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Examining the Relationships between Earthquake Preparedness Factors at Household Level
Case Study: Nakagyouku Communities, Kyoto City

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Synopsis

This study discusses the relationships between earthquake preparedness factors at household level. Three groups of variables of earthquake preparedness factors are examined in this paper, namely thinking and talking about earthquake, risk perception and intention to prepare. Two communities from Nakagyouku Ward, Kyoto City, Shuhachi and Jouson, were selected for this research. In each community, we analyze the relationships separately. We assume that those communities are different, where Shuhachi represents a community with an active *Jishu-bousai-soshiki or Jishubo*, mainly dominated with non-apartment houses while Jouson is a community where more apartment houses exist. After the analyses we found that there is not so significant difference identified between the two communities. In addition, the effects of *Jishubo* activities on the community were evaluated based on the variables of earthquake preparedness. Some suggestions with reference to the roles of *Jishubo* to increase earthquake preparedness at household level are also presented.

Keywords: earthquake preparedness, household, Kyoto, risk perception

1. Introduction

This study discusses the relationships between earthquake preparedness factors at household level. Many research studies have intended to find the relationships between risk perception, preparedness and household adjustments at household levels (Lindell and Whitney 2000; Matsuda and Okada 2007). Understanding the relationships among these factors is important to find ways to improve preparedness, for example by means of risk communication (Lindell and Perry 2000; Matsuda and Okada 2005). In many cases, it has been found that resident's preparedness is highly important to reduce the injuries when earthquake occurs.

Preparation at household level, like furniture's fastening, structural reinforcement, having torch or flashlight, storing food for a few days, is suggested very crucial during emergency situation after an earthquake. Arguably, when a big disaster and sudden disaster, like an earthquake, hit the community as well as the households need to be prepared themselves because the assistance from the government could be late due to the failure of infrastructures, difficult access and less resources.

Okada and Matsuda (2005) proposed to consider a multilateral knowledge development for risk communication to increase preparedness at household and local level. This is carried out in the context of promoting self-help management for earthquake risk. Moreover, they identified the roles of citizens, NPOs and researchers to be carried out

together. The three stakeholders have each own capacity and capability to increase people's ability to prepare.

After the 1995 Hanshin – Kobe Earthquake, the non private organization and voluntary activities have ever since emerged in Japan (Shaw and Goda 2004). The NPOs have been promoting and carrying out activities, disaster campaign and disaster drills throughout the country.

The emergence of the NPO and voluntary activities in Japan is noted by the activities run by *Jishu-bousai-soshiki*. The *Jishu-bousai-soshiki*, or *Jishubo* for short, literally meaning "autonomous organization for disaster reduction" is a neighborhood association for disaster preparedness and rescue activity at the community level in Japan (Bajek *et al*., 2008). *Jishubo* is a local organization run at neighborhood level. Since then, the *Jishubo* organizations have been emerging and been set up after the Great Hanshin – Kobe Earthquake. In the quiescence situation, when disaster does not happen, the role of *Jishu-bousai-soshiki* is to run risk communication activities, i.e.: public education, disaster drills and workshops.

There has been few research conducted to assess the effect of *Jishubo* on the society. Assessment is important in order to understand whether the the *Jishubo* has caused significant impact on the increase the preparedness of the communities or not. Thus, the main objective of this research is to make a comparison between a community that has experienced disaster education and other community that has not experienced disaster education in the context of risk perception and preparedness.

2. Methodology

The data was based on the questionnaire-based survey we conducted in July 2007 about social resilience in two neighborhoods of Nakagyouku Wards, Kyoto, namely: Shuhachi and Jouson (see Figure 1 for the location of Nakagyouku in Kyoto City). The questionnaire followed and adapted those of Paton's questionnaire which was earlier used in the context of New Zealand. We tailored the questionnaire to the Japanese context and cultural differences.. Originally the questionnaire was intended to check the preparedness at individual level. However as nature of distributing the data (one household accepted only one questionnaire) and that each individual could represent his/her family in response to disaster (see Lindell and Whitney 2000), arguably the data obtained from the questionnaire were assumed to able to represent factors at household level.

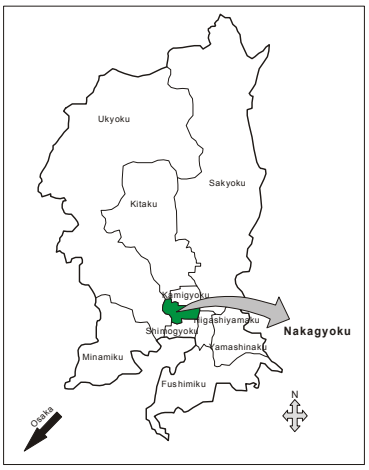

Figure 1. Location of Nakagyouku in Kyoto City

The number of questionnaires sent to the respondents was 1,000 and 950 in Shuhachi and Jouson, respectively. The response rate was 152 or about 15.2% in Shuhachi, while in Jouson the response rate was 108 or about 11.4%.

2.1 Hypotheses

This study aims to check several hypotheses which were developed in order to test the relationships between factors affecting the intention to prepare. The hypotheses are developed based on the following literature review:

1. *Discussion with peers or "talking about disaster" affects people's risk perception and preparedness*. Turner and colleagues (1986) studied residents of earthquake prone Southern California and found that "discussion of earthquake topics" with peers was positively correlated with earthquake fear, perceived danger, personal understanding of the earthquake threat, and household preparedness. Similarly, study by Mileti and O'Brien (1992) about California earthquake preparedness found that adoption of hazard adjustments after the Loma Prieta (San Francisco)

earthquake was related to social contacts that produced higher levels of information quality (number of messages, message specificity, and message consistency). Based on this background we check the relationships between variables "talking about earthquake issues" and variables related with risk perception and intention.

2. *Thinking about disaster issues affects people's risk perception and preparedness*. We assume that the more a person think about disaster issue, the more likely he will have higher risk perception and the higher will be the intention to prepare. This hypothesis is tested by checking the relationship between variable "thinking about earthquake issues" and variables related with risk perception and preparedness.
3. *People's risk perception has a high relationship with intention to prepare*. Lindell and Whitney (2000) conducted a literature review which assumed that risk perception is related with the intention to prepare.
4. *There are significant differences of earthquake preparedness factors between Shuhachi and Jouson Communities*. We assumed that both communities have different characteristics, mainly because of the existence of active *Jishu-bo* in Shuhachi, and minor differences in their characteristics which are formed due to the distance to the city center.

2.2 Variables

Having the above hypotheses, we continue by defining what variables are used in order to check the relationships. We use three groups of variables in the questionnaire: talking and thinking about earthquake issues, risk perception and intention.

The first group of variables is critical awareness. Critical awareness is related to how often someone thinks and talks about disaster issues. The more he/she thinks and talks about disaster issues, the more likely he will be involved in activities to reduce disaster. In this group, we select three questions: "thinking about earthquake issues", "talking about earthquake issues inside of the communities", and "talking about earthquake issues outside of the communities".

"Thinking about earthquake issues" is measured using frequency from 1 to 6 ranging from never to once a week (1 = never, 2 = rarely, 3 = a few times a year, 4 = once a month, 5 = a few times a week, 6 = once a week). "Talking about earthquake issues inside and outside of the communities" is also measured using frequency, from 1 to 6, ranging from never to once a week. By measuring this variable, we aimed to identify how often the respondents talked about the earthquake issues. The more you talked about the issue, the more you wanted to do preparedness against the earthquake risk because it has become one of the priorities.

The second group of variables represents people's risk perception taken from negative outcome expectancy scales, which includes "earthquake is too destructive to bother preparing for" and "a serious earthquake is unlikely to occur in my lifetime". The former variable aims to measure whether the respondents perceived that there are not many things could be done to reduce an earthquake, while the latter is related to the fact whether the respondents have an assumption that the big earthquake will not hit. Thus it is expected that a respondent who assumed that big earthquake will not hit is less likely to adopt preparedness against earthquake. All these two factors are measured using 1 – 5 Likert Scale (1 = strongly disagree and 5 = strongly agree).

The third group of variables is intention, which is measured by means of variables related to intention as suggested by Lindell and Whitney (2000). In this research we tested following variables: "the intention to increase the level of preparedness", "check the level of preparedness", "become involved with local group", "seek information about earthquake risk and "seek information about earthquake preparedness". The first two variables are related with whether the respondents are willing to strengthen the quality of the current preparedness. The response in this variable illustrates about a continuing activity to increase the preparedness. In relation to that, "check the level of preparedness" aims to identify whether the respondents want to understand the current quality of preparedness that has been carried out.

Variable "become involved with local group" is aimed to measure whether the respondents intend to join or have joined any activities, like *Jishubo*, in order to reduce the risks. Variables "seek information about earthquake risk" and "seek information about earthquake preparedness" aim to measure whether the respondent actively eager to get more knowledge on how to deal with the risk. All these variables were measured with four scales: "no", "probably", "definitely" or "have done".

3. Study Area

Nakagyo ward (*Nakagyoku*) is a district in Kyoto City, with the area of 7.38 km^2, which is located from the center to the north west of the down town of Kyoto City. The land use in this ward consists of government and municipal offices, politics and economics organization, financial institutions, shopping area, houses and apartments. Shuhachi and Jouson are among 25 school districts (*gakku*) in this ward. Shuhachi is located in the western most of this ward, while Jouson is located closer to the down town. There are more apartments and high rise buildings in Jouson than in Shuhachi. Shuhachi is larger than Jouson in terms of area and population. In fact, the area of Shuhachi is the largest in this ward, which is

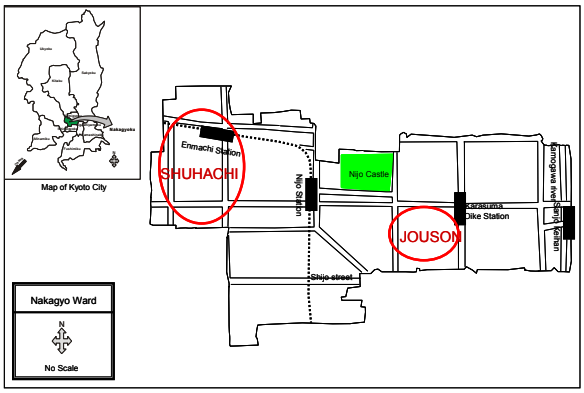

Figure 2. Location of the study area

1.055 km^2 with the population of 10,939 people.On the other hand, Jouson is 0.224 km^2, with the population of 4,146 people (by February 2005). The location of the study area is shown in Figure 2.

Another different characteristic found between Shuhachi and Jouson is the existence of activities of *Jishu-bousai-soshiki*. Shuhachi has more active *Jishu-bousai-soshiki* than Jouson. In Shuhachi, the member of 18 people, they regularly hold internal meetings, as well as the meetings with the leaders of sub-neighborhood (leaders of *chonaikai*), and the Shuhachi community's fire brigade (*shoubodan*).

They also distribute fire extinguishers to the whole community (one every several households), and maintain the disaster prevention equipments provided by Kyoto City in a special storage.

Table 1 Demographic characteristic of respondents

Characteristics		S	J	Characteristics		S	J
Age	below 30	12.3%	15.4%	**Occupation**	company employee	10.5%	24.5%
	30-40	8.2%	12.5%		government official, teaching staff	4.9%	4.9%
	40-50	15.1%	14.4%		businessman	17.5%	21.6%
	50-60	19.9%	20.2%		farmer	1.4%	0.0%
	60-64	8.2%	11.5%		housewife	9.8%	8.8%
	65-70	12.3%	9.6%		part-time job	8.4%	4.9%
	more than 70	24.0%	16.3%		unemployed	8.4%	7.8%
					a pensioner	24.5%	14.7%
Gender	Male	51.7%	47.2%		student	9.8%	9.8%
	Female	48.3%	48.1%		other	4.9%	2.9%
Annual Income (Million Yen)	0-2	28.47%	21.88%	**Type of house**	House	61.97%	40.74%
	2.01 - 4	30.66%	23.96%		Apartment	38.03%	52.78%
	4.01-6	20.44%	17.71%				
	6.01-8	7.30%	12.50%	**House Structure**	wooden	53.85%	32.35%
	8.01-10	7.30%	9.38%		concrete made	46.15%	67.65%
	10.01-12	2.19%	4.17%				
	12.01-14	2.19%	1.04%				
	14.01-	1.46%	9.38%	S = Shuhachi	J = Jouson		

Once a year, they hold an assessment and orientation about disaster prevention knowledge for the newly elected leaders of *chonaikai*, an evacuation drill involving the whole community (in cooperation with *shoubodan*), and *Jizoubon* festival where they do disaster education to children in the community.

From our study sample, some different demographic characteristics are also found, as shown in Table 1. In terms of gender, both samples in Shuhachi and Jouson are fairly equal between male and female. The ages of people in Shuhachi are generally older, where mostly are retired, while in Jouson are younger and mostly are company employees.

From the sample, most of respondents from Jouson live in concrete-structured buildings, while the ones from Shuhachi mostly live in wooden-structured buildings. This supported the fact about the respondents in Jouson with more people living in apartments (52.78% compared to the ones who stay in houses), and they have lived here in shorter period than in Shuhachi.

Shuhachi samples consist of people that live in apartments with 35.53%. Logically this makes sense since usually old Japanese houses are wooden-structured and generally the people in Shuhachi is older than people in Jouson, and Jouson is located closer to the center of business district, where the development of high-rised buildings and apartments are faster than the farther districts.

4. Results and Discussions

This section discusses the results of questionnaire survey for all variables from Shuhachi and Jouson communities and the relationships that we found from the data analyses in Shuhachi and Jouson Communities. The results of the questionnaires from the first, second, and third groups of variables are shown in Figures 3, 4, and 5 respectively.

From those figures we can see the cumulative frequencies of each variable in each community and the distribution of the data.

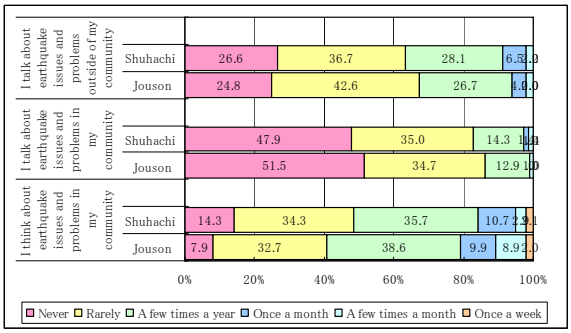

Figure 3 Result of Questionnaires for variables related to Thinking and Talking about Earthquake Issues in Communities

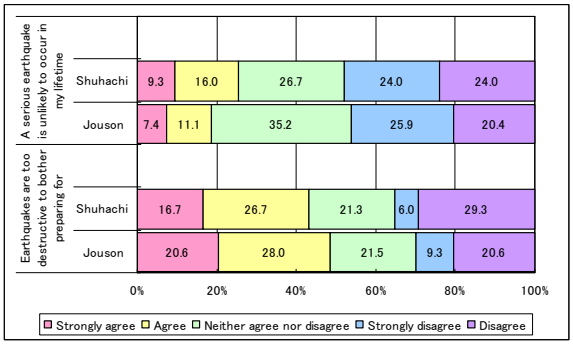

Figure 4 Result of questionnaires for variables related to Risk Perception

As for the relationships between variables, we will refer to the set of hypotheses we mentioned earlier and then examine them in each community.

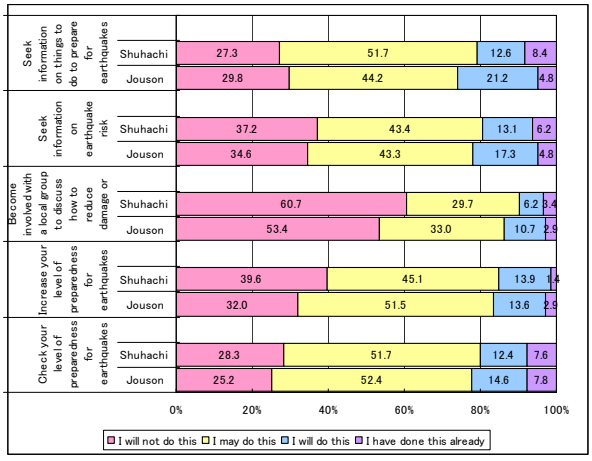

Figure 5 Result of questionnaires for variables related to Intention

4.1 Set of Hypothesis 1: Relationship between Discussion with Risk Perception

The set of hypothesis 1 is that "the less frequent a person talks about the earthquake issues,

the lower the risk perception he/she has". This hypothesis is divided into two sub-hypotheses according to types of risk perception as we discussed earlier (sec. 2.2): "earthquake is too destructive to bother preparing for" and "a serious earthquake is unlikely to occur in my lifetime". As for talking about the earthquake issues, there are two types in each sub-hypothesis: talking inside and outside communities. Finally, the relationships of all variables were examined using statistical tests.

The first sub-hypothesis aims to test the relationship between "talking about earthquake issues" inside and outside of the communities and the perception that "earthquake is too destructive to bother preparing for". Given that the responses provided by the two communities show a small number of people who talk about the earthquake issues, we select the responses based on those whose responses are "never" and "rarely". In a similar way, we examined the responses from variable "earthquake is too destructive to bother preparing for" from the answers to "strongly agree" or "agree".

We discuss about talking about earthquake issues inside communities first. There is no relationship between these two variables in Shuhachi as shown by the significant value of p = 0.88 (df = 16, $\chi^2 = 9.59$), while significant relationship is found in Jouson as shown by p = 0.08 (df = 12, $\chi^2 = 19.19$). In Shuhachi, out of the respondents who "talk about earthquake issues within communities" for "never" and "rarely" there are 32.2% who "strongly agree" or "agree" that "earthquake is too destructive too bother preparing for". On the other hand, those who gave similar responses in Jouson are about 35.2%. This implies that there is a similar characteristic in the two communities in term of the relationship between talking about earthquake issues and perception that earthquake is too destructive to bother preparing for. From a closer look at the Shuhachi community data, we found that the distribution of people who claimed agree or disagree with this statement are almost the same. This implies that the risk perception in Shuhachi is higher than that of Jouson. This fact brings us into a new insight that there is another factor, besides talking inside the communities, which is related to or influence the value of risk perception. *Jishubo* might have influenced in increasing the risk perception of people in Shuhachi, though the influence of the *Jishubo* activities might have not caused people to talk about earthquake issue more often. However we need to check the role of *Jishubo* more careful as other factors such as media and campaign from the government could play other role. On the other hand, the case in Jouson reflects the relationships that the less frequent people talk about earthquake issues, the lower the risk perception is.

There is no significant relationship we found between variable "talking earthquake issues outside of the community" and "earthquake is too destructive too bother preparing for" in both Shuhachi and Jouson communities (Shuhachi: p = 0.18, df = 16, $\chi^2 = 20.85$ while Jouson p = 0.24, df = 16, $\chi^2 = 19.16$). The communities in Shuhachi who "never" and "rarely" talk about earthquake issues outside of the communities and "agree" or "strongly agree" that earthquake is too destructive too bother preparing for are about 28.3%. Similar number is also found for Jouson community which is about 29.8%. This implies that there is no difference between the patterns in Shuhachi and in Jouson.

Sub-hypothesis 2 examines the relationship between variables "talking about earthquake issues" and "a serious earthquake is unlikely to occur in my lifetime". Same as earlier, again we sum up the respondents who "never" and "rarely" talk about earthquake issues inside the communities because only a few people talk about earthquake issues. In similar analysis, we make a distinct for talking "within the communities" and "outside the communities". We discuss talking "within the communities" first.

There is no significant relationship between talking about earthquake issue inside the community and perception that "a serious earthquake is unlikely to occur in my lifetime" in Shuhachi (p = 0.97, df = 16, $\chi^2 = 6.84$) while there is a significant relationship found in Jouson (p

= 0.08, df = 12, $\chi^2 = 19.47$). In Shuhachi, the communities who "rarely" and "never" about "talk about earthquake issues outside of the communities and "agree" and "strongly agree" that "a serious earthquake is unlikely to occur in my lifetime" are about 20.8%. In Jouson, there are about 13% respondents who gave such responses. Smaller number in Jouson implies that lesser people in Jouson who talk about the earthquake issues think that a serious earthquake is unlikely to occur.

A closer look at the Shuhachi community data again show that the distributions of people who either agree or disagree with the statement that "a serious earthquake is unlikely to occur" are almost the same. The risk perception of respondents in Shuhachi in general is more evenly distributed and thus higher than the risk perception of respondents in Jouson. Our assumption is again due to the existence of active *Jishubo* in Shuhachi which increase the risk perception of the people. In Jouson, the hypothesis is proven by the fact that many people less frequently talked about earthquake issues inside of the communities and more respondents with a low risk perception were found.

There is no significant relationship between variable "talking about earthquake issues outside of the communities" and variable "a serious earthquake is unlikely to occur" in both Shuhachi and Jouson communities (Shuhachi: p = 0.187, df = 16, $\chi^2 = 20.79$, Jouson: p = 0.240, df = 16, $\chi^2 = 19.61$). The number of respondents who talk about earthquake issues outside of the communities and think that a serious earthquake is unlikely to occur in Shuhachi is about 19.6%. On the other hand, the number of respondents in Jouson from the same variable is about 12%. Both data of talking earthquake issues outside of Shuhachi and Jouson communities illustrate that there is another factor related to and influence the risk perception.

To conclude, the discussions of hypothesis 1 reveal that there is a pattern we found in Jouson community that "the less frequent people talk about earthquake issues inside of the communities, the lower their risk perception is". However, we do not find this case in Shuhachi. The difference could be due to the existence and influence of *Jishubo* activities in this community. The fact that still less people talk about earthquake issues in the community reveal that the *Jishubo* activities have not influenced people to put disaster and disaster preparedness into their top priority. In Jouson, it is obvious that less people talk about earthquake issue inside of the communities and therefore lower risk perception is found.

None of the relationships between talking outside of the communities and the risk perception is significant in both Shuhachi and Jouson. Thus, so far we could conclude that the risk perception of the people is not influenced by or related with the talking outside of the communities.

4.2 Set of Hypothesis 2: Relationship between Thinking about Disaster with Risk Perception

Hypothesis 2 is developed based on the idea that the more people think about disaster issues the higher their risk perception is. In this context we checked the relationship between the variable related to thinking about earthquake issues and the other two variables related to risk perception: "earthquake is too destructive to bother preparing for" and "a serious earthquake is unlikely to occur in my lifetime".

There is a significant relationship between "thinking about earthquake issues" and "earthquake is too destructive to bother preparing for" in Jouson (df = 20, $\chi^2 = 36.381$, p = 0.014), while not in Shuhachi (df = 20, $\chi^2 = 23.506$, p = 0.265). A closer look into the data reveals that more answer is concentrated in "disagree" in Shuhachi. This means more people who have higher risk perception and more thinking in Shuhachi. On the other hand, the pattern at the Jouson community is more visible. We found that people who think earthquake issue more frequently have higher risk perception.

In Shuhachi, there are about 19.5% respondents who "never" and "rarely" think about the earthquake issues "agree" and "strongly agree" that "earthquake is too destructive to bother preparing for", whereas in Jouson, a smaller number is found. There are about 15.0% of people who "never" and

"rarely" think about the earthquake issues "disagree" and "strongly disagree" that "earthquake is too destructive to bother preparing for".

The relationship between "thinking about earthquake issues" and "a serious earthquake is unlikely to occur in my lifetime" is significant in Shuhachi (df = 20, $\chi^2 = 36.85$, p = 0.012) but not in Jouson (df = 20, $\chi^2 = 20.48$, p = 0.428). The pattern of this relationship is obvious in Shuhachi. It is found that people in Shuhachi think more frequently and have higher risk perception. In Jouson, however, we found a more distributed data. This means that the more frequent people think about earthquake issues does not mean that the higher risk perception is. It is found from the data that the risk perception value is more scattered.

In Shuhachi, there are about 14.4% respondents who "rarely" and "never" think about earthquake issues and "strongly agree" and "agree" that "a serious earthquake is unlikely to occur in lifetime", while there are only about 8.0% of their counterpart in Jouson.

To conclude, the discussions on hypothesis two indicate several findings as follows. In Jouson we found the pattern of the relationship between variable thinking about earthquake issues and variable earthquake is too destructive to bother preparing for. In Shuhachi, the relationships are found between variable thinking about earthquake issues and variable a serious earthquake is unlikely to occur in my lifetime. People in Shuhachi think more frequent about earthquake issue and have higher risk perception on this compared to people in Jouson. This is particularly observable due to the activity of Jishubo which emphasize on the coming of next earthquake to Kyoto (presentation by Ota, 2008).

4.3 Set of Hypothesis 3: Relationship between Talking about Earthquake Issues with Intentions

Hypothesis 3 discusses about the relationship between "talking about earthquake issues" and intention variables. Lindell and Whitney (2000) suggest that intention is used to measure preparedness. As used earlier, talking about earthquake issues consist of talking inside and outside of the communities. Variables related to intention consist of five variables: "check the level or preparedness", "increase the level of preparedness", "involve with local organization", "seek information about earthquake risk" and "seek information on things to do to prepare for earthquake". In this section we discuss the relationship among above variables.

Like in the previous sections, due to the low number of people who "talk about earthquake issues" in both cases, we select among those who response on "rarely" and "never". The respondents on variable intention are measured by those who provided "no" as responses. In the relationship with the intention, the lesser people ("rarely" and "never") talk about earthquake issues, the smaller their intention to do earthquake preparedness is.

Table 2 Results of hypotheses 3 testing

There is a strong relationship between talking inside the communities and intention in Shuhachi (see table 2 on part of inside of the communities).

Relationships between Variables		Talking about earthquake issues			
		Inside of the communities		Outside of the communities	
		S	**J**	**S**	**J**
Check the level of preparedness	χ^2	29.18	16.93	22.06	15.70
	df	12	9	12	12
	p	0.004	0.5	0.037	0.20
Increase the level of preparedness	χ^2	23.30	10.39	34.40	18.67
	df	12	9	12	12
	p	0.025	0.319	0.001	0.09
Become involved with a local group for disaster reduction	χ^2	51.89	14.23	22.20	12.86
	df	12	9	12	12
	p	0.000	0.114	0.035	0.37
Seek information about earthquake risks	χ^2	37.04	6.649	33.23	7.884
	df	12	9	12	12
	p	0.000	0.674	0.001	0.79
Seek information about earthquake preparedness	χ^2	29.90	9.89	22.08	9.07
	df	12	9	12	12
	p	0.003	0.359	0.037	0.697

All variables of intention significantly correlate with "talking about earthquake issues inside communities" in Shuhachi (all p values are < 0.05) while no significant correlation is found for Jouson. These data indicate a strong correlation between talking about earthquake issues inside the communities and the intention to prepare for earthquake disaster.

When we examined more closely, it was found the reason of this significant value. The respondents mainly answered either "I will not" or "I may" for the variables related to intention. For example, the answers on intention to prepare for earthquake disaster are "I will not" and "I may" with about 28.3% and 52.3% respondents respectively.

As discussed earlier, for the variables related to talking, either inside or outside of the communities, many respondents answer either "rarely" or "never". This means that the significant relationship is due to less frequent of people talking about earthquake issues and less intention do they have to prepare.

These data suggest a low level of intention to prepare and a large number of people who less frequently talk about earthquake issues. As a result high correlation exists between talking inside the communities and intention to prepare, for Shuhachi community.

In Jouson community, however, we found more people say either "I will do" or "I have done" in respect to intention do earthquake preparedness. This finding does not follow the theory of "the more frequent people talk about earthquake issue, the more their intention to prepare is". As a result, the correlation value is low. On the other hand this finding reveals that more people who have intention in Jouson than people in Shuhachi.

Similar pattern is found for relationships between variable talking outside of the communities and variables of intention. There are very significant relationships between those variables in Shuhachi while not in Jouson (see table 2 on part of outside of the communities; all p < 0.05). Because the majority of respondents in Shuhachi talk less frequently about earthquake issues, these data again suggest that majority of the people have a low level of intention. On the other hand, the case is different in Jouson, where we found a few number of people have intention ("will do" and "have done") to prepare for earthquake.

4.4 Hypothesis 4: There are Significant Differences of Earthquake Preparedness Factors between Shuhachi and Jouson Communities

In order to test whether there are significant differences of earthquake preparedness factors between Shuhachi and Jouson communities, we analyze the differences of each variable by using Mean Rank analysis. We also tested each variable from both communities, assuming that both communities are independent, by using Mann-Whitney U test with the significant value of $p \leq 0.1$.

The results of mean rank analyses are shown in Table 3. As for the first group of variables (thinking and talking about earthquake issues), although Jouson has slightly higher scores compared to Shuhachi, in average they are similar, which implies that the frequencies of thinking and talking about earthquake are the same for both communities. The same can be said for the third group of variables, which shows how much people intend to do something for their preparedness

Table 3 Result of mean rank analyses

Variables	Mean	
	S	J
Thinking & Talking about Earthquake (Scale 1 – 6)		
I think about earthquake problems in my community	2.6	2.85
I talk about earthquake issues and problems in my community	1.64	1.73
I talk about earthquake issues and problems outside my community	2.16	2.21
Risk Perception (Scale 1 – 5)		
Earthquakes are too destructive to bother preparing for	3.18	3.29
A serious earthquake is unliketo occur in my lifetime	2.63	2.54
Intention (Scale 1 – 4)		
Check the level of preparedness	2.02	2.1
Increase the level of preparedness	1.88	1.92
Become involved with a local group for disaster reduction	1.52	1.63
Seek information on things to do to prepare for earthquake	1.77	1.87
Seek information on earthquake risk	1.99	2.04

S: Shuhachi J: Jouson

against earthquake. The score of intention for Jouson communities is slightly bigger than that of Shuhachi.

In the second group of variables, the average of people in Jouson who agree that earthquake is too destructive to bother to prepare for is higher, which indicates lower risk perception in relations with their motivation to prepare. While in Shuhachi communities, lower risk perception whether an earthquake is likely to occur, is found compared to the risk perception in Jouson communities.

By the scores of mean rank as shown in Table 3, we found that both communities have similar patterns of means in each variable of preparedness factors in household level. However it should be made clear that these scores could not represent the distributions of the data as we could see in chi-square analysis.

These results of the mean rank analyses are also supported by Mann-Whitney statistical significance tests, as shown in Table 4.

As we can see from the table, the result of Mann-Whitney U test is that none of the variables is lower than the level of significance, which in other words, Shuhachi and Jouson communities are not different in terms of preparedness in household level.

Table 4 Result of Mann-Whitney U test

Test Statistics

Variables	Mann-Whitney U	Asymp. Sig. (2-tailed)
Thinking & Talking about Earthquake (Scale 1 – 6)		
I think about earthquake problems in my community	6234	.101
I talk about earthquake issues and problems in my community	6722	.475
I talk about earthquake issues and problems outside my community	6854	.742
Risk Perception (Scale 1 – 5)		
Earthquakes are too destructive to bother preparing for	7561	.417
A serious earthquake is unlikely to occur in my lifetime	7820	.626
Intention (Scale 1 – 4)		
Check the level of preparedness	7172	.562
Increase the level of preparedness	6871	.283
Become involved with a local group for disaster reduction	6874	.227
Seek information on things to do to prepare for earthquake	7281	.620
Seek information on earthquake risk	7403	.948

Finally, we can conclude that, through mean rank analyses and Mann-Whitney U test, there is no significant difference of earthquake preparedness factors between Shuhachi and Jouson communities. This means that the hypothesis we have made based on the assumption that the existence of *Jishubo* might influence the preparedness of Shuhachi communities is not proven.

5. Conclusions

The results of this study show that in general, people in both communities talk and think less frequent about earthquake issues in their communities. Therefore, earthquake issues are not considered important or as the priority for them. They also show very low intention for preparedness. In general, there are less than 26% people who stated “will do” and “have done this already” for this variable. However, the level of their risk perception is not low in both communities. As an illustration, the frequency of people who answered “strongly disagree” and “disagree” in the variable of “A serious earthquake is unlikely to occur in my life time” are 48% in Shuhachi and 46.3% in Jouson.

From the first hypothesis testing, it is proven in Jouson that there is a relationship between talking about earthquake issues inside of the communities with risk perception. While in Shuhachi, it is not proven, due to the fairly distributed data between the people who never and rarely talk and people who often talk about earthquake issues. Perhaps there are some influences of *Jishubo* activities to this variable.

If we look at Figure 3, we will see that both communities talk more to outside than to inside of their communities. We suppose that this related to the fact that there are more people who spend their times outside than the people who spend times inside of their communities (see Table 1). In spite of that, there is no relationship between talking outside of their communities with risk perception. For instance, a person who frequently talks about earthquake issues outside of their communities does not mean having a high risk perception.

As for the second hypothesis testing, we found

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that it was proven in Jouson that there is a significant relationship between thinking about earthquake problems and risk perception regarding to willingness to prepare. And in Shuhachi it was proven that there is a relationship between thinking about earthquake problems and risk perception. We suppose that this is due to the existence of activities or some information about earthquake preparedness provided by *Jishubo* in Shuhachi.

In the third hypothesis testing, the relationship was significantly proven for all variables in Shuhachi, but not in Jouson. This is due to an obvious pattern shown by Shuhachi respondents that people who less frequently talk about earthquake issues have low intention to prepare for earthquake. While in Jouson's case, the pattern is not clear. For instance, there are some people who rarely talk about earthquake issues, but at the same time they have high intention to prepare.

From the results that we have discussed above, we found that Jishubo activities, such as providing some information about earthquake and preparedness and holding earthquake drills once a year, have played the role in enhancing risk perception of the people in Shuhachi, which we could see from the relationship in thinking and risk perception.

However, the activities have not resulted into a higher frequency of discussion about earthquake issues within communities, which actually has a significantly high relationship with the intention to prepare. That is, people who discuss more frequent about earthquake issues tend to have higher intention to prepare for earthquake.

Lastly, from the fourth hypothesis testing, we also found that there is no significant difference between Shuhachi and Jouson communities in relation to earthquake preparedness factors in household level.

In conclusion we argue that Jishubo plays an important role in increasing the earthquake awareness in Shuhachi, but it has to be assessed how it can enhance the intention to prepare for earthquake of the each household in the community. As Bajek (2007) stated, people in Shuhachi is more resilient as a community, rather than as individuals. Based on this and the result of our study, and as also supported by the evidence of some activities held by Jishubo in Shuhachi, we suggest with the existence of Jishubo, some efforts to enhance the participation of the whole community in their activities and the method to convince people about earthquake preparedness in each household need to be done. Thus, at first the effectiveness of Jishu Bousai Soshiki activities in Shuhachi community needs to be evaluated.

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世帯レベルにおける地震への備え要因間の関連性検証：京都府中京区のコミュニティを事例に

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要　旨

本研究では,世帯レベルでの地震への備えに関する，複数要因の関係を検証する。変数グループを含む地震への備え要因として「地震に関連した会話や思考」,「リスク認知」と「備える意図」の三つを設定した。また，研究対象として，京都市中京区に存在する朱八学区と城巽学区におけるコミュニティを選定した。

朱八は一戸建てが多く，活発な自主防災組織（自主防）が存在する一方で，城巽はマンションが多いという特徴を持つ。そのため，城巽における社会的一体性は朱八より脆弱であると想定しが、分析の結果両者に大きな差異は認められなかった。さらに、自主防の活動がコミュニティに及ぼす影響を、地震への備え要因に基づいて評価した。最後に、自主防の役割を考察し，世帯レベルにおける地震への備えを向上させる提案を行った。

キーワード：地震への備え，世帯，中京区，京都，リスク認知