



# Assessing the Preparedness and Awareness regarding Earthquakes among the residents of Srinagar City of Jammu and Kashmir, India

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## Abstract

*Natural hazards and calamities have occurred and will occur in future also as it is beyond the control of the human being, but by taking proper steps, the effect of these hazards on human lives can be reduced to a considerable level. Disaster mitigation measures consist of policies and actions taken before an event, which are intended to minimize the extent of damage when an event does occur. Disaster prevention, mitigation and preparedness are emphasized as better option than disaster response in achieving the goals and objectives of vulnerability reduction. However all the measures of pre-earthquake (preparedness/preparation and planning), during earthquake (emergency and response) and post earthquake (recovery and rebuilding) should be a continuous and interlinked coordinated activity to achieve the maximum satisfactory result. Public education and community participation is the key to success of the implementation of reduction and mitigation programmes. Aim of the study was to assess the preparedness and awareness among the residents of Srinagar city regarding earthquake hazards and its consequences. Primary data was collected with the help of standard questionnaires. On the basis of preparedness at the locality/household level, the situation in all the municipality wards is different. Regarding the awareness at the household/locality level, the condition is similar in all the municipality wards.*

**Keywords:** Disaster mitigation, preparedness, awareness, Srinagar city.

## Introduction

While no natural disaster can be prevented from happening, the incorporation of well formulated planning will mitigate damages and losses significantly (Ilkisik et al. 2010). The effective earthquake disaster management can be achieved through the adequate preparedness, effective emergency management and by rehabilitating the communities affected by disasters. The entire approach of the earthquake management should be interlinked by connecting various phases of management and administration with each other (Goel and Kumar 2001). While natural hazards will continue to occur, their capacity to become a disaster or merely a manageable event depends on many factors, including the magnitude of the hazard, the vulnerability of people and their communities, the built environment and political systems (Guzey et al. 2013). Considering the increasing levels of risks originating from natural hazards, recent literature points to a better understanding of physical, social, economic and political/institutional vulnerabilities to natural hazard impacts for the development of comprehensive and integrated risk models and risk management strategies (Blaikie et al. 1994; Guzey et al. 2013). Physical, social

and economic dimensions of vulnerability should be integrated into the process of risk management (Uitto 1995; Uitto 1998).

While occurrence of natural disasters cannot be prevented altogether, their adverse impact can be reduced substantially by undertaking various preparedness and mitigation measures by community involvement (Goel and Kumar 2001). Some parameters to be considered when evaluating the vulnerability of urban fabrics against earthquakes include level of awareness and preparedness of the residents (Hosseini et al. 2009). Preparedness is a state of readiness to respond to environmental threats. It results from a process in which a community examines its susceptibility to the full range of environmental hazards, identifies human and material resources available to cope with these threats, and defines the organizational structures by which a coordinated response is to be made. Because vulnerability, resources and organizational structures change over time and performance skills disappear when not exercised, planning and training must be continual processes in order to establish and maintain emergency preparedness (Daines 1991; Buckle et al. 2000; Perry and Lindell 2003). Preparedness is the area which is most recognizable in disaster planning because it relates to the various technical interventions that are commonly seen as necessary for disaster avoidance (especially warning systems, land zoning and preparedness planning) (Cannon 1994). It is believed that early warnings, as well as disaster preparedness, have significantly helped in reducing the death tolls in recent disasters (Fritz and Williams 1957; Abramovitz 2001; Kienberger 2007; Asuero et al. 2012).

Disaster preparedness research indicates that certain demographic variables have a significant influence on preparedness. People who live with small children and/or individuals with disabilities are more likely to indicate a higher level of preparedness. Other variables, such as education, income and the perception of vulnerability, also tend to predict preparedness (Eisenman et al. 2006), and a number of other important psychological variables – such as key attitudes and beliefs are likely to be useful in not only predicting but also marshalling people's willingness to prepare themselves for a disaster (Miller et al. 2013). The planning, preparedness and response should be improved by increasing the participation of different groups that are especially vulnerable to disaster. Emphasizes should be put on grassroots or 'bottom-up' initiatives and partnerships between the various actors in the hazards management arena. These include city authorities, disaster agency personnel, non-governmental organizations (NGOs) and other resource bodies, as well as different groups of city dwellers who possess important local knowledge (Red Cross 1994; Uitto 1998). Preparedness measures such as the maintenance of inventories of resources and the training of personnel to manage disasters are vital components of managing a disaster (Kanwar 2001). Preparedness activities include development of response procedures, design and installation of warning systems, exercises to test emergency operational procedures and training of emergency personnel (Fernando 1999).

One way to reduce a disaster's physical impacts is to adopt emergency preparedness practices, that provide the human and material resources needed to support active responses at the time of hazard impact (Lindell and Perry 2000). The first step in emergency preparedness is to identify the demands that a disaster of a given magnitude would place upon the community. These demands can be met by performing four basic emergency response functions: emergency assessment, expedient hazard mitigation, population protection and incident management (Lindell and Perry 1992, 1996). Emergency assessment consists of those actions that define the potential scope of the disaster impacts, expedient hazard mitigation consists of short term actions that protect property, population protection actions protect people from impact, and incident management actions activate and coordinate the emergency response (Lindell and Prater 2003). The level of disaster preparedness is a major factor in mitigation of natural disasters. There is a need for dissemination of the measures to be taken before, during and after a disaster event. Particularly preparedness measures need to be practiced periodically. Mitigation of the effects of disasters and protection against hazards require both structural and non-structural measures. In recent years, the adequacy of programmes based solely on structural measures has been recognized. Numerous attempts have been suggested to employ non-structural loss prevention measures, as well to assist in minimizing losses through exercising control over development in disaster-prone areas. Non-structural mitigation measures typically concentrate on identifying hazard prone areas and limiting their use. Examples include land-use zoning, selection of building sites, tax incentives, insurance programmes, relocation of residents to safe areas and establishment of a warning system (Fernando 1999).

## Objectives of the study

The aim of the study is to assess the Preparedness and Awareness among the residents of Srinagar city regarding earthquake hazards and its consequences; and to prepare the Earthquake vulnerability zonation maps of the city on the basis of the selected Preparedness and Awareness indicators.

## Study area

Srinagar is the largest city of Jammu and Kashmir state. It is located between 33°53'49''- 34°17'14'' North latitudes and 74°36'16''- 75°01'26'' East longitudes at a height of 1585 meters above sea level. Srinagar city is the most pivotal center of economy of the Kashmir Valley being a center of tourist attraction. Srinagar has been shaken numerous times by earthquakes in the past millennium, most recently by damaging earthquake in 2005 (M 7.6) (Bilham et al. 2010). Srinagar city is located on both the sides of the Jhelum River which passes through the city and meanders through the valley.

## Literature review

Mitigation seeks to reduce risk, that is, vulnerability to damage or loss. Mitigation focuses on the hazard that causes the disaster and attempts to minimize the adverse impacts of the hazard on communities (Fernando 1999). Erdik and Durukal (2008) carried out earthquake risk and its mitigation in Istanbul. Nateghi (2000) discussed the earthquake disaster mitigation strategies for the city of Tehran. Fernando (1999) described about mitigation, its components and importance. The study also discussed the need for public awareness and training regarding mitigation and role of non-governmental organizations in disaster management. Aboagye, Dari and Koomson (2013) examined the relationship between demographic characteristics and mitigation strategies in the Savannah Region of Ghana. Their study concluded that deeper understanding of how perception and demographic characteristics combine to influence a group's level of vulnerability would be beneficial in establishing more effective interventions to reduce human vulnerability.

Three studies were designed by Miller, Adame and Moore (2013) to extend a combination of vested interest theory (VI) and the extended parallel process model of fear appeals (EPPM) to provide formative research for creating more effective disaster preparedness social action campaigns. The study was conducted to develop an effective vested interest scale for assessing individual awareness and vestedness relevant to disaster preparedness. Perry and Lindell (2003) reviewed the concepts of community preparedness and emergency planning and their relationships with training, exercises and the written plan. Heping (2003) carried out a study on the earthquake disaster preparedness and reduction in China. Rocha and Christoplos (2001) conducted a study on the Disaster mitigation and preparedness in Nicaragua. A study was conducted by Sharma (2001) on Gujarat earthquake which took place on 26<sup>th</sup> January 2001 with a magnitude of 6.9 on the Richter scale. The study discussed some issues which emerged from that disaster on search and rescue, relief and rehabilitation, scientific and technical, communication and earthquake preparedness. Mishra, Fuloria and Bisht (2012) enhanced disaster management by mapping disaster proneness and preparedness in the state of Tamil Nadu.

## Database and Methodology

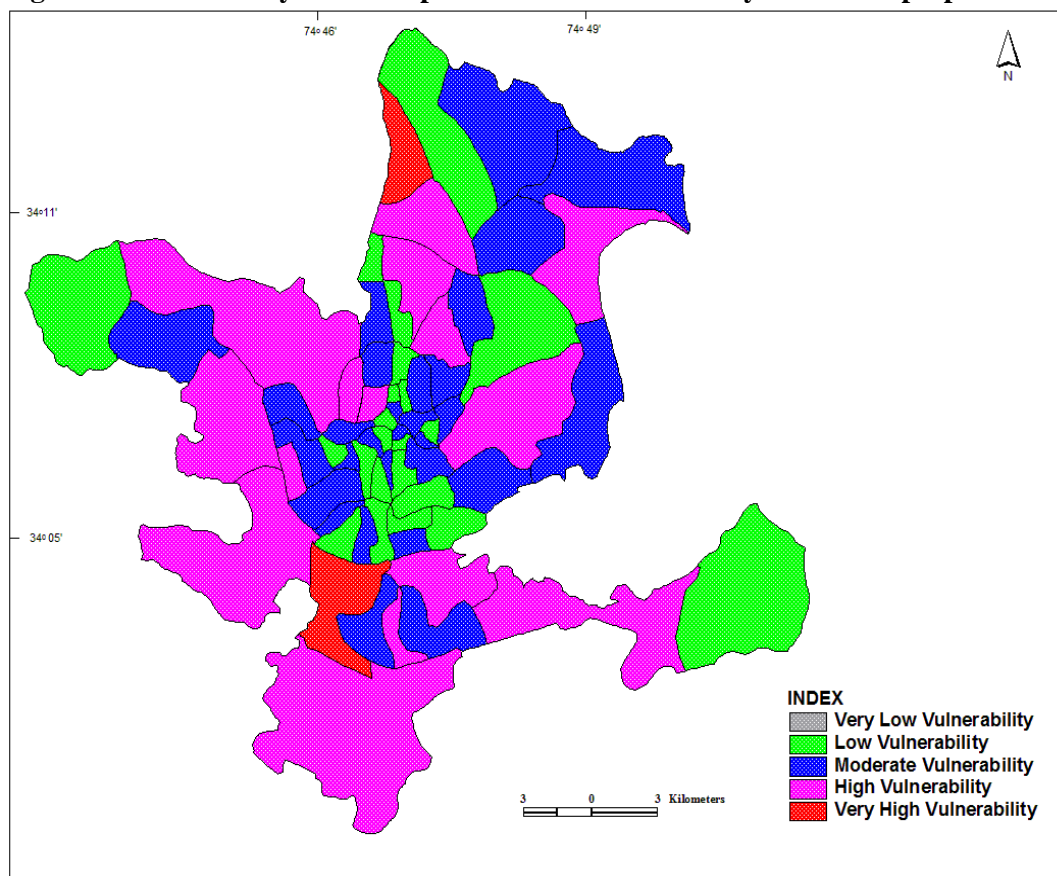
Data was generated at the municipality ward level in Srinagar city. Stratified random sampling was carried out in order to select the samples from each municipality ward within the city (Kothari 1985). A total of 595 houses were considered for the collection of primary data. Data was collected regarding the indicators of preparedness and awareness among the residents of city. The primary data was collected with the help of standard questionnaires. As per the reviewed literature, variables were selected for assessing the preparedness and awareness of the inhabitants of Srinagar city at household as well as locality level. The variables selected include; Sufficient level of awareness and preparedness of the family members; Earthquake early detection and warning systems; Basic or detailed earthquake hazard maps of the locality; Specialized equipment and well-trained rescue services; Good coordination between the residents of the locality; Emergency preparedness practices, plans and

procedures; Sufficient supplies of medical, transport and communication facilities; Proper guidelines for housing constructions and land-use activities; School earthquake awareness programmes through rallies, competitions like essay, debate, drawing etc.; Increased capability of women in First aid, Shelter management, search and rescue, trauma counseling etc.; Purchasing of property on the basis of adequate information about hazard vulnerability of the area; Distribution of assets over other locations and other forms of financial sources (e.g., savings accounts, insurance, stocks/bonds); Adoption of any hazard adjustment to limit losses if an earthquake were to strike; Generation of awareness about earthquake vulnerability and possible preventive actions; Securing of the household items that can cause injury or damage during an earthquake disaster (such as water heaters, bookcases and other appliances); Development of an earthquake preparedness plan for the household, such as creating a savings account for house, communication capability and 72-hour food availability in case of an earthquake event; Awareness through Newspapers; Radio; Posters; Television; Workshops; Seminars; Training; Large scale public education and training; Regular studies, research and workshops; Warning dissemination; Preparation of preparedness and response plans; Awareness campaigns for the Residents and community at large; Development of manuals and training modules, education and communication materials (Abramovitz 2001; Asuero et al. 2012; Britton 2001; Cannon 1994; Devi 2012; Khan 2012; ECLAC 1991; Eidsvig et al. 2011; Fernando 1999; Fritz and Williams 1957; Futane 2013; George and Dar 1999; GOI-UNDP 2002-2007; Kanwar 2001; Khan 2012; Kienberger 2007; Lindell and Perry 2000; Lindell and Prater 2003; Petrucci 2012). Kendall's method (Mahmood 2008) was used to rank the obtained data while as H test was carried out to check the differences and similarities among the municipality wards statistically (Soffer et al. 2009; Fung 2010; Brown et al. 2014; Venkateswaran 2014).

### **Assessment of preparedness and awareness**

By using the Kendall's method (Mahmood 2008) the responses obtained through field survey for the variables selected for the preparedness and awareness indicators, were ranked for all the municipality wards and the same has been used for the preparation of the respective maps. On the basis of the ranking scores of the variables of preparedness at the locality/household level, the wards were divided into five categories of very high (rank score 121 – 150), high (rank score 91 – 120), moderate (rank score 61 – 90), low (rank score 31 – 60) and very low (rank score 0 – 30) vulnerability which were spatially depicted through maps.

**Figure 1: Vulnerability of municipal wards based on locality/household preparedness**



Source: Generated from sample survey

**Table 1: Vulnerability of municipal wards based on locality/household preparedness**

S.No.	Category of Vulnerability	Rank score	Number of wards	Name of wards
1.	Low	31 – 60	22	Lal Chowk, Rajbagh, Wazir Bagh, Sheikh Dawood Colony, Magarmal Bagh, Qamerwari, Shaheed Gunj, Karan Nagar, Islamyarbal, Aali Kadal, Ganpathyar, Malik Agan, Tarabal, Zindshah Sahib, Jamia Masjid, Madin Sahib, Nowshera, Soura, Zakura, Bud Dal, Laweypora and Khanmoh
2.	Moderate	61 – 90	29	Nishat, Dalgate, Jawahar Nagar, Natipora, Rawalpura, Batmaloo, Alochi Bagh, Nund Reshi Colony, Parimpora, Bemina East, Chattabal, Syed Ali Akbar, Nawab Bazar, Barbarshah, Khan Khai Moulla, S.R. Gunj, Aqil Mir Khanyar, Khwaja Bazar, Safa Kadal, Jogilankar, Hassnabad, Mukhdoom Sahib, Zadibal, Zoonimar, Hazratbal, Tailbal, Dara, Alesteng and Maloora
3.	High	91 – 120	15	Harwan, Mehjoor Nagar, Chanapora, Zainakot, Bemina West, Id Gah, Kawdara, Lal Bazar, Umar Colony, Buchpora, Locut Dal, Palpora, Khumani Chowk, Humhama and Pandrathan
4.	Very High	121 – 150	2	Barzulla and Ahmad Nagar

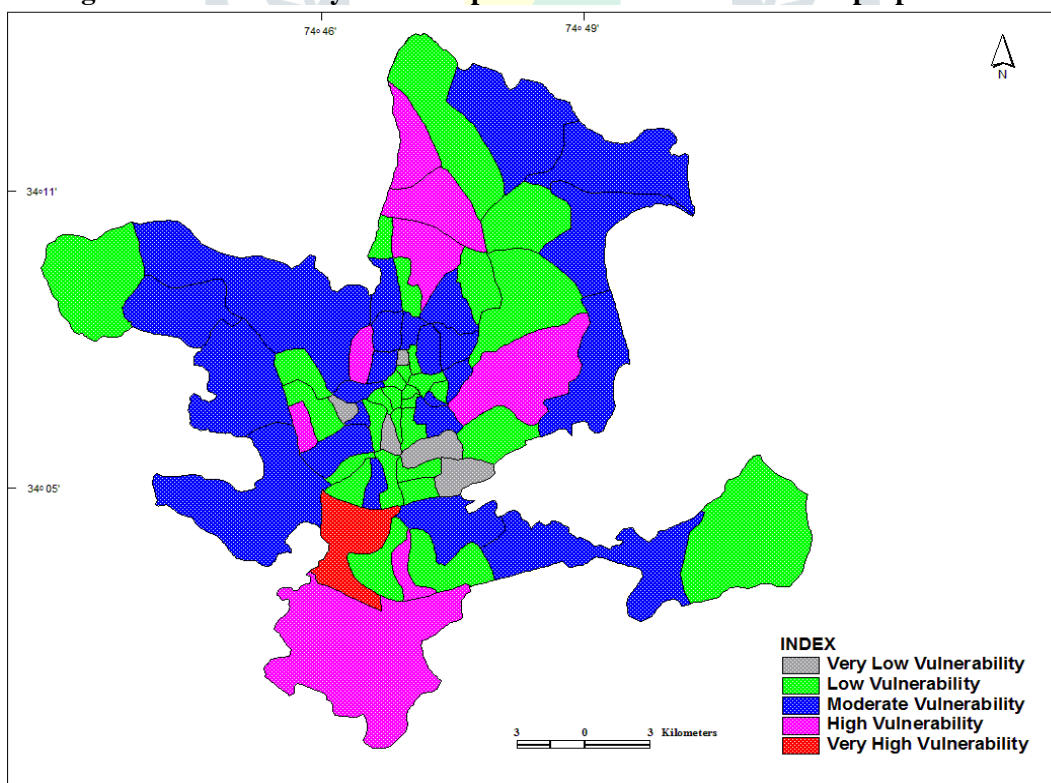
Source: Computed from sample survey

In order to find out the differences among the municipality wards with respect to the selected variables for preparedness at the locality/household level, the Kruskal wallis test (H test) was carried out (Soffer et al. 2009; Fung 2010; Brown et al. 2014; Venkateswaran 2014). As per the results of the test, the p-value for two variables i.e. specialized equipment and well-trained rescue services; school earthquake awareness programmes through rallies, competitions like essay, debate, drawing etc. is < 0.05 which shows that there is a statistically significant difference among the municipality wards with respect to those two variables of preparedness while as in case of

rest of the variables, the p-value is  $> 0.05$  which denotes that there is not statistically any significant difference among the municipality wards and hence it indicates that the situation in all the wards with respect to those variables is almost similar and the difference is insignificant. Hence we conclude that with respect to specialized equipment and well trained rescue services; as well as school earthquake awareness programmes through rallies, competitions like essay, debate, drawing etc. the situation in all the municipality wards is different and it varies from one ward to another while as on the basis of sufficient level of awareness and preparedness of the family members; earthquake early detection and warning systems; basic or detailed earthquake hazard maps of the locality; good coordination between the residents of locality; emergency preparedness practices, plans and procedures; sufficient supplies of medical, transport and communication facilities; proper guidelines for housing constructions and land-use activities; and increased capability of women in first aid, shelter management, search and rescue, trauma counseling etc. the situation in all the municipality wards is similar.

The ranking scores of the variables selected for the preparedness indicator at the household level as per the Kendall's method has been calculated for the 68 wards of city. On the basis of the obtained scores, the city was classified into five vulnerability classes which have been spatially represented in Figure 2. The Kruskal wallis test (H test) (Soffer et al. 2009; Fung 2010; Brown et al. 2014; Venkateswaran 2014) has been carried out on the variables indicating the preparedness at the household level. As per the results of the test, the p-value for all the variables is  $> 0.05$  and hence it can be concluded that there is not statistically any significant difference among the municipality wards and hence the situation in all the municipality wards with respect to the selected variables is similar and the difference is insignificant. Therefore it can be concluded that with respect to purchasing of property on the basis of adequate information about hazard vulnerability of the area; distribution of assets over other locations and other forms of financial sources (e.g., savings accounts, insurance, stocks/bonds); adoption of any hazard adjustment to limit losses if an earthquake were to strike; generation of awareness about earthquake vulnerability and possible preventive actions; securing of the household items that can cause injury or damage during an earthquake disaster (such as water heaters, bookcases and other appliances); and developing an earthquake preparedness plan for the household, such as creating a savings account for house, communication capability and 72-hour food availability in case of an earthquake event is almost similar for all the municipality wards.

**Figure 2: Vulnerability of municipal wards based on household preparedness**



Source: Generated from sample survey

**Table 2: Vulnerability of municipal wards based on household preparedness**

S.No.	Category of Vulnerability	Rank score	Number of wards	Name of wards
1.	Very Low	0 – 25	5	Lal Chowk, Rajbagh, Qamerwari, Shaheed Gunj and Jamia Masjid
2.	Low	26 – 50	30	Dalgate, Jawahar Nagar, Wazir Bagh, Natipora, Rawalpora, Sheikh Dawood Colony, Batmaloo, Magarmal Bagh, Parimpora, Bemina East, Karan Nagar, Syed Ali Akbar, Nawab Bazar, Islamyarbal, Aali Kadal, Ganpathyar, Malik Agan, Khan Khai Moulla, S.R. Gunj, Khwaja Bazar, Tarabal, Zindshah Sahib, Nowshera, Soura, Zakura, Hazratbal, Tailbal, Bud Dal, Laweypora and Khanmoh
3.	Moderate	51 – 75	24	Harwan, Nishat, Mehjoor Nagar, Alochi Bagh, Nund Reshi Colony, Zainakot, Chattabal, Barbarshah, Aqil Mir Khanyar, Safa Kadal, Jogilankar, Hassnabad, Mukhdoom Sahib, Kawdara, Zadibal, Madin Sahib, Zoonimar, Lal Bazar, Dara, Alesteng, Palpora, Maloora, Khumani Chowk and Pandrathan
4.	High	76 – 100	8	Chanapora, Bemina West, Iid Gah, Umar Colony, Buchpora, Ahmad Nagar, Locut Dal and Humhama
5.	Very High	101 – 125	1	Barzulla

Source: Computed from sample survey

As per the rank scores of the variables selected for the awareness indicator, the municipality wards were categorized into five vulnerability classes of very low vulnerability (rank score 0 – 50), low vulnerability (rank score 51 – 100), moderate vulnerability (rank score 101 – 150), high vulnerability (rank score 151 – 200) and very high vulnerability (rank score 201 – 250). The same categorization has been spatially represented through Figure 3. The Kruskal wallis test (H test) (Soffer et al. 2009; Fung 2010; Brown et al. 2014; Venkateswaran 2014) has been carried out on the variables indicating the awareness at the household/locality level. As per the results, the p-value for three variables is  $< 0.05$  which indicates that with respect to those variables (i.e. warning dissemination; preparation of preparedness and response plans; awareness campaigns for the residents and community at large) there is a statistically significant difference among the municipality wards. On the other hand, the p-value is  $> 0.05$  in case of rest of the variables of awareness which denotes that there is not statistically any significant difference among the municipality wards and hence it indicates that the situation in all the municipality wards with respect to those variables is almost similar and the difference is insignificant. Hence we conclude that with respect to the variables like awareness through newspapers; awareness through radio; awareness through posters; awareness through television; awareness through workshops; awareness through seminars; awareness through training; awareness from none of the sources; large scale public education and training; regular studies, research and workshops; and development of manuals and training modules, education and communication materials, the condition is similar in all the municipality wards.

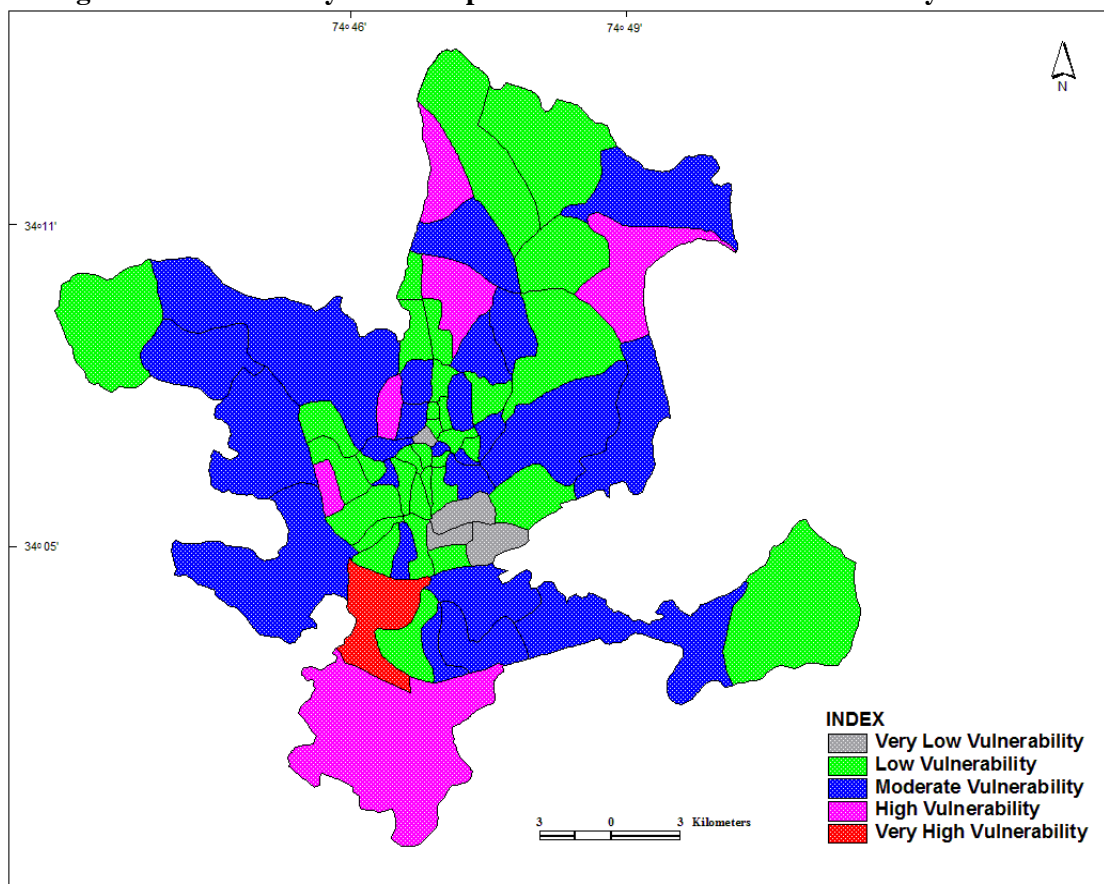
**Table 3: Vulnerability of municipal wards based on household/locality awareness**

S.No.	Category of Vulnerability	Rank score	Number of wards	Name of wards
1.	Very Low	0 – 50	4	Lal Chowk, Rajbagh, Wazir Bagh and Aali Kadal
2.	Low	51 – 100	33	Dalgate, Jawahar Nagar, Rawalpora, Sheikh Dawood Colony, Batmaloo, Magarmal Bagh, Nund Reshi Colony, Qamerwari, Parimpora, Bemina East, Shaheed Gunj, Karan Nagar, Syed Ali Akbar, Nawab Bazar, Islamyarbal, Ganpathyar, Malik Agan, S.R. Gunj, Khwaja Bazar, Tarabal, Zindshah Sahib, Hassnabad, Jamia Masjid, Madin Sahib, Nowshera, Zoonimar, Soura, Zakura, Tailbal, Bud Dal, Alesteng, Laweypora and Khanmoh

3.	Moderate	101 – 150	24	Nishat, Mehjoor Nagar, Natipora, Chanapora, Alochi Bagh, Zainakot, Chattabal, Barbarshah, Khan Khai Moulla, Aqil Mir Khanyar, Safa Kadal, Jogilankar, Mukhdoom Sahib, Kawdara, Zadibal, Lal Bazar, Buchpora, Hazratbal, Locut Dal, Dara, Palpora, Maloora, Khumani Chowk and Pandrathan
4.	High	151 – 200	6	Harwan, Bemina West, Iid Gah, Umar Colony, Ahmad Nagar and Humhama
5.	Very High	201 – 250	1	Barzulla

Source: Computed from sample survey

Figure 3: Vulnerability of municipal wards based on household/locality awareness



Source: Generated from sample survey

### Conclusions and Suggestions

Awareness raising makes individuals, communities and institutions aware of vulnerabilities and the negative impacts of disasters and environment degradation on their livelihoods (Rezaei and Ghaderi 2013). On the basis of preparedness at the locality/household level, with respect to specialized equipment and well trained rescue services; as well as school earthquake awareness programmes through rallies, competitions like essay, debate, drawing etc. the situation in all the municipality wards is different as there is a statistically significant difference among the wards while as on the basis of level of awareness and preparedness of the family members; earthquake early detection and warning systems; basic or detailed earthquake hazard maps of the locality; good coordination between the residents of locality; emergency preparedness practices, plans and procedures; sufficient supplies of medical, transport and communication facilities; proper guidelines for housing constructions and land-use activities; and increased capability of women in first aid, shelter management, search and rescue, trauma counseling etc. the situation in all the municipality wards is similar.



According to the preparedness at the household level, there is not statistically any significant difference among the municipality wards and hence the situation in all the municipality wards with respect to the selected variables is similar. Regarding the awareness at the household/locality level, with respect to the selected variables (i.e. awareness through newspapers; radio; posters; television; workshops; seminars; and training; large scale public education and training; regular studies, research and workshops; and development of manuals and training modules, education and communication materials) the condition is similar in all the municipality wards as there is not statistically any significant difference among the wards while as in case of variables (i.e. warning dissemination; preparation of preparedness and response plans; and awareness campaigns for the residents and community at large) there is a statistically significant difference among the municipality wards.

Information regarding hazards and the related precautionary measures to be taken should be a part of the academic curriculum of students. Earthquake mock drills for emergency response should be included in the learning process too. Teachers should be well trained so that they understand the likely effects of earthquakes and the precautions that should be taken and hence can guide the students properly. Further studies and research should be conducted on the earthquake vulnerability analysis, even at the ward level and the findings of such studies should be made public through newspaper and magazine articles, or preparation of manual for the general public awareness.

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