

### The predictors of earthquake preparedness in Tehran households

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#### Abstract

**Background:** The high risk of an earthquake happening and the harmful consequences that it leaves, besides the unsuccessful policies for preparing the community for mitigation, suggested that social factors should be considered more in this regard. Social trust is an influencing factor that can have significant impact on people's behavior.

**Objective:** To determine the relationship of the influencing factors on the preparedness of Tehran households against earthquake.

**Methods:** This was a cross-sectional study with 369 participants (February to April 2017) involved through stratified random sampling from selected urban districts of Tehran. The Persian version of an 'Intention to be prepared' measurement tool and a standard checklist of earthquake preparedness behaviors were used. The tool was evaluated for internal consistency and test-retest reliability in a pilot study (Cronbach's  $\alpha = 0.94$  and Intra Class Correlation Coefficient = 0.92).

**Results:** Multivariate linear regression analysis showed that social trust is the most important predictor for the preparedness mean of changes in Tehran ( $R^2=0.109$ ,  $p<0.001$ ,  $\beta$ : 0.187 for the Preparedness behavior;  $R^2=0.117$ ,  $\beta$ : 0.298,  $p<0.001$  for Intention to be prepared; and  $R^2=0.142$ ,  $\beta$ : 0.345,  $p<0.001$  for the Perceived preparedness).

**Conclusion:** The relationship between social trust and preparedness dimensions suggested that changing a social behavior is not possible through considering only individual characteristics of community members and not their social networks relations. The programs and policies which try to enhance the social trust in general, may be able to increase public preparedness against earthquakes in the future.

**Keywords:** Preparedness; Earthquake; Household; Social trust; Tehran

#### 1. Introduction

The rise in the number and drastic consequences of disasters worldwide and especially in Asia (1), the geographic location of Iran as a high seismic prone country (2) along with the history and risk of earthquake happenings with

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severe damages and casualties in Tehran (2, 3) that have left negative impacts on the residents' lives, as well as the daily activities and long-term health situation (4, 5), have caused recent researchers to focus on assessing the different aspects of this natural hazard. Preparedness must be at all levels of the individual, collective and organizational context in order to reduce injuries caused by these incidents (1). One of the key principles for risk management is capacity building and adaptation to the effects of the hazard for the residents of vulnerable areas (4); however, previous studies indicated that awareness of hazards is not singly enough to motivate people to be prepared for hazardous events (4, 6-8), and the interaction between community members is necessary to motivate their preparedness decisions. These decisions are influenced by the quality of the relationships they have within their communities and with the health care authorities and responsible organizations (8). The impact of the social context interposes the relations of the associated factors with the intention and/or the action of preparedness in the society in which the information is distributed, as it also affects the way this information is used and interpreted (9). Trust among all individual and social factors, is a factor that can reduce the complexity and instability that people face in cases of natural hazards in which all decisions are about dealing with the uncertainty and risk management (10). This concept acts as a mediator between individuals, societies and social factors, in order to form the intention to prepare for a serious hazard (11). People become worried about unpredictable crisis situations, and are motivated to reduce the uncertainty these situations cause. Then, they will seek reliable sources of information based on the interpretation they have about that risk and the protecting strategies in this regard (12). Moreover, the type of the risk someone encounters will also determine his/her readiness (13). This indicates the importance of balancing social responsibilities (14), the quality of interrelationships and the trust or distrust between individuals and urban management organizations in uncertain situations like earthquakes; because in these conditions, people decide to be prepared based on the information they receive from their reliable sources (11). Until the presentation of the cognitive social model of disaster preparedness (13, 15), social trust was not discussed as an influencing factor on preparedness and behavior in previous literature. The results of studies over the past two decades have shown that social relationships have significant impacts on the formation of people's beliefs and on the risk reduction strategies. The importance of trust on the source of information, the public empowerment this trust makes, and its efficacy in raising the adaptability potentials and protective behaviors has been confirmed in the preparedness process of all countries reviewed (16, 17). Risk perception, self-efficacy, past experience of risk, confidence in the mass media and the psychological sense of belonging have been introduced as the predictors of preparedness behavior changes; but trust to the government has indicated a complex relationship with preparedness because of suppressing that which happens in self-efficacy (18). Another finding in Europe suggested that in the majority of people from various nationalities, despite the significant differences in factors affecting individual preparedness, the more the level of trust to the emergency authorities raised, the less they were prepared to deal with unexpected events including earthquakes and they were reluctant to be prepared in general (19). In Iranian publications, some demographic and individual factors were related to a number of risk reduction behaviors (3, 7) and changes in the intention to prepare; although increasing the amount of trust in urban crisis management authorities has reduced this intention (7). The inclination of a community to participate in earthquake risk reduction programs has been related to the level of participation, the status of social and familial relationships, and the trust of residents in the local groups and communities in their neighborhood (20), and age, sense of safety, life satisfaction and shared values (7) have been able to change the level of social trust in both women and men in society. The results about the influencing factors on public preparedness are contradictory, while recent findings suggest that people have not taken any serious action despite having perceived the risk of earthquake (1, 7, 21). These findings suggest that recognizing the factors associated with people's preparedness for earthquakes needs to be further explored. The present study aimed to assess the influencing factors on the preparedness dimensions whereas the total effect of individual, environmental and social factors on public preparedness have not been studied, or some contradictions existed both in the national and international results in the research literature. The city of Tehran is highly vulnerable towards many kinds of natural and man-made disasters especially a huge drastic earthquake. Therefore, considering the high rate of emotional reactions among the people, the magnitude of the population and the cultural barriers of crisis management, the present study was designed to investigate the relationship between the social factors affecting preparedness dimensions in its inhabitants. For this reason, in this research, the relationship of social trust together with other demographic characteristics of Tehran residents, along with three dimensions of their preparedness against earthquake, have been evaluated based on the cognitive social approach (6).

## **2. Material and Methods**

### ***2.1. Research design and setting***

This was a cross-sectional study from February to April 2017 aimed to investigate the relationship between effective factors on preparedness with participation of 369 Tehran citizens. Demographic variables, social trust and three

dimensions of preparedness have been evaluated and analyzed in this study. The concept of preparedness was explained explicitly in previous studies in terms of three dimensions as: the real behavior, perceived readiness, and the intention to prepare. Social trust here, means a process in which people establish their trust based on the meanings and values that they hold between themselves and their authorities. Their preparedness to deal with a natural hazard is contingent upon this trust. The concept has two dimensions: general trust and the trust to emergency authorities (11). The real behaviors of preparedness include direct activities (learning how to properly cut off water, electricity and gas; having food and water supplies for four days; fixing heavy objects; etc.) and building capacities (joining earthquake-related organizations, participating in meetings about earthquake risk) (22), which are conducted before the occurrence in order to help improve survival likelihood and to deal with the possible impacts of future events. Perceived preparedness means that a person assumes him/herself or the society he/she lives in, to be prepared for a particular risk (18). Intention to prepare as the third dimension, is exactly the purpose of conducting those behaviors that can reduce the damages caused by the severe and devastating consequences of disasters (3, 11).

### 2.2. Participants

All residents of twenty-two urban districts of Tehran, who accepted verbal consent to participate in this research, were at least 18 years of age, able to speak, read and write in Persian language and did not have apparent mental or psychological disabilities, were considered as eligible for participating in this study. Stratified random sampling of the households was used in this study. Urban areas of Tehran were divided to 152 blocks (Avval book, 2015: Tehran map) which have been classified into three categories of vulnerability (23) and four levels of urban development and social welfare (24). Then, one to two blocks were randomly selected from all crossed levels based on the population density of the region (Table 1). The total population of family households in the selected area was extracted using the Statistics Center of Iran. The samples were calculated based on the ratio number of households living in that region. We needed 320 people for this study which was calculated using the sample size rule in theoretical models (25), and considering 8 components of social predictors of an Intention to prepare model (10). Presuming loss of sampling or incomplete questionnaires as possibilities, the research team agreed to ask for 15% more participants. Finally, 369 questionnaires were completed and used for analysis. Fortunately, there was no sampling loss, due to the data collection being carried out at the presence of research assistants visiting house by house in the chosen areas. Two assistants simultaneously from two different directions in each area, randomly selected a street for collecting data. If a resident was not present or willing to participate, they would go to the next house until the end of sampling in that block.

**Table 1.** The selection of sampling area based on the level of vulnerability against earthquake and the index of urban development and social welfare in each region of Tehran.

Vulnerability level	Urban development of the districts	Selected block Number	Number of samples from each block	Necessary number of samples	Total filled questionnaires
Low vulnerability area	11	103	40	76	80
	20	142	40		
Medium Vulnerability area	1	9, 11	40	158	160
	7	63, 83	40		
	10	104, 105	40		
	15	114	40		
High vulnerability area	2	67, 68	43	126	129
	5	47, 69	43		
	8	60, 61	43		
Total number of samples				360	369

### 2.3. Instrument and data collection

Actual preparedness behavior has been calculated using a set of questions based on the behavioral elements of Public Readiness Index (PRI) which have been previously shown to be valid and reliable (3, 5, 11). Counting the number of the real actions of preparedness that individuals and/or households take, provides a practical “score” to assess their actual readiness that would be a number between 0-13. The Earthquake Preparedness Measurement Tool has been developed to evaluate the impact of individual, societal and environmental factors on preparedness behavior which includes 8 scales (Intention to prepare; General trust; Trust to emergency authorities; Empowerment; Community participation; Collective efficacy; Positive/Negative outcome expectancies) (11). It has

been provided in English, and reported good psychometrics in some studies (9, 10, 26-28). The translated version was prepared in accordance with the principles of the process of cultural and psychological adaptation (29) and approved by the original designer in Australia. The face validity of the translated questionnaire with 10 participants was evaluated and confirmed. The Persian version showed a good internal consistency ( $\alpha$  Cronbach's  $\alpha = 0.94$ ) and excellent test-retest reliability (Intra-cluster correlation coefficient: 0.92 after two weeks) for the whole scale in the pilot study with 52 respondents (response rate: 74%). The score for intention to prepare was calculated as follows: I've done it before = 4; I'll do it = 3; Maybe I'll do it = 2 and I will not do it = 1. Therefore, according to 22 questions of this scale, its score ranged between 88-22. The total score of perceived preparedness obtained from 7 questions related to this concept in the instrument, with points from 7-27. Social trust in this study was based on the sum of the scores that included 5 general trust questions and 16 questions of trust in Emergency authorities (ranged between 105-21 and were calculated based on a 5-Likert scale: totally agree=5; agree=4; neither agree nor disagree=3; disagree=2; totally disagree=1.

#### 2.4. Ethical Considerations

All participants verbally accepted the consent to participate in the study. The confidentiality of information and their permission to withdraw from the study at any time were guaranteed by the researchers. This study, with the code IR.USWR.REC.1395.107, has been approved by the Ethics Committee of the University of Social Welfare and Rehabilitation, Deputy of Research and Technology.

### 3. Results

A total number of 369 questionnaires were completed and used for analysis. The average age of the study participants was 34 years. The other demographic information is presented in Table 2. The descriptive statistics of the variables studied in Tehran's households presented in Table 3, showed that the average score of participants' Intention to prepare was 65.3 (SD=13.86), the average number of Actual preparedness behaviors were 3.7 (SD=3.01) and the average Perceived preparedness is also achieved at 9.8 (SD=4.13).

**Table 2.** Demographic information of the study participants

Variables		n (%)
Gender	Female	137 (37.1)
	Male	232 (62.9)
Monthly Income (I.R. Rial)	Low: $< 2 \times 10^7$	178 (48.2)
	Medium: $2-4 \times 10^7$	176 (47.7)
	Good: $> 4 \times 10^7$	15 (4.1)
	< High school Diploma	4 (1.1)
Education	Undergraduate	262 (71)
	Post-graduate	103 (27.9)
Marital status	Married	228 (61.8)
	Unmarried	141 (38.2)
Size of Household	1-4 members	276 (74.8)
	> than 4 members	93 (25.2)
Job situation	Contract/Long term employment	57 (15.45)
	Contract/ Short term employment	117 (31.71)
	Self Employed	139 (37.67)
	Retired/Pensioner	14 (3.8)
	Jobless	42 (11.38)
Home ownership	Landlord/Owner	256 (69.4)
	Tenant/Not owner	113 (30.6)
Previous experience of earthquake	With past experience	251 (68)
	Without past experience	118 (32)

**Table 3.** The descriptive statistics of studied variables in Tehran's households

Variable	Mean	SD	Max	Min
Actual preparedness	3.7	3.01	13	0
Intention to prepare	65.3	13.86	88	22
Perceived preparedness	9.78	4.13	23	3
Trust	58.15	18.46	105	26

The average score of trust has been 58.15 (SD=18.46) in general. Among the variables that showed a significant correlation with at least one of the dimensions of preparedness in the history of studies, the correlation between trust and all aspects of preparedness was significant (Table 4). In order to compensate for the confounding effects, the variables related to the preparedness dimensions in linear regression with the significance level ( $p \leq 0.2$ ), if not correlated in between, have been simultaneously entered into the regression model. The results of this multivariate linear regression using the enter method for the relationship of preparedness with trust, gender, number of family members, age and region of residence are presented in Table 5. Trust is significantly related to all dimensions ( $\beta$ : 0.172,  $p < 0.001$  for Actual behavior;  $\beta$ : 0.298,  $p < 0.001$  for Intention;  $\beta$ : 0.345,  $p < 0.001$  for Perceived preparedness). This multivariate regression analysis suggested that by increasing one unit in the social trust score, if gender, monthly income and the number of family members are considered, the actual behavior of preparedness will increase up to 10%. Increasing trust in older people who live in less vulnerable areas to earthquakes are also factors that can predict up to 12% of changes of intention to prepare. And finally, if trust increases one unit in families with fewer members, it can predict up to 14% of perceived preparedness changes. Despite assumptions from previous studies, having or not having an earthquake experience, occupational status, and vulnerability of the local area were not significantly related to these changes at all.

**Table 4.** The correlation between the predictors and preparedness dimensions

Variables	Perceived prep.	Intention to prepare	Prep. behavior
Trust	0.336**	0.274**	0.155*
Gender	-0.025	0.018	0.170*
Age	0.005	0.129*	0.084
Monthly income	-0.022	-0.044	0.104*
Education	-0.036	-0.036	-0.003
Marital status	0.016	-0.038	-0.053
Family members	-0.080	-0.017	-0.107*
Job situation	-0.078	0.060	0.004
Home ownership	-0.013	0.001	-0.083
Past experience	0.336	0.022	-0.100
Region of residence	-0.022	-0.041	0.104*

\*Correlation coefficient was significant at  $p < 0.05$  level; \*\*Correlation coefficient was significant at  $p < 0.001$  level.

**Table 5.** Multivariate regression analysis of the relations between the predictors and the preparedness dimensions

Preparedness dimension	Predictor	t	$\beta$	p-value	R <sup>2</sup>	F	p-value	B
Actual preparedness behavior	Trust	3.393**	0.172	<0.001	0.097	5.447	<0.001	1.895
	Past experience	-1.656	-0.094	0.099				
	Gender	2.703*	0.131	0.007				
	Ownership	-1.735	-0.070	0.084				
	Family members	-2.288*	-0.116	0.023				
	Age	1.759	0.092	0.080				
	Monthly income	2.273*	0.105	0.024				
Intention to prepare	Trust	6.037**	0.298	<0.001	0.117	16.067	<0.001	41.817
	Age	2.597*	0.128	0.010				
	Residence region	2.762*	0.137	0.006				
Perceived preparedness	Trust	6.983**	0.345	<0.001	0.142	11.829	<0.001	9.266
	Residence region	-1.010	-0.050	0.313				
	Past experience	-1.961	0.097	0.051				
	Job situation	-1.396	-0.069	0.163				
	Family members	-2.058*	-0.101	0.040				

#### 4. Discussion

The main goal of this study intended to identify the relationship between social trust and preparedness in households and to find the associating factors influencing this relationship. As the findings indicated, the average of intention to prepare against earthquake in Tehran households was slightly higher than the expected average. While the calculated averages for social trust and the other dimensions of preparedness, namely, the actual behavior, and perceived preparedness were generally less than the expected average. The result of this study is reporting a part of a larger research project. According to the main study goals, the researchers explained about the extent of vulnerability of

the participants' region of residence against earthquake to them before filling the questionnaire, so perhaps this alert prior to the implementation has increased their motivation to get prepared; however, it has no effect on the other dimensions of preparedness. Prior to writing this article, researchers had not found any study that simultaneously evaluated the factors affecting all three dimensions of preparedness, or compares their variations, so each dimension is separately discussed. Tehran citizens' trust related to their earthquake preparedness was lower than the expected average. From the findings of this study, it can be predicted that the higher the level of social trust will be, the actual behaviors will rise up to 10% in men who can earn more than an average monthly income and live in families with 4 members or fewer. The intention to prepare will increase up to 12% in older people who live in less vulnerable areas, and the perceived preparedness of all participants with 4 or fewer family members will grow up to 14% in cases of raising each one unit in social trust score. These findings are consistent with the positive relationship between social trust and the public preparedness shown in previous studies (4, 9, 10, 14, 16, 20, 28). This is evidence to show that trust can prominently determine interpersonal relationships and social processes that may conduct a social behavior. Therefore, trust is necessary for deciding whether to prepare for a real or potential risk. Basolo and colleagues have identified trust as an important factor in risk and information sources management since it can increase the perceived preparedness for natural disasters (30). Some studies have also highlighted the importance of trust as a mediator in the relationship between individual and social factors through affecting the intention to prepare and to enforce a protective behavior. But they still emphasized more on the effect that is imposed by trust to the received information and to the technology providing that information on the intention to prepare or the mitigating actions. According to their results, this aspect of trust is more important than trust to the emergency authorities (17, 18, 31). Okazaki et al. have also confirmed the positive impact of increasing the reliability of information resources, because it can rise up adopting more protective actions (17).

From the perspective of various aspects of trust, which is, general trust and trust in urban authorities, some differences have been found with the results of other studies. In this regard, the influence of trust on the source of information and the empowerment of people as the result of that information, is also confirmed in the preparedness process (16), but there are also some reports that intention to prepare and the mitigation would significantly decrease in people if their trust to urban emergency management authorities was high (7, 19). In 2014, DeYoung also noted the repressive impact of trust to the government on self-efficacy of the community members and their preparedness for natural disasters as a consequence (18). Here, it may be argued that the communities were not prepared at all, did not feel the necessity of preparedness or even seek information about serious risks and hazards they are prone to, since they had an overwhelming confidence in their local authorities and delegated all responsibilities to them in this regard. This can be worse when it comes along with the lack of sense of belonging and local participation in the community. Although, these results are partly different from the findings of this study, this contradiction will be more reasonable if the differences in measuring the concept of trust is considered. In this research, social trust included a combination of two structures: general trust and trust in the Emergency management authorities that had a few questions about trust to hazard and preparedness information and its sources, while several previous studies (7, 17-19, 21, 30) examined only one aspect of trust. In comparison, it can be said that increasing general trust, trust in information and trust to the information resources can increase the community preparedness, but perhaps people's excessive trust to the authorities responsible for emergency situations will cause them to delegate their responsibilities to others and have less motivation for getting prepared.

Preparedness behaviors showed higher scores in less vulnerable areas, though, it can be concluded that people who live there, are more likely to be prepared against earthquake hazards because they think that preparedness could be efficient in reducing the risk and the consequences. This is consistent with the findings of previous studies (3, 32). Given that in the research background, risk perception of Tehran inhabitants was generally higher than average (7), it can be said that despite perceived risk of earthquake by the people who live in more vulnerable areas, they do not believe that preparedness can be effective in reducing the frequency and severity of the possible damages. This lack of belief in preparedness may derive from deficiencies in necessary information, low level of trust to the sources of relevant information, or to each other and to the authorities. The findings of this study indicated that social trust in the studied population was lower than average, which could somehow suggest one of the reasons why these people were not prepared at all.

Earthquake experience in the past, home ownership, income, marital status, job and education situation showed no significant effects -even when mediating with social trust- on any of the preparedness dimensions in this study, which is also contradictory to the findings of the previous studies (3, 7, 32). This finding highlights the importance of the impact of social environment mediators such as community participation in social activities, empowerment

and collective efficacy on forming the relationship between trust and preparedness. The results also suggest that changing a social behavior is not a possibility when considering only the individual characteristics, whereas the relationships in the social networks count to be more efficient. This reveals the capability of a social cognitive model, as a more cost benefit and effective way of predicting the factors that may affect utilizing the available resources to achieve an optimal social behavior in a target population. We must remember that natural hazards and communities at risk have unique characteristics that should be considered in all aspects of preparedness. The full recognition of the complex realities that people consider when referring to such factors requires more studies. Other research in this area has also pointed to this fact (7, 11, 16, 18, 22, 26-28).

In this study, researchers were faced with some limitations in spite of all the attempts to describe the factors affecting the preparedness of Tehran households against earthquakes. Those limitations include collecting data in a limited time period (cross-sectional study) due to time and budget constraints, the necessity of using a tool with so many questions, the length of the data gathering process (spending about 20-30 minutes per questionnaire with the presence of the inquirer and outdoors), and the time of doing it (winter of 2016) in extreme cold weather. For this reason, more research assistants contributed to the implementation process, and the expected timeframe for data collection was extended for more than two months due to interference with the New Year holidays.

## **5. Conclusions**

The findings of this study provided valuable information on the relationship between social trust and various dimensions of preparedness. So, in terms of applications, to improve the preparedness for earthquakes in the general public, planning for the programs that can change the process of social trust in the line of increasing it, is obviously important. Therefore, since we know a thorough and detailed review of the processes in the entire community is indisputable, it is suggested that future research be designed to focus on more precise identification and determination of social variables affecting the preparation in longitudinal studies (for considering the time factor) or an interventional program (to remove confounding factors and assess the direct impact of influencing factors), or research with a qualitative approach to examine the process and components of the social trust process in order to shape the intention and behavior of earthquake preparedness in the target community context. Also, given the obvious importance of social trust in public preparedness, it would be helpful to conduct a study that will examine and introduce the most appropriate way of distributing responsibilities related to disaster preparedness in a community in order to win the trust of its members.

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## **Conflict of Interest:**

There is no conflict of interest to be declared.

## **Authors' contributions:**

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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