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Relevance Analysis between Indirect Disaster Experience and Household Earthquake Preparedness

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Synopsis

This paper discusses household earthquake preparedness triggered by indirect disaster experience. A questionnaire survey was conducted to figure out the relevance between the attributes of experiences (distance to the impacted site and hazard type) and types of earthquake countermeasures adopted after indirect disaster experiences. Using two indicators, i.e., initial and triggered adoption rates, it has been found that 1) disasters occurred in one's neighborhood induce more households' countermeasure adoptions; and that 2) countermeasures with low broad-sense cost are more easily adopted after indirect experience. Local circumstances also make significant difference in people's preparedness before and after indirect disaster experience.

Keywords: indirect disaster experience, earthquake countermeasures, household preparedness, questionnaire survey, relevance analysis

1. Introduction

In seismic prone regions such as the Tokai and Tonankai coasts in Japan or the Pacific coast of the United States, household preparedness for an earthquake is an important issue (Ronan and Johnston, 2004). However, in many countries, governments still struggle with residents' low execution rate of earthquake countermeasures. Many research works have addressed this apparent human nature such that "I am not prepared for it although I know an earthquake will occur in the future". This nature is explained by empirical data, and psychological theories such as cognitive dissonance (Katada et. al., 2003).

On the other hand, it is also known as a human nature that people's awareness of preparation for future disasters tends to increase when they indirectly observe a disaster impact in other places through media, or see and hear directly what happened in their neighborhood. A newspaper reported that after the Niigata Chuetsu (the mid Niigata) Earthquake in 2004, the number of requests of seismic diagnosis and the sales of emergency kits increased sharply. Such social phenomena may be interpreted as follows: Motivation for disaster preparedness become stronger when they happen to simulate a disaster as a self-experience, or when they become nervous about possible earthquakes after they observed others suffering a tragedy.

In this paper, such observed or near disasters for a certain individual are called *indirect disaster experience.* As shown by the Sumatra Tsunami and Hurricane Katrina, it is quite common in a modern society that disaster news spread worldwide in a moment. Indirect disaster experience includes such indirect observation of remote disasters through the globally-networked media and near disasters which occurred in one's close neighborhood. Note that such indirect experience is distinguished from *direct* disaster experience which is obtained through the personal impact of the disaster imposed on him/her.

The final goal of this research is to present effective strategies to improve household earthquake preparedness by making best use of the opportunity of indirect disaster experience. For this purpose, the paper aims to clarify the

relevance between the attributes of indirect disasters experience and household earthquake countermeasure adoptions, under the assumption that indirect disaster experience triggers some new mitigation actions.

On September 5, 2004, the Off-shore Kii Peninsula Earthquake occurred. The earthquake threatened residents along Tokai and Tonankai coasts since its epicenter was close to that of Tokai-Tonankai Earthquake, which is expected to cause immense impact on this area. The authors conducted a questionnaire survey in the two towns in the area to ask whether the respondents had adopted new earthquake countermeasures or whether the earthquake event had triggered to change their attitudes towards future earthquakes. As other possible triggers, major disasters occurred in 2004 were listed: Typhoon No. 23, Niigata Chuetsu (the mid Niigata) Earthquake and Sumatra Tsunami. Based on the results, we examine the relevance between the attributes of indirect disaster experience (distance to the impacted site and hazard type) and that of earthquake countermeasures adopted after the experience. In Chapter 3, we clarify influencing trigger disasters by descriptive statistics of the data. In Chapter 4, two indicators of initial and triggered earthquake countermeasure adoption rates are introduced to classify earthquake countermeasures. Comparison of the two study areas is also presented to illustrate the local factors from the view point of efficient use of indirect disaster experience. In Chapter 5, we investigate the interaction of attitude change on earthquake countermeasures.

2. Proactive countermeasures for earthquake disasters

2.1 Effectiveness, priority and prevalence of household earthquake countermeasures

The Fire Defense Agency in Japan (2006) lists up the following 10 items in Table 1 as family earthquake countermeasures. As is the case with Table 1, these lists usually do not show each countermeasure's effectiveness or priority. This is partly because the priority of the countermeasures largely depends on local circumstances. Additionally there are not many examples of publicized information on evaluating effectiveness of earthquake countermeasures. In Japan, it is believed that furniture fixation and house reinforcement are the major practices to be promoted for residents. The rationale is that more than 80% of victims were crushed to death in the Hanshin-Awaji (Kobe) Earthquake in 1995. However, this lesson is not fully taken into account at practical level. The surveys by Shizuoka (2005) and Mie (2005) Prefectures (both are potentially impacted area of Tokai-Tonankai Eq.) presented that such countermeasures for houses are hardly prevailed as compared with other actions such as storages.

Table 1 List of earthquake countermeasures for households

Countermeasures
1. Disaster drill
2. Family planning
3. House reinforcement
4. Reinforcement on block fences
5. Furniture fixation, prevention from falling
6. Fire extinguisher
7. Storage of emergency foods and tools
8. Prevention of fires
9. Emergency communication means

In the United States, Ronan and Johnston (2004) explained Lindell and Perrys' (2000) review on the 23 works on earthquake adjustments. They said that "knowledge-based adjustments are generally more prevalent than those that require some form of behavioral activity or expenditure of resources including effort, time, money, or skill". They summarize the result such that the amount of "effort" required for adjustments determine their prevalence. This fact is consistent with Japanese cases. As stated above, empirical data show that prevalence of earthquake countermeasures are determined by the costs in the broad sense (financial, psychological, and time). High-cost countermeasures have high effectiveness but tend to be low in prevalence and vice versa. This tendency is supported by the results explained later.

In this paper, we postulate that indirect disaster experience has a certain effect to reduce the broadly defined costs of adopting earthquake countermeasures, at least temporally, thus letting down the barrier in adopting new preparedness actions.

2.2 The List of earthquake countermeasures

Based on the above literature review of related research and additional interviews conducted by the authors collaborated by a disaster mitigation oriented

non-profit organization, we listed 10 earthquake countermeasures for our consideration (see Table2). We divide them into three behavioral types; *storage*, *house safety* and *information*.

3. Survey design and basic statistics

3.1 Survey design

(1) Trigger disasters and study area

The Off-shore Kii Peninsula Earthquake which occurred on September 5, 2004, was a twin earthquake consisting of two quakes (The Fire Defense Agency, 2005) (Fig. 1).

- The 1st quake: initiated at 19:07, maximum JMA seismic intensity was 5 lower, M6.9, and 6 are slightly injured.
- The 2nd quake: initiated at 23:57, maximum JMA seismic intensity was 5 lower, M7.4, 6 are seriously injured, 30 are slightly injured and 4 houses are partly damaged.

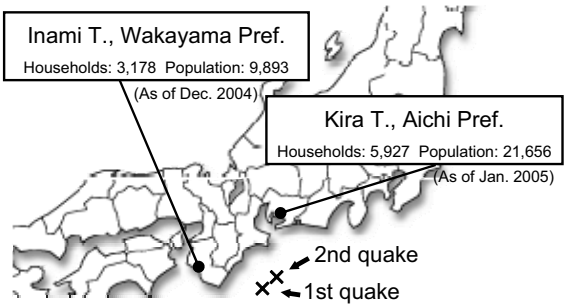

Fig. 1 The epicenters and study area

The study area is Inami Town in Wakayama Prefecture and Kira Town in Aichi Prefecture as shown also in Fig. 1. Maximum JMA seismic intensity of the off-shore Kii Peninsula Earthquake in Inami was 4 and that in Kira was 3. No damage is reported from both towns.

As other possible trigger disasters, major disasters in 2004 were listed in the survey: Typhoon No. 23 in September, Niigata Chuetsu Earthquake in October, and Sumatra Tsunami in December. Typhoon No.23 was an impacted event in Inami since it caused one death in the town by tidal waves. Niigata Chuetsu Earthquake was the year (2004)'s biggest earthquake in Japan. Sumatra Tsunami was of course world-wide catastrophe. This tsunami was listed only in the survey for Kira because it occurred after the Inami survey.

(2) Survey procedure

Samples are chosen randomly, i.e., 200 households from each town (400 in total) including 100 from the coast area and 100 from others. The survey sheets are sent and collected by mail. The abstract of questionnaire is shown in Table2, and the collected numbers of the survey sheets are shown in Table3.

Table2 Questionnaire abstract

A. Indirect disaster experience and countermeasure adoption • Does your family adopt the following earthquake countermeasures? (Answers: Yes, No) • If Yes → Specify a disaster which triggered the action. (Select from Kii Eq., Typhoon No. 23, Niigata Chuetsu Eq., and Sumatra Tsunami)
(Category 1: Storage) M1. Prepared food and water. M2. Prepared equipments other than food. (Category 2: House safety) M3. Prevented window dispersion and falling objects. M4. Fixed furniture. M5. Requested quakeproof check or reinforcement. M6. Purchased an earthquake insurance. (Category 3: Information) M7. Discussed a family emergency plan. M8. Checked location of public shelter. M9. Checked procedure for emergency communication. M10. Discussed a community emergency plan in neighborhood.
B. Indirect disaster experience and attitude change towards earthquake • Do you think of the following statements after these disasters? If yes, specify the disaster(s) from Kii Eq., Typhoon No. 23, Niigata Chuetsu Eq. and Sumatra Tsunami.
1. Big earthquake will occur soon. 2. Big earthquake will not occur anytime soon. 3. I cannot save my life and property if earthquake occurs. 4. I can save my life and property if prepared for earthquake. 5. I have to prepare for earthquakes.

C. Relationship with the coast

- Does your family have relationship with the coast? (Select from my house is located, my office is located, run fishery and none of them)

D. Indirect disaster experience and attitude change towards tsunami

- Do you think of the statements after the following disasters? If yes, specify the disaster(s) from Kii Eq., Typhoon No. 23, Niigata Chuetsu Eq. and Sumatra Tsunami.

1. My family or I would be hit by tsunami if a big earthquake occurred.
2. My family or I would not be hit by tsunami even if a big earthquake occurred.
3. I cannot save my life and property if tsunami hits.
4. I can save my life and property if prepared for tsunami.
5. I have to prepare for tsunami.

E. Respondents' attributes

- Acknowledgement of local activities on community-based preparedness, Members of family, aged persons in family, respondent's age and sex.

Table3 Response collection of the survey

	Mailed	Collected	Valid response	Response rate (%)
Inami	200	72	67	33.5
Kira	200	74	68	34.0

3.2 Findings from descriptive statistics

(1) Indirect disaster experience and earthquake countermeasures

Fig. 2 depicts earthquake countermeasure adoption in the all study areas. Compared by initial adoption rates (adoption rates since before the listed disasters) *information* countermeasures (M7 to M10) are most prevalent (29.6% in average over items in the category), followed by *storage* (M1 and M2, 23.0%) and *house safety* (M3 to M6, 15.0%). Compared by the total adoption rates after all trigger disasters, the order of prevalence stays the same: *information* (53.3%), *storage* (45.2%) and *house safety* (23.2%). This result is consistent with the conclusion of Lindell and Perry (2000) as mentioned in Chapter 2.

For all countermeasures, the off-shore Kii Peninsula Earthquake was chosen most contributory as a trigger for action among all disasters, followed by Niigata Chuetsu Earthquake and Typhoon No. 23. Sumatra Tsunami was chosen only by 2 households in M7. In the eight countermeasures out of ten, initial adoption rates are larger than triggered adoption rates. Overall, indirect experience of neighbor disasters is more chosen to be contributory to triggering countermeasure adoption than observation of distant disasters.

(2) Indirect disaster experience and attitude change

The graph of attitude changes by indirect disaster experience (Fig. 3) shows that positive changes towards additional mitigation actions such as "A big earthquake will occur." or "I have to prepare for earthquakes." prevail whereas concurrent negative changes such as "A big earthquake will not occur." are also not negligible. The same tendency is observed in attitude change for tsunami. Compared with earthquake cases, there are more concurrent negative changes observed for tsunami such as "I cannot save my life and property". In contrast there are less positive changes found such as "I can save if prepared." That means respondents express a more pessimistic attitude towards preparation for tsunami than earthquakes.

As for trigger disasters, in contrast with countermeasure adoption, more respondents' negative attitude changes are triggered by distant disasters such as the Niigata Chuetsu Earthquake, or the Sumatra Tsunami. Positive attitudinal changes are observed after nearby disaster experiences.

An interesting finding is that some respondents (although it is not many) answer that there was some change in attitude towards earthquakes and tsunami after typhoon No. 23. This fact shows that an indirect disaster experience of different hazard has a potential to serve as a trigger for earthquake preparedness.

4. Classification of earthquake countermeasures

4.1 Initial and triggered adoption rate

In this chapter, we will discuss the classification of the ten earthquake countermeasures by using two indicators, i.e., initial and triggered adoption rates.

Initial adoption rate is the ratio of respondents who executed a certain action since before the trigger disasters occurred to the all respondents. Triggered adoption rate is the ratio of respondents who *newly* executed a certain

action after one of the trigger disasters occurred to the all respondents. Therefore, the same number of triggered adoption rate as that of initial adoption rate means the number of adoption has increased double for a particular countermeasure.

Because the number of classifying items (countermeasures) is only ten, non-parametric statistical technique is used for classification. The difference of the distribution of two indicators is tested by Wilcoxon signed-rank test. The cluster analysis and a linear regression of the two indicators are used as classification criteria.

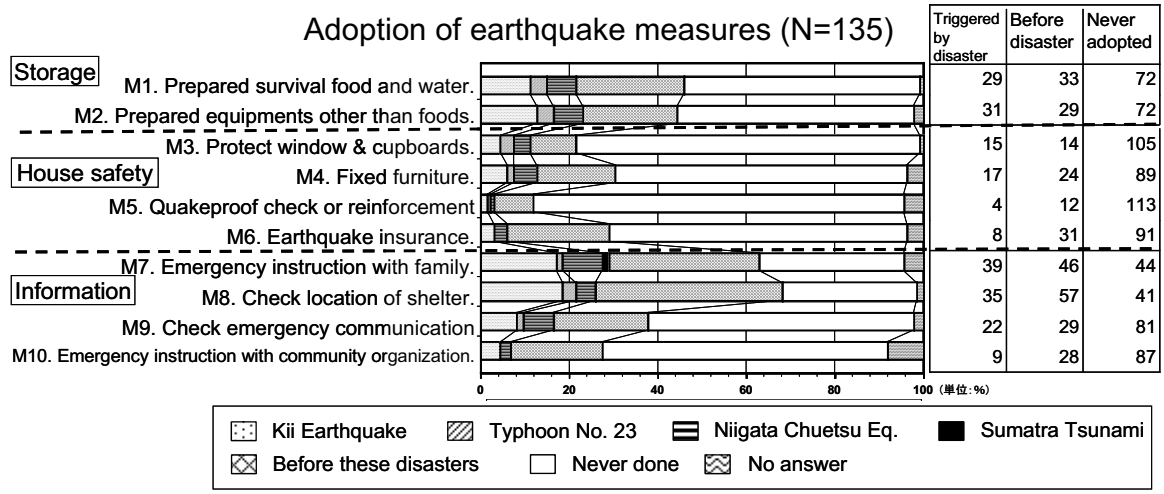

Fig. 2 Indirect disaster experience and earthquake countermeasure adoptions (All study areas)

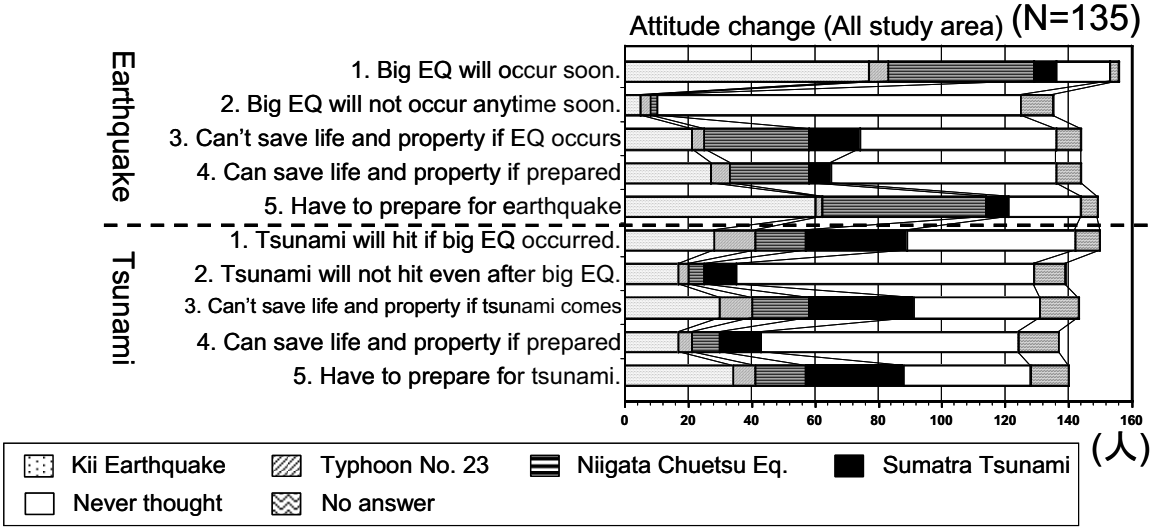

Fig. 3 Indirect disaster experience and attitudinal change (multiple answers, All study areas)

4.2 Classification

Fig. 4 is a scatter chart of initial adoption rate (horizontal axis) plotted against triggered adoption rate (vertical axis) for each countermeasure. A linear regression line of both variables (R^2=0.58, slope 0.69 (*t*-value: 3.29), intercept: -0.014) and the dotted line shows a 45 degree straight line for reference.

Distribution change between initial and triggered adoption rates is tested for a given significance level by Wilcoxon signed-rank test (N=10, statistics: -2.50, p=0.012). In this section, each countermeasure is identified by the numbers from M1 to M10 shown in Table2.

By cluster analysis (between-group average method) using the two variables, two clusters are obtained: group

of M7 and M8 located at the right of the scatter chart. (A in Fig. 4), and the other group of the countermeasures (B and C in Fig. 4).

Above all, the 10 earthquake countermeasures are classified as follows.

Group A: M7 and M8 filtered by cluster analysis.
Group B: M5, M6 and M10. Both initial and triggered adoption rates have smaller values than the reference values of linear regression.
Group C: M1, M2, M3, M4, and M9. Other than those above.

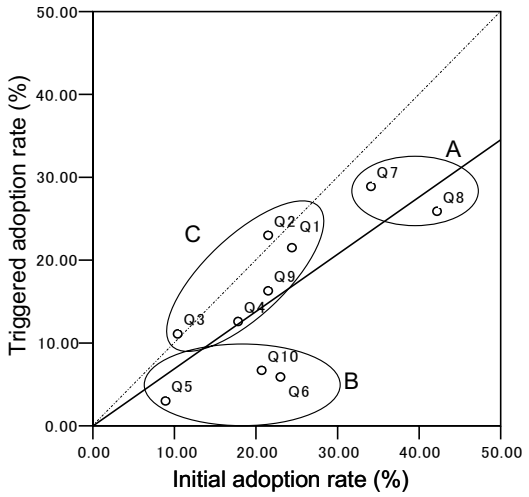

Fig. 4 Scatter chart of initial and triggered adoption rates

Each group has the following implications. Countermeasures in Group A have already been widespread practices at the initial state before indirect disaster experience. Therefore, any further newly actions triggered by indirect disaster experience are rather difficult to be expected. *Information* countermeasures are included in the group. In Group B, countermeasures with low adoption rates are included. These countermeasures are rarely adopted by households, and not many of them executed even after indirect disaster experience. The group consists of "request of quakeproof check or reinforcement" and "earthquake insurance" from *house safety* countermeasures, and "community emergency plan" from *information* countermeasures. The other countermeasures are included in Group C. They did not so much prevail at the initial state, but many actions are found to be triggered by the indirect disaster experience. Countermeasures in the group are interpreted to have high potential to be adopted after indirect disaster experience. In the group, *storage* countermeasures, and "prevented window dispersion and falling objects" and "furniture fixation" from *house safety* countermeasures are included.

4.3 Discussions

Countermeasures in Groups A and B have a quite high or extremely low initial adoption rate. On the other hand, countermeasures in Group C have a quite high triggered adoption rate as compared to their initial adoption rate. For instance, the number of adoption of M2 ("Prepared equipments other than food.") and M3 ("Prevented window dispersion and falling objects.") in Group C increases twice as much as that of initial state.

It can be interpreted that broadly-defined costs of Group C countermeasures are discounted immediately after indirect disaster experience. Let us examine more detailed relation between these costs and discounts by indirect experience. First, comparing *house safety* countermeasures in Group B (i.e. M5 and M6) and Group C (i.e. M3 and M4), financial cost for Group B (quakeproof check, reinforcement and insurance) is overwhelmingly larger than that for Group C (prevented window dispersion and furniture fixation). Second, including M10 (community emergency plan in neighborhood), all Group B countermeasures require request to or cooperation with outsiders. Specifically, close communications and discussions with neighbors is necessary to develop a community emergency plan, and consultation by the government or a private engineering or insurance company is necessary to have quakeproof check properly made or to get secured by an insurance purchase.

This is to say, indirect disaster experience has a certain effect to reduce costs of personal or in-family effort, however, it is not possible to discount large financial costs, or communication costs to interact with the third party.

Above all, the ten earthquake countermeasures are classified by behavioral types (i.e. *information*, *house safety*, and *information*) and initial and triggered adoption rates (i.e. Group A to C). After each group's characteristics, Group A is named "Widely adopted", B is named "Entry barrier", and C is named "Self-help" countermeasures (Table 4).

Table 4 Classification of earthquake countermeasures

Group	Type	Countermeasures
A	Widely adopted	*Information* (in-family)
B	Entry barrier	*Information* (with-community) *House safety* (reinforcement, insurance)
C	Self-help	*Storage* *House safety* (interior countermeasures)

Summarizing the findings, low cost countermeasures which can be executed with self-help are adopted by many families after indirect disaster experience. Those countermeasures widely adopted since before disasters have little potential to be further spread by trigger disasters. Those countermeasures with high barrier of financial and communication costs are hardly adopted even after trigger disasters. In order to make full use of the opportunity of indirect disaster experience for dissemination of earthquake countermeasures, self-help countermeasures have more potential to spread than widely-adopted or entry-barrier countermeasures.

4.4 Comparison between towns

Table 5 shows the adoption condition in Inami and Kira Towns. In eight countermeasures, initial adoption rates are higher in Kira, and triggered adoption rates are higher in Inami. In four of them, significant difference or a significant tendency was detected in the frequency distribution of initial and triggered adoption in the two towns. An exception is M10 ("Discussed community emergency plan."), where both initial and triggered adoption rates are significantly higher in Inami.

Behind this difference between two study areas is involved the local governments' policy on disaster prevention. Kira is designated as a special reinforced area for Tokai Earthquake by the Cabinet Office of the Japanese Government in 2002, therefore the town has emphatically worked on the spread of proactive countermeasures of earthquakes. On the other hand, Inami is not specified as one of the reinforced areas. Regardless of this public movement, the town government implemented advanced activities for community based preparedness in the year of 2004 when this survey was done. For instance, they started to develop a participatory mapping for tsunami evacuation plan.

The survey results show that the participation level of community based preparedness in Inami is higher than that in Kira (50.7% in Inami, 35.3% in Kira answered that he/she knows well local activities of community preparedness for disasters. 31.3% in Inami and 13.2% in Kira answered he/she participates often in local preparedness activities.).

Fig. 5 shows the scatter plots of adoption rates in Inami and Kira. The linear regression line of Inami has a steeper slope because more triggered adoption is observed as compared to initial adoption there than in Kira.

Table 5 Comparison of adoption rates by towns

Measures	Initial adoption rate		Triggered adoption rate	
	Inami (%)	Kira (%)	Inami (%)	Kira (%)
M1. Prepared food and water.	16.4	32.4	23.9	19.1
M2. Prepared equipments other than food. **	11.9	30.9	26.9	19.1
M3. Prevented window dispersion/falling objects.	9.0	11.8	10.4	11.8
M4. Fixed furniture. *	10.4	25.0	11.9	13.2
M5. Requested quakeproof check/ reinforcement.	7.5	10.3	3.0	2.9
M6. Purchased an earthquake insurance.	16.4	29.4	6.0	5.9
M7. Discussed a family emergency plan. **	25.4	42.6	37.3	20.6
M8. Checked location of public shelter. *	40.3	44.1	34.3	17.6
M9. Checked emergency communication.	23.9	19.1	19.4	13.2
M10. Discussed a community emergency plan . *	23.9	17.6	10.4	2.9

Bias of frequency distribution is tested by χ^2 test (d.f.=2). ** $p < .05$, * $p < .1$

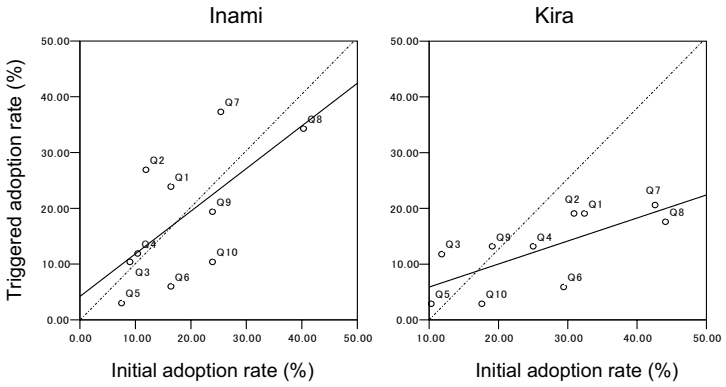

Fig. 5 Scatter plots in Inami and Kira towns

Considering the above results and the local backgrounds, an implication is given for the application of indirect disaster experience depending on local circumstances of disaster prevention activities. Assuming each local government aims at quantitative improvement of earthquake countermeasure adoption, using indirect disaster experience for the purpose of promotion of earthquake countermeasures is considered an effective strategy where motivation of disaster prevention is being fostered rapidly, such as Inami. The survey result shows approximately 2.5 times of respondents in Inami adopted *storage* countermeasures (M1 and M2) after trigger disasters as many in number as its initial state.

On the other hand, as typified by Kira, where earthquake countermeasures have already prevailed to some extent, further spread of the identical countermeasure adoption cannot be so much expected even after indirect disaster experience. There remains not much potential left. To use the opportunity of indirect disaster experience in these areas, it is more reasonable to strategically promote those items which have a relatively low initial adoption rate (e.g. in Kira case, M3 whose initial adoption rate is 11.8%).

Another idea is that if a local government goal can change its policy priority from quantitative achievements to quality ones such as "maintaining the quality of earthquake countermeasure adoption", thereby indirect disaster experience becomes an appropriate opportunity for the government to make timely assessment of household earthquake preparedness. Our survey cannot keep track of if households have maintained each countermeasure. However, the quality of preparedness is guaranteed only if countermeasures are kept in good condition and repeatedly checked out until the last moment before a disaster occurs. This repeated life cycle of maintenance is necessary for implementing preparedness. Therefore, it is also an effective strategy for a local government to use indirect disaster experience as an opportunity to recheck or assess the prevailed earthquake countermeasures adopted by households.

5. Adoption of countermeasures and attitudinal change

5.1 Furniture fixation and attitudinal change

From the preceding chapter, adoptions of self-help countermeasures are found to be influenced most by indirect disaster experience. In this chapter, we examine how households who adopted (and not adopted) self-help countermeasures changed their attitude towards earthquakes triggered by the listed disasters. For the analysis, M4, furniture fixation was taken up as an example countermeasure.

Three graphs of Fig. 6 show the frequency of attitudinal change of the groups by adoption of furniture fixation. Toward the left are those who adopted after trigger disaster (N=17), toward the upper right are those who adopted before the disasters (N=24), and the lower right those who never adopted (N=89). Because the number of samples is different, the scale of the graph is different.

Intuitively, there seems no big difference in frequency distribution among the groups. To statistically test this hypothesis, Fisher's exact probability test was conducted between 1) "triggered adopted" group and "initially adopted" group, and 2) "triggered adopted" group and "never adopted" group. Fisher's exact probability test is a method of independency test when expected frequency is small. As a result, shown in asterisk (**) in this figure, a significant difference was

detected only in the attitudinal change item 4, i.e., "can save life and property if prepared", between the triggered-adopted and never-adopted group (Pearson's χ^2 statistics: 11.79, p=0.019). In this item, many households who never adopted furniture fixation answered "never thought" that he/she can save life and property if prepared.

Moreover, it was shown that significant more households in the never-adopted group answer they never thought "they can save their life and property from earthquakes if they prepare for it" compared to the triggered-adopted group. Considering there are no other differences in the other attitudinal changes, many households which have never fixed furniture do not seem to agree with the effectiveness of preparedness although they admit earthquake is expected and preparation is necessary.

However, this current study is limited to only one countermeasure of furniture fixation and the population of each group is small so that the above findings should not be generalized.

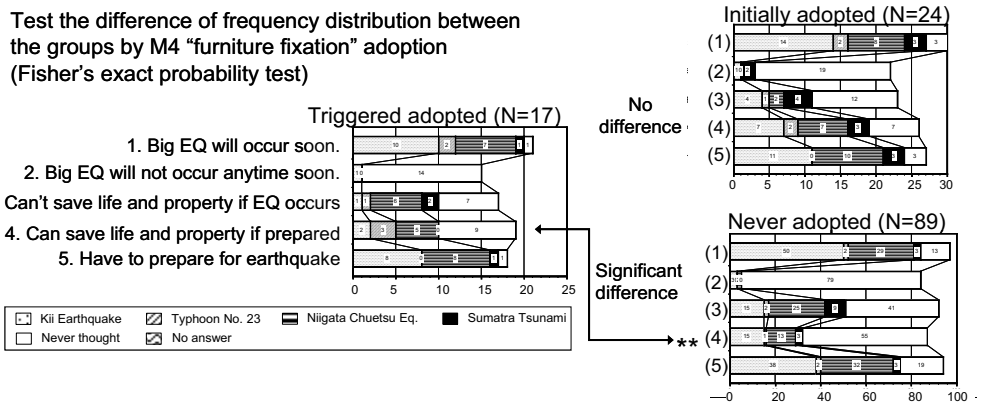

Fig. 6 Attitudinal changes by adoption of furniture fixation

6. Conclusions

In this research, the relevance between indirect disaster experience and earthquake countermeasure adoption has been examined based on the results of the questionnaire survey.

From descriptive statistics, it has been found that indirect disaster experience triggering more households' actions is determined by the distance and familiarity rather than the scale of the disaster. Disasters felt by themselves and disasters in the vicinity induce households' countermeasure actions easily even if the scale is small, whereas indirect observation through media is unlikely to lead to new countermeasure actions at household level. On the other hand, it has been shown that indirect disaster experience causing change in attitude is influenced depending on the scale of the disaster. Especially observing the tragedies might cause even a negative attitudinal change towards future disaster preparation.

From the analysis using initial and triggered adoption rates of the ten representative countermeasures, they are classified with referenced to broadly defined costs. Countermeasures influenced by indirect disaster experience (i.e. triggered adoption rate is high as compared to its initial adoption rate) are *storage* and *house safety* countermeasures which one can do it him/herself. In contrast, countermeasures requiring high financial cost, or outsiders' participation such as reinforcement, insurance and community discussions are not much executed even after indirect disaster experience. These countermeasures do not have a high potential to be spread by an opportunity of indirect disaster experience.

The comparison of the data of the two study areas implies an effective strategy on how indirect disaster experience should be best dealt with; that is, it is better to use it as an opportunity to promote the adoption of new earthquake countermeasures in the areas where initial adoption rate is low, whereas it is more reasonable to use it as an opportunity to review and recheck the already adopted countermeasures in the areas where initial adoption rate is high.

Fisher's exact test has been conducted to determine if there are nonrandom associations of attitudinal change between the group which practiced furniture fixation after indirect disaster experience, and the group which have been practicing since before the disaster experience.

As a result, significant difference was not found in any attitudinal changes. Therefore, it cannot be inferred that attitudinal change triggered by indirect disaster experience leads to adoption of furniture fixation.

As mentioned at the beginning of the paper, we have challenged a seemingly strong human nature that disaster preparedness hardly prevails although this nature has not yet been well explained by theories and facts. The major policy question posed here was: can we take any strategy to change such a human attitude, and can we present any effective policy recommendation? Our modest proposal at this moment is to suggest implementation strategies to change households' attitude by timely making use of indirect disaster experience.

The following three points are remained to be solved in this research. First, for practical recommendation, findings by this research need to be discussed together with comprehensive evaluation of earthquake countermeasures including effectiveness and financial costs. It is a policy problem that to think of selective and strategic dissemination of earthquake countermeasures by using indirect disaster experience. Another issue is the sustainability of preparedness. Although how to sustain the awareness for earthquake preparedness is an important problem in disaster risk management, our research does not pursue whether adopted countermeasures have repeatedly been practiced up to the present time. Moreover, our survey has put a tacit assumption that households adopting a countermeasure have been maintained until the present moment. As far as indirect disaster experience is concerned, it works as a momentary trigger at a certain time point, however a question is whether its effect is continuous or not. The verification of this question is a future task of the research, nevertheless it is more reasonable to promote irreversible countermeasures (which remain effective once they are put into practice.) such as prevention of glass dispersion or furniture fixation using an opportunity of indirect disaster experience.

Finally, discussions from spatially and temporary, more macro viewpoints are also necessary so as to clarify a more persistent influence of indirect disaster experience on countermeasure adoptions. For instance, the possessing rate of earthquake insurance increases after the Great Hanshin Earthquake, and the number of requests of quakeproof diagnoses increases rapidly after the Niigata Chuetsu Earthquake on a nationwide scale. To make our analysis more consistent with such data, another survey is needed to keep track of the influence for a long period of time.

Acknowledgements

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災害の間接的経験と家庭での地震に対する備えの関連性分析

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要旨

本論文は，近隣での損害が及ばないレベルの災害体験やメディアを通じた災害の目撃を，災害の間接的経験と呼び，これと地震の事前対策の実施に及ぼす影響を明らかにする．著者らは2004年に発生した様々な災害を間接的経験となる災害として列挙し，これらを機に実施した対策の内容や意識の変化を調査した．これをもとに，間接的経験の特徴と対策の実施，および地震に対する意識変化と事前対策の実施の関係を検証する．

キーワード: 間接的経験，地震に対する備え，プリペアドネス，意識調査，関連分析