative to Event Theory (PRE) (Duval and Mulilis, 1999) etc. These models consider the risk preventive behavior of individuals as merely a reflection of the dynamic interactions of various intellectual variables, such as risk perception, self-efficacy, outcome expectancy and many others. It is assumed that an individual makes a decision as an atomized unit, and, therefore, his/her information collection and processing activities take place in social isolation. These models emphasize only the internal factors and the role individuals play in their own behavior. The influence of social groups and organizations in an individual's decision-making process remains untouched in cognitive-based models. The serious intellectual lacuna in the heuristic-based approach is that it ignores the critical role of various social and collective factors including group affiliation, cultural practices, socialization processes, social change and so forth in the individual adoption of the decision-making process (Scherer and Cho, 2003; Bhandari et al., 2011). It is argued that cognitive-based models fail to provide adequate accounts for preparedness behavior as the world continues to see examples of low preparedness that cause the loss of life and damage to property. Field studies across the world report that evacuation readiness remains low among disaster-prone communities (Sagala et al., 2009; Samaddar et al., 2014). Planners and practitioners who are at the sites are struggling to produce effective strategies to encourage households to adopt preventive measures (Sagala et al., 2009). Therefore, there is an urgent need to look beyond the interpretations of evacuation behavior provided by the cognitive-based models.

An alternative and supplementary approach could be social network analysis, which postulates that individuals make an adoption decision based on their relation with others in society, their social position in social network(s) and observing the behavior of peers, neighbors and relatives with whom they are socially connected. Frequent interaction or social roles provide shared contexts for interpreting prior behavior and attitudes that influence subsequent attitudes (Dean and Brass, 1985). Empirical observation suggests that individuals make decisions not in social isolation, but in interaction with others (Townshend et al., 2014). Social intimacy, frequent interaction, and social norms all create shared contexts for information sharing and can be used to interpret prior behavior and attitudes that influence subsequent attitudes and behavior (Sagala et al., 2009; Bhandari et al., 2011; Townshend et al., 2014). Studies using this line of pursuit in disaster and other forms of risk management are rare (Scherer and Cho, 2003; Muter et al., 2013). Therefore, this study examines the evacuation behavior of Mumbai slum dwellers under landslide risks in light of the diffusion of innovation and social network approaches to provide a comprehensive social account of the evacuation behavior.

1.1 Roles of Social Networks on Households' Evacuation Decisions

In the present study, we consider evacuation as an innovative idea that members of the community have to adopt in order to reduce their disaster risks. The diffusion of innovation studies considers that the adoption of an innovation is not an instantaneous process, but there are several phases before an individual reaches a decision (Rogers, 1983b). Diffusion of innovation studies (Rogers, 1983b) postulate that the innovation adoption process is a combination of three critical junctures or phases – individuals learn about the innovation; then they decide that innovation would be desirable or useful; and finally they adopt the innovation. In the disaster risk context, previous research has shown that there is another critical stage called risk appraisal in the adoption process of disaster preventive innovation (Paton, 2003). Before considering adopting an evacuation plan, an individual must first conclude that the hazard specifically affects him or her. If an individual believes the hazard can adversely affect him or her, the individual will look forward to discovering possible actions and measures (Rogers, 1983; Paton, 2003). Therefore, to adopt an evacuation plan, an individual may go through the following stages – whether or not a disaster risk exists, whether or not evacuation is effective and then develop an intention to evacuate and finally actual evacuation.

Social network theory postulates that in the process of adopting a new technology or knowledge, an individual observes the behavior of other members of a community (Valente, 1995). Learning from other experiences through social interactions helps individuals to make appropriate decisions based on their own subjective reality. Becker (1970) mentioned that to make or develop a decision, particularly to make an adoption decision of new technology, social networks help an individual in three ways – first, to provide information about an innovation that otherwise an individual might have missed; second, to provide social support for an individual's adoption decision and thus to legitimize the innovation; third, to create social influence on an individual to accept or reject the innovation. Studies on attitude change conclude that group norms have a strong influence on information, values, perceptions, norms and behavior, such as adopting an innovation (Zaltman and Duncan, 1977). Therefore, the role of social networks in the diffusion of the innovation process is important, partly because networks are considered to provide opportunities to exchange information and knowledge; and also because social networks impose constraints on behavior. The Social Network Threshold Model of Collective Behavior (Granovetter, 1978) postulates that in order to reduce the uncertainties of adopting an innovation, individuals observe the behavior of other members of the community and for that reason an individual's adoption behavior is a function of the behavior of others in a group or community (Granovetter, 1978). Therefore, it is logical to argue that an individual's risk perception, evacuation outcome expectancy and finally evacuation intention are constructed and shaped by his/her social network types and nature.

1. 2 Types of Social Networks and Behavioral Patterns

Individuals are connected to different types of social networks and all such networks play a critical role in the decision-making processes of individuals (Valente, 1995). Sometimes, the extent of an individual's social network is confined within primary social relations, such as extended family and kinship structure, friends and co-workers. But one's social network may extend at a greater social system level, such as city, state etc. Social network studies have found that individuals are influenced by many actors in the social system or network (Valente, 1995). For example, individuals who belong to the same group and interact frequently with each other may have similar risk perception and adoption opinions (Townshend et al., 2014; Scherer and Cho, 2003). Burt (1987) found that an individual's decision-making process is influenced by those having structurally similar positions. Conversely, Granovetter (1973) showed that weaker social ties are more important in obtaining information on innovations. Therefore, exploring who influences individuals in making decisions on various aspects of evacuation would further expand our understanding on individuals' evacuation behavior. In this study, the following social networks and groups are considered central to shaping individuals' risk perception and formulating evacuation intention.

Cohesive Group: Several scholars have argued that people are influenced most by the cohesive group with whom they have very frequent, intensive and direct social relations (Coleman et al., 1975). A cohesive group is marked by the degree of interpersonal contacts or ties of its members. Individuals have various direct and indirect social ties with others, but their cohesive group consists of those with whom they have the highest social interaction. Social network studies have reported that cohesive group members foster more intense information sharing than amongst non-cohesive members (Wasserman and Faust, 2006). The direct relation between cohesive group members not only provides channels for quick information flow, but often influences individual perception, such as that exemplified in the risk perception case by Scherer and Cho (2003). Cohesive group members share and discuss an issue together and help each other to reach decisions (Coleman et al., 1957; Becker, 1970). It is reported that cohesive group network partners play a significant role in obtaining new ideas and putting social pressure (both negative and positive) on the innovation adoption decision (Gayen and Raeside, 2010). Conversely, some researchers argue that cohesive groups inhibit the infiltration of new ideas and only provide redundant information (Granovetter, 1973).

Neighborhood and Spatial Group Networks: The behavioral similarities of individuals are common when they live in geographical proximity (Rogers, 1983b). Physical proximity allows individuals to observe, learn about other experiences and share ideas and values with each other. These interactions help an individual not just to become aware of an innovation, but also to minimize risks, such as the disadvantages associated with the innovation adoption decision (Samaddar et al., 2014b). Individuals who live in the same neighborhood generally have greater social interactions and their adoption behavior is channeled through social learning and social influence generated through neighborhood membership (Rogers, 1983b).

Based on the above discussion, this study investigates how various social network groups influence the household evacuation decision-making process including risk perception, evacuation outcome expectancy, and evacuation intention in landslide-prone slums in Mumbai, India.

2. Background: Landslide Risks in Slums on Hillocks, Mumbai

The island city of Mumbai is located on the western coast of India and is considered the commercial capital and economic growth center of the country. Originally composed of seven small islands, land reclamation and infill conducted during the 18th and 19th century integrated these islands into a continuous peninsula (Someshwar et al., 2009). This city originally developed as a seaport on the west coast of the Indian peninsula; then in the 19th century diverse economic activity and growth occurred, particularly in the manufacturing and financial sectors (Deshpande and Arunachalam, 1981). Today, Mumbai is considered as not only the financial capital of India, but also an important business hub of south Asia. Mumbai city contributes over 25% to the country's tax revenues and generates about 5% of India's Gross Domestic Product (GDP) (Gupta, 2007). With the rapid industrialization and economic boost, people from all over India come to the city in search of jobs. Hence, intra and interstate migration increased the city's population from 7.7 million in 1971 to 18.3 million in 2001 (Census of India, 2001) and this is projected to increase to 22.4 million by 2011 (MMRDA, 1999). A great number of those migrants are poor farmers or landless laborers from rural areas, who cannot afford formal housing in Mumbai. High rents force them to choose abandoned, fragile, and hazardous housing, which constitutes 65% of the population of the city (Samaddar et al., 2015). A large number of such urban poor have illegally constructed houses on the slopes of abandoned and vulnerable hills in sub-urban areas including Ghatkopar, Sakinaka, Vikhroli, Bhandup, Chembur, which are hilly terrains, i.e. mostly small hillocks. These houses do not have proper foundations and are constructed without consideration of any engineering parameters; in fact, most of such houses are made from temporary materials (called semi-pucca or kuchcha houses) (Emmel and Soussan, 2001; Samaddar et al., 2015). Kale (2009) posits that most of the risk-prone areas are at the foot and edge of hills. Haphazard and unplanned building construction and poor infrastructure cause soil erosion and hence increase the risks of landslides. The absence of trees in the area also has an adverse impact on the binding capacity of the soil and thus poses further risks. This leads to a huge life threat to the people living in these landslide-prone areas, especially during the monsoons. About 9.5% (almost 1 million people) of the population of Mumbai _ lives in a landslide-prone area (41 sq. km) (School of Planning and Architecture, 2010). Almost every year, landslides take place in Mumbai. Major landslides occurred in Mumbai in 2000, 2005, 2009 and 2010 killing many and destroying many shanties (Kale, 2009; School of Planning and Architecture, 2010). The landslides cause small chunks of land from the hillocks to fall from above, but as the areas are very densely populated, this results in the collapse of shanties and the deaths of local people.

Recently, the local government, the Municipal Corporation of Greater Mumbai (MCGM), which is solely responsible for the city's disaster risks management, has identified landslide-prone areas and set up guard walls around hillocks (Kale, 2009). However, all the hillocks could not be guarded due to the densely populated nature of the areas and funding shortages. Alternatively, evacuation of the citizens from landslide-prone areas is considered the most viable solution to reduce risks. Since 2006, every year, just before the monsoon, MCGM has issued an evacuation order in landslide areas, particularly to households within the landslide risk zone, that is, the foothills and edges of the hills (Kale, 2009). MCGM has regularly organized door-to-door campaigns, putting up posters and notices in public places, and distributed handbills to ensure the evacuation of households living in those landslide-prone slums. However, on September, 2009, after the city Government's initiation of landslide risk reduction initiatives, 12 people were killed and 13 others injured in a landslide in a Mumbai slum. Many more small-scale landslides and injuries are reported. According to the MCGM field engineers and local newspapers, the evacuation rate is still very low, and the loss of human life and damage to assets is increasing every year. The low evacuation rate raised major critical questions, such as - Are the local communities worried about landslide risks when, as slum dwellers, they face so many other risks daily, such as job risk, shelter risk, security risk? Do they believe evacuation is a useful and meaningful countermeasure when they have few socio-economic resources to execute any such disaster preparedness plan? We urgently need to expand our understanding of these questions and examine the underlying factors influencing the community's evacuation behavior.

2.1 Case Study Area: Landslide-prone slums in Ghatkopar (West)

The data for this study were collected through field surveys in a landslide-prone slum community in Ghatkopar (West) in L-Ward, Municipal Corporation of Greater Mumbai (MCGM). This landslide-prone slum in Ghatkopar (West) consists of several small clusters of information settlements or slums on hillocks, namely Himalaya Society, Milind Nagar, Netaji Nagar, Adarsha Society, Jai Santoshi Mata Nagar, Sidhart Nagar, and Rajiv Nagar. The total population of the entire area is approximately 25,000, living in 4000 huts. Oral history has revealed that in the 1970s the present settlement was uninhabited scrubland on which a number of communities gradually built a village-like settlement. People from different parts of India have come and built their houses in this slum. Several of the communities moved from squatter sites and pavement dwellings in the city of Mumbai. Other groups were new migrants to the city from different states. Communities involved in the initial establishment of the slum consolidated their position within it and increased in size by drawing in relatives and caste groups from their rural locality. At the same time, more groups of migrants moved in to take over the spaces between the patchworks of communities already established on the hillside. The infrastructure of the settlement is in very poor condition. There are no roads or drainage systems. The lack of proper drainage systems, sanitation facilities and water supply is accelerating the landslide likelihood and susceptibility of the area. Landslides are common phenomena in this area; major landslides observed in the area occurred in the years of 2000, 2001, 2005, 2009, and 2010. In the 2000 landslide, 67 people died. Before the monsoon, the local Ward office sent out a notice to every household imploring them to evacuate their houses. In some part of the slums, the Mumbai Metropolitan Regional Development Authority (MMRDA) had set up guard walls. However, the guard walls could not be set up for all the hillocks due to the densely populated condition of the areas and funding shortages. Alternatively, evacuation of the citizens from landslide-prone areas is considered the most viable solution to reduce risks. Since 2006, every year, just before the monsoon, MCGM has issued evacuation orders in the landslide areas, particularly to households in the landslide zone, that is, the foothills and edge of the hills (Kale, 2009). MCGM has regularly organized campaigns through door-to-door visits, posters in public places, and the distribution of handbills to ensure that slum dwellers threatened by landslides evacuate in time.

3. Method

3.1 Field Survey

This study employed the snowball sampling method to obtain social network data and information. A snowball sample is a non-probability sampling technique that is appropriate to use in research when the members of a population are difficult to locate (Wassermann and Faust, 2006). A snowball sample is one in which the researcher collects data on a few members of the target population he or she can locate, then asks those individuals to provide information required to locate other members of that population whom they know. Those participants then suggest additional participants, and so forth, thus gathering volume like a snowball rolling down a hill. In this study, each respondent was asked to name their social network partners (including friends, relatives, with whom they share an intimate relationship) who live within the landslide-prone area. The individuals (heads of the households) named in the first round of interviews then became the sample of the second round. This referral process continued until no new individuals were named.

In order to obtain social network data and conduct the snowball survey method, it was necessary to fix the geographical boundary of the survey area and make prospective respondents aware of it. Therefore, before conducting the field survey, we attempted to acquire the landslide zoning map prepared by the local ward office (L-Ward, Municipal Corporation of Greater Mumbai). Simultaneously, we attempted to locate the landslide zoning boundary on the actual site demarcated by the Ward office. However, the zoning map was not available and the onsite boundary markings were not clearly visible at the time of the survey. Therefore, we prepared our own landslide zoning map with the help of field engineers and officials of the local municipal ward office. For this, we first gathered a basic map available from the ward office and asked the local ward office (L-Ward) to mark the landslide-prone areas as officially declared. Once the map was prepared, our research team, including the first author of the paper, walked along the boundary of the landside zone, took photographs of local landmarks, such as large trees, religious buildings, tall public buildings etc. and simultaneously marked them on the map. Thus, the landslide map and local landslide markings were ready before the field survey was conducted.

Before conducting interviews, surveyors first introduced the goals and significance of the survey to prospective respondents. If a prospective respondent agreed to answer the questions, the surveyor then introduced the landslide zoning map along with photographs of local landmarks. Afterwards, the surveyor first confirmed from each respondent that by looking at the photographs and maps they could recognize the total area coming under the landslide zone. In instances where respondents could not understand the map (12 such cases occurred), the surveyor reintroduced the map and photographs.

Heads of households were the target respondents and if the head of the household was not at home during the first visit, information about his/her availability was collected and noted; the visit was repeated up to two times. If the selected household's head could not be reached after these repeated visits, another elder and important decision-maker of the household, for example the wife, was selected for the interview. The language used during the interview was Hindi, which was considered to be the most appropriate in a linguistically heterogeneous and cosmopolitan Mumbai urban community. Research assistants with data collection experience were recruited and trained for 3 days involving lectures, mock interviews, and pretests to ensure the quality of data. The field procedures were also closely monitored by the principal investigators, including the first author of the paper, to ensure that the field assistants adhered to the procedures laid down. A total of 86 individuals were interviewed in the survey between May and June in 2012.

3.2 Data and Methods of Analysis

Dependent Variables

Based on the study objectives, we collected three dependent variables – landslide risk perception, evacuation outcome expectancy and evacuation intention. Table 1 shows the questionnaires or questions used for data collection of dependent

Table 1: Questionnaires Used for Dependent Variables [a]

Variable	Questionnaire	N	Mean	SD
Landslide Risk Perception	*Are you worried that a landslide will take place again and cause loss and damage to your life and property?*	86	3.46	1.18
Outcome Expectancy of Evacuation	*Do you think evacuation is an important and effective countermeasure to reduce risks of landslide?*	86	3.74	1.19
Evacuation Intention	*Do you want to evacuate before the next rainy season if an order is issued by the BMC (Bombay Municipal Corporation)?*	86	2.19	1.15

[a]All items were measured on a 5-point Likert-type scale; 5 = Absolutely/Obviously, 1 = Not at all.

variables. The matrix for each dependent variable was constructed using a "Euclidean Distance" method, which is discussed in detail later in this section.

Independent Variables

Cohesive Group: The composition of the cohesive group is determined by the degree of interpersonal contacts or ties of its members. For data on general interpersonal ties, we collected sociometric data on households' personal interaction in day-to-day life. Respondents were asked: "Please name three individuals in the area within this landslide zone in Ghatkopar area with whom you most often interact and share spare time in your daily life." These sociometric data (See Fig. 1) were used to group the individuals into cohesive groups. The social network matrix was formed in such a way that cell entry Xij equaled one if actor i selected actor j for the social interaction. For example, if actor i mentioned his or her daily social network partner was actor j, the cell entry Xij equaled one, and all other entries equaled zero.

These sociometric data were used to group the individuals into cohesive groups, as shown in Fig. 1, using the FACTIONS method technique by running UCINET Social Network Software 6.0 version 1.00 (Borgatti et al., 2002). The FACTIONS routine in UCINET takes the bipartite graph as input and uses a combinatorial optimization algorithm called Tabu Search (Glover, 1989) to assign nodes to as many clusters as hypothesized by the user (researcher) so as to maximize a fit criterion. The fit criterion is a correlation between the observed data and idealized pattern in which the density of ties between groups is 0% (Borgatti and Everett, 1997).

Neighborhood Networks: To construct neighborhood networks, we used the records of individuals' neighborhood affiliation, that is locally known as a Chawl. Thus to formulate the neighborhood sociomatrix, cell entry *Xij* equaled one if two actors belong to the same neighborhood, and zero if they have different neighborhood affiliations. The number of neighborhood groups is 6; sizes of groups are 16, 20, 7, 8, 13, and 12.

Cultural Affiliation: To recognize the cultural affiliations of individuals, three types of cultural group data were collected including religion, linguistic group and native district place (from whence the individuals originally came). These data were first used to formulate an affiliation matrix. The

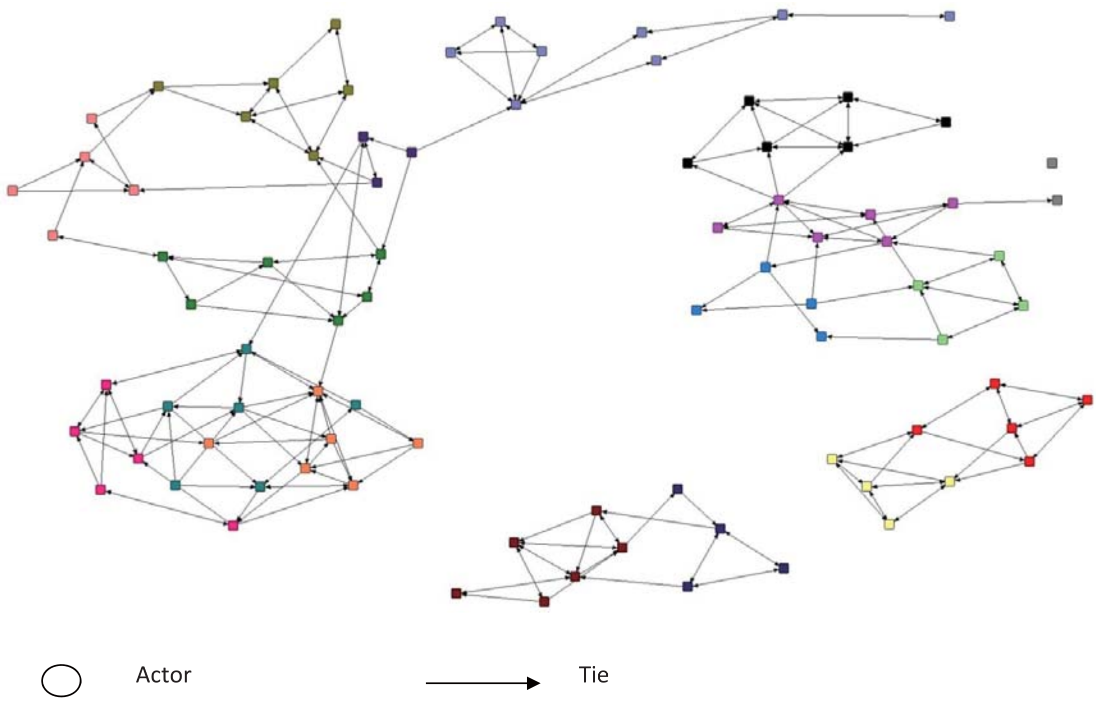

Figure 1: Interpersonal contacts and cohesive (FACTIONS) group patterns in a landslide-prone slum, Ghatkoper, Mumbai. (The number of cohesive groups is 17. Sizes of groups are – 2, 3, 4, 4, 4, 4, 4, 5, 5, 5, 5, 6, 6, 6, 6, 6, 8. The location of nodes (actors) is random. The color indicates the group affiliation of actors).

affiliation matrix records the affiliation of each actor with each event or group affiliation. The affiliation matrix, $A = \{aij\}$, is a two-mode sociomatrix in which rows represent actors and columns represent events or group affiliations (in the context of the present study, this is cultural background, such as the name of a particular religion, or the name of the place from whence the individuals migrated). There is an entry of *1* in the *(I,j)*th cell if row actor *i* is affiliated with column event *j,* and an entry of 0 if row actor *i* is not affiliated with column event *j*. Each row of the matrix indicates an actor's affiliation with a particular group. This two-mode affiliation matrix data was then converted to one-mode sociomatrix data by using UCINET Social Network Software 6.0 version 1.00 (Borgatti et al., 2002). In the affiliation sociomatrix, if actor *i* and *j* are both affiliated with event, *k,* then $aij = ajk = 1$. The number of co-memberships for actors *i* and *j* is equal to the number of times that $ajk = ajk = 1$ *for* $k = 1, 2, \ldots, h$.

In addition, four control variables were included in each regression test; these are education level, period of stay in the area, household size, and housing typology. Education level, age and period of stay were measured as continuous variables. The study found that 53% of respondents had primary education, 19% had attended class 8 or junior high school, 13% had a secondary degree (up to class 10) and only 6% had a higher secondary degree (class 12). The average period of stay in this area was established as 10 years (minimum 4 and maximum 30 years). The average household size was 5 (Minimum 2 and Maximum 11). The sociomatrices for these three variables were constructed using the "Euclidean Distance" method through UCINET Social Network Software 6.0 version 1.00 (Borgatti et al., 2002). For example, number "5" was entered in cell *xij* if member *i* in a dyad has lived in the place (period of stay) for the last 15 years (coded as 15) and the other dyad member, *j*, has lived in the place for the last 10 years (coded as 10). The higher the number in cell *Xij*, the greater the difference in period of stay between members of the dyad. The same rule is followed for two other variables, education and household size. Housing typology was measured through observation. We found three predominant housing typologies - Kachha Ghar (Thrash Housing) = 41%; Semi Pacca Ghar (Semi-concrete Housing) = 36%; and Pacca Ghar (Brick and Cement Housing) = 23%. For the sociomatrix of housing typology, cell entry *Xij* equaled one if two actors had the same housing type and zero if they were not the same.

We used the Quadratic Assignment Procedure (QAP), a multi-regression technique, provided by UCINET Social Network Software 6.0 Version 1.00 (Borgatti et al., 2002) to determine how various social networks influence individuals' landslide risk perception, outcome expectancy of evacuation and evacuation intention. This approach is similar to ordinary multiple regression. However, it enables analysis of matrix data. The equation used was Y = B0 + B1 (cohesion) + B2 (cultural affiliations) + B3 (neighborhood networks) + B4 (period of stay) + B5 (household size) + B6 (housing type) + B7 (education).

4. Results

The QAP multiple regression analysis result displayed in Table 2 shows that individuals' landslide risk

Table 2: Matrix Regression Analysis (QAP) Results Showing Standardized Beta

	Risk Perception	Evacuation Outcome Expectancy	Evacuation Intention
Cohesive Networks	- .042**	- .034**	- .010
Cultural/ Social Affiliations	.011	- .078**	- .194****
Neighborhood Networks	- .132****	.020	.021
Period of Stay in the area	.013	.251****	.163***
Household Size	- .013	.060	.057*
Education	- .040	- .002	.022
Housing Typology	.025	.020	- .031
R- Square	.026	.074	.068

**P> .05; **P> 0.01; *** P> 0.005; ****P> 0.001* perception is significantly associated with two factors, neighborhood networks and cohesive group networks; no other factors are significant. People, who live in the same place or neighborhood, perceive risk in a similar fashion, whereas outcome expectancy, that is, perceived effectiveness of evacuation in reducing landslide risk is most strongly associated with individuals' cultural and social affiliation. Two other factors significantly associated with outcome expectancy are period of stay and cohesive networks. In the case of evacuation intention, cultural affiliations and period of stay are both strongly significant denominators. Household size is also significantly associated with evacuation intention. Individuals living for a long time in the area and having large household size do not intend to evacuate.

5. Discussion:

The results show that the evacuation decision-making processes of slum dwellers are greatly influenced by their social group and social network partners including cohesive groups, socio-cultural groups and neighbors. Dwellers in those landslide-prone hillocks very rarely make decisions to evacuate just from their own individual perspectives in social isolation, but they mutually influence each other, discuss with others and pass opinions to fellow residents. The present study reveals the following important findings.

Risk Perception –

The landslide risk perceptions of slum dwellers are strongly associated with two factors – their neighborhood affiliations and cohesive group networks. Neighborhood association was the most influential factor for formulating risk perception. Landslides in these hillocks are locally confined and less catastrophic; as a result, the entire area is not equally affected. The frequency and magnitude of landslides vary from one neighborhood to another, even though the slums are not very large. The settlements or neighborhoods located at the foot and edge of the hill experience more frequent and severe landslides. Higher frequency and greater severity of landslides, therefore, induced higher risk perception among the inhabitants of those neighborhoods than the neighborhoods experiencing less frequent and minor landslides.

However, the connection between cohesive networks and risk perception could be observed from the perspective that neighborhood members are often cohesive group partners. Living in geographical proximity may foster social association and bonding among individuals. One's perception about the possibility of landslide or possible losses is influenced by friends, relatives and co-workers living in the same neighborhood. The association between risk perception and interpersonal networks has also been reported by Scherer and Cho (2003) and very recently by Muter et al. (2013).

Evacuation Decision and Social Networks:

Though landslide risk perception is very high among the slum dwellers, only a few like to evacuate and believe evacuation would be an effective mechanism to reduce the risk to their life and property. Like risk perception, residents' beliefs about the effectiveness of evacuation (outcome expectancy) are greatly influenced by their cohesive group partners, but when it comes to intention to evacuate, the influences of cohesive groups or direct networks are insignificant. There are other factors that influence the residents' evacuation intention – cultural affiliation, period of stay and household size. Why it this so? Possible explanations could be that those living in the area for a long time are well settled in the slum in terms of having permanent housing, a steady source of income, and greater household assets. Moreover, a great sense of belonging exists among the residents that have lived in those hillocks for a long period of time. Therefore, evacuation is not a better choice because evacuation during the rainy season every year may disrupt these establishments and bring more intense livelihood challenges to those families. Some slum dwellers reported that because of long absence of residence due to evacuation, gangs and new settlers will come and occupy their houses and land and can take over their property. Legitimacy of tenure is always an issue for the slum dwellers in Mumbai (Parthasarathy, 2009), and consequently, relocation, even a temporary one, aggravates the insecurity of losing property rights. Therefore, the relatively permanent residents are unwilling to evacuate, whereas the recently-migrated households have a more favorable attitude towards evacuation.

The significant association between household size and perceived effectiveness of evacuation is obvious as the heads of the large households need more resources and alternative livelihood arrangements due to evacuation, particularly when the evacuation is for a relatively longer period of time.

More interestingly, social networks play strong roles in shaping individuals' evacuation decisions also, but the type of social networks that were critical in shaping an individual's risk perception, was not important in shaping people's evacuation intention. Direct and strong social ties confined within a particular geographical boundary, such as a neighborhood, are critical in shaping residents' risk perception, but not so significant in influencing their evacuation decisions. To make an evacuation decision, a resident in those hillocks in Mumbai depends on large, widely distributed social groups or networks based on religion, language, caste and ethnic identity. The possible reasons could be that these cultural or social networks, such as religious groups or linguistic groups, provide opportunities and support during resettlement and other emergencies. During the evacuation or temporary relocation, religious, cultural and ethnic groups work as lifelines to render support for obtaining alternative work, finding temporary shelters, and childcare support, which are necessary, but difficult to arrange from any other sources for these marginalized slum communities. The city authority and non-governmental originations do not provide such means to these socio-economically marginalized communities (Parthasarathy, 2009). Therefore, cultural and social networks are the only social capital that replace those needs and play a decisive role in household landslide evacuation decisions.

6. Conclusions and Implications

Evacuation is essential for saving the lives of thousands of slum dwellers living in landslide-prone hilly terrain in various parts of Mumbai City, India. However, the city government has recently acknowledged that even after investing numerous efforts and continued intervention, the evacuation rate in those hilly regions is inadequate. The city authority is, therefore, deliberately seeking plans and strategies to enhance its risk communication mechanism to ensure the planned evacuation of thousands of slum dwellers. Given this challenge, the present study investigated the factors accountable for household evacuation decisions in a landslide-prone slum in Mumbai. Unlike previous studies, most of which are cognitive based and consider that individuals make decisions as an isolated atomized unit, the present study explored how various social networks and groups influence an individual's evacuation decision. Our findings corroborate the hypothesis that social networks do play an important role in the evacuation decision. More specifically, we found that individual risk perception is shaped to a great extent by neighbors and cohesive group partners with whom the individual has direct and strong interconnections in daily life. On the other hand, we observed that when it comes to making decisions for action, such as the evacuation intention, individuals seek information and follow the opinions of wider social network partners such as cultural and social groups based on religion, caste and language.

Policy Implications -

The most significant implication of this study is that it is a pioneering attempt to analyze the households' evacuation decisions beyond the limit of individual or cognitive perspective. It also investigates how individuals are influenced by social networks and social norms that affect personal beliefs on disaster preparedness. Therefore, the research on evacuation behaviors and other disaster preparedness should not be confined to collecting data on individual demographics and cognitive characteristics, but also include information on respondents' social networks.

The other planning implications that can be drawn from the present study are that since individuals learn from and are influenced by their cohesive and socio-cultural groups, the city authority may intensify their dialogues with neighborhood groups and local leaders in order to locate which areas are more landslide prone and where these people can evacuate.

Since the city government does not provide any temporary shelters for evacuation, it would be effective to provide support to help find alternative temporary housing and jobs. Providing such support would be easier if the city government sought collaboration with cultural, ethnic and religious group based originations.

In this regard, a local participatory platform comprising local ethnic representatives and leaders can be formed to intensify the dialogues between the city authority and local residents. The success stories, such as those evacuated previously, can be made available to others to have them understand how the evacuees were able to manage their lives and livelihood during the evacuation. This may encourage the non-evacuees.

Since, there exists a sense of loss of property rights, the city authority must ensure that the residents can be resettled in the original place without any political or social harassment. It seems that mass-media and leaflet distribution would be an effective mechanism to encourage residents to evacuate, but the emphasis should be placed on personal and two-way communication between residents and the city government.

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