

STUDY ON RISK PERCEPTION CONCERNING HOUSING SAFETY AGAINST EARTHQUAKES

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Abstract: In most earthquake-caused deaths, people are killed by their own houses. It is thus crucial to convince people that the investment in safer housing will eventually prove to be worthwhile. Because people base their choices regarding housing safety on their own perception of seismic risk, we conducted a field survey in 2007 in Indonesia, Nepal, Pakistan, and Turkey to better understand the seismic risk perception of residents.

The survey targeted approximately 800 households in each country. Trained surveyors visited the selected houses to conduct interviews and fill in questionnaires. The questionnaire includes questions asking whether the residents think their house is safe against earthquakes, how they want to avoid the risks of damage to their house and harm to their family, and what they know about seismic retrofitting, in addition to questions about their sex, age, household income, occupation, and house-related information such as floor area, structural type, cost, and ownership.

This study analyses how people perceive seismic risk, how such perception is associated with demographic variables and housing conditions, and how their risk perception affects their behaviour towards earthquake-safe housing measures. The findings will help stakeholders develop disaster risk management policies and initiatives that take into account public risk perception, disseminate technologies for safer housing to communities, and convince people that investment for safety is worthwhile.

Keywords: earthquakes, houses, risk perception, disaster reduction, Indonesia, Nepal, Pakistan, Turkey

1. Introduction

In most earthquake-caused deaths, people are killed by their own houses. Most of the world's population lives in

vernacular houses that are built of adobe, brick, stone, and wood, and are non-engineered and thus vulnerable to earthquakes. Because earthquakes cannot be predicted precisely even by the most advanced science and technology, it is essential to make these houses safer in order to reduce the number of people harmed and the amount of severe damage caused by future earthquakes. The more resilient the existing houses are against earthquakes, the lower the death rate will be in the event of an earthquake, and the less drastic will be the disruptions to economic and social activities in the affected areas. No matter how effective emergency management and relief activities are, lost lives can never be regained. No matter what effective technologies are developed, the non-engineered houses will not be safer unless these technologies are applied.

Non-engineered houses can be strong when they are constructed with appropriate and practical techniques that are affordable to ordinary people. A big challenge, however, is that the house owners lack the motivation to invest to secure the safety of their houses, particularly to retrofit existing vulnerable houses. The vulnerable houses can be retrofitted through the voluntary decisions of the house owners themselves, not by the authorities. House builders and masons lack interest in securing sufficient safety mainly because house owners are not concerned with the structural safety of their houses. It is thus crucial to convince people that the investment in safer housing will eventually prove to be worthwhile. This survey was conducted to better understand the seismic risk perception of people in developing countries, who are directly responsible for securing their own housing safety. The study analyses how the residents perceive seismic risk and how such perception is associated with socio-economic demographic variables and housing conditions. The findings will help stakeholders develop disaster risk management policies and initiatives that take into account the people's risk perception, disseminate technologies for safer housing to communities, and convince people that investment for safety is worthwhile. This survey was conducted as a part of the Collaborative Research and Development Project for Disaster Mitigation, coordinated by Building Research Institute (BRI), with financial support from the Japanese Ministry of Education, Culture, Sports, Science and Technology.

2. Methodology of Survey

The survey was conducted in early 2007 in Turkey, Pakistan, Nepal, and Indonesia, using the questionnaire developed by Okazaki, National Graduate Institute for Policy Studies (GRIPS). The survey was conducted in two different kinds of communities in each country for the purpose of comparison. A partner institute in each country decided what two kinds of communities should be selected in that country (Table 1). For example, Indonesia and Pakistan selected one community which was severely hit by a recent earthquake and the other community which was not. Nepal selected one community where a community based disaster management activities are implemented and the other where such activities are not implemented.

Approximately 400 households were randomly selected in each community so that the sampling error should be less than approx. 5 percent. The surveyors visited the selected houses to conduct an interview with the head of each household (or spouse) and filled in the questionnaire through an interview. The questionnaire asks whether the respondents think their house is safe against earthquakes, how they want to avoid the risks of damage to their house and harm to their family, what they know about retrofitting, and so on, in addition to questions about their sex, age,

Table 1 Two selected communities in the four countries

Country	Community 1	Community 2
Indonesia	Bandung No earthquakes in the past	Jogjakarta Hit by an earthquake in 2006
Pakistan	Panyali Heavily damaged by 2005 earthquake	Kamman Hardly damaged by 2005 earthquake
Nepal	Kathmandu 13 Ward Community based disaster management is not conducted	Kathmandu 17 Ward Community based disaster management is conducted
Turkey	Avcilar, Istanbul Most vulnerable area with low income people	Bakirkoy, Istanbul Most vulnerable area with middle income people

number of family members living together, household income, occupation, and house-related information such as floor area, structural type, cost, and ownership (Table 2). The questionnaire was pre-tested in October 2006 in Nepal by the National Society for Earthquake Technology (NSET)-Nepal.

The partner institutes and representatives for the joint survey are as follows.

- Indonesia: Professor Wayan Sengara, Director, Center for Disaster Mitigation, Institute of Technology Bandung (ITB)
- Nepal: Mr. Amod Dixit, Secretary General, NSET-Nepal
- Pakistan: Professor Najib Ahmad, Project Manager, Preston University
- Turkey: Associate Professor Alper Ilki, Structural and Earthquake Engineering Laboratory, Istanbul Technical University (ITU)

Table 2 List of questions in the questionnaire

Attributes of the respondents	Risk perception and behaviour of the respondents
Q3. Sex	Q8. What do you think will most severely affect your life?
Q4. Age	Q9. What kind of disaster do you think will most affect your life?
Q5-1. Family members living together: Total number	Q10. Do you think a big earthquake will occur in the area where you live in the future?
Q5-2. Family members living together: Number of members < age 15	Q11. What kinds of impacts do you anticipate due to a big earthquake? [Multiple answers]
Q5-3. Family members living together: Number of members > age 60	Q12. What have you done to reduce the impacts of earthquakes? [Multiple answers]
Q6a. House: How long have you been living in this house?	Q14. Do you think your house is strong enough to withstand a big earthquake?
Q6b. House: Ownership	Q14a. [if answered 'No' in Q14] Do you plan to make your house safer? (Or do you plan to move due to the unsafe house?)
Q6 c . House: Floor area	Q14b. [if answered 'No' in Q14a] Are you worried about the collapse of your house due to earthquakes?
Q6d.House: Type of house	Q15. Whom do you rely on for a safer house?
Q6e. House: Major structure	Q16. If your house collapses and kills some of your family due to a big earthquake, who would you blame?
Q6f-1. Cost of house in local currency: Purchase	Q17. If your house would be severely damaged by an earthquake, what would be the causes for the weakness of the house?
Q6f-2. Cost of house in local currency: Self-built (total cost)	Q18. Are you concerned if your neighbours' houses are highly vulnerable?
Q6f-3. Cost of house in local currency: Rent (per month)	Q19. Do you think information on the seismic risk of houses in the neighbourhood should be shared among people?
Q7. Have you ever experienced any disasters? If yes, what kind(s) of disaster(s) you have experienced? [Multiple answers]	Q20. Do you have any knowledge about the available techniques for strengthening houses against earthquakes?
Q13. Who built your house?	Q21. How costly do you think is it to protect your house from earthquakes?
Q30. Are any community based associations or organizations working for disaster risk reduction in this area?	Q22. [only to house owners] How much could you spend to protect your house/property from a big earthquake?
Q33. What is your academic qualification?	Q23. [only to house owners] How much could you spend to protect your family members from a big earthquake?
Q34. What is your occupation?	Q24. [only to house owners] What is your plan for a safer home?
Q35. How much is your monthly	Q25. [only to house owners] What kinds of support would make you decide to invest for strengthening or retrofitting your house?
	Q26. [only to house renters] How much of an increase in your rental fee could you accept to protect your house/property from a big earthquake?
	Q27. [only to house renters] How much of an increase in your rental fee could you accept to protect your family members from a big earthquake?

household income (approx.)?

Q28. [only to house renters] What is your plan for a safer home?
 Q29. What facilities do you think should be protected with high priority? [Choice of three answers]
 Q31. Have you ever participated in any initiatives/activities for disaster risk reduction?
 Q32. How long do you plan to live in this house?

3. Results of the Survey

3.1 Attributes of the respondents

While only about half of the respondents in Nepal were male, male respondents were dominant in Pakistan (96%) and Indonesia (71%). On the contrary, female respondents were dominant in Turkey (64%) because the survey was conducted on weekdays, when many men work outside the home. With regard to age, respondents in their forties formed the dominant group in Indonesia (34%) and in Turkey (23%). Respondents in their twenties formed the dominant group in Nepal (37%), and respondents in their fifties were dominant in Pakistan (30%). The most common number of family members living together was 2–4 in Turkey, 3–5 in Indonesia and Nepal, and 4–10 in Pakistan.

With regard to the period of living in the current house, the majority answered ‘less than 5 years’ in Indonesia (93%), Pakistan (50%), and Nepal (38%) (Table 3). Table 4 shows the ownership of the house. Almost all the respondents (98%) owned their houses in Pakistan; in Indonesia 82% owned their houses, and in Turkey house owners made up 75% of the respondents. Half of the respondents in Nepal owned their houses and the remaining half were renting. Houses in Pakistan and Nepal were comparatively large (the majority of houses were larger than 200 m² and 120–160 m², respectively), while houses in Indonesia and Turkey were comparatively small (the majority of houses were 40–80 m² and 80–120 m², respectively).

Table 5 shows house types. Detached houses were dominant in Indonesia (60%) while townhouses or flats were dominant in Nepal (70%), Pakistan (52.6%), and Turkey (97%). Table 6 shows the structure of the houses. ‘Bricks with Reinforced Concrete (RC) frame’ was the dominant structure in Indonesia (74%) and Nepal (72%), while almost all the buildings in Turkey were RC structure. There were also many ‘bricks without RC frame’ structures in Nepal. The majority in Indonesia and Turkey purchased their houses while the majority in Pakistan built their houses by themselves. Most respondents in Indonesia purchased their houses with less than US\$5,500, while respondents in Turkey paid more than ten times that amount to purchase a house. The majority of respondents in Pakistan built their houses with US\$800–1,600. In Nepal, the monthly rental fee of US\$15–30 was the majority.

Table 3 How long have you been living in this house?

	< 5 years	5–10 years	10–20 years	> 20 years	Sum
Indonesia	746 93.3%	52 6.5%	0 0%	2 0.3%	800 100%
Pakistan	398 49.8%	287 35.9%	115 14.4%	0 0%	800 100%
Nepal	290 37.9%	136 17.8%	134 17.5%	206 26.8%	766 100%
Turkey	218 25.2%	168 19.4%	279 32.3%	200 23.1%	865 100%
Total	1,652 51.1%	643 19.9%	528 6.3%	408 12.6%	3,231 100%

Table 4 Ownership

	Own	Rent	Others	Sum
Indonesia	653 81.6%	112 14.0%	35 4.4%	800 100%
Pakistan	788 98.5%	9 1.1%	3 0.4%	800 100%
Nepal	405 50.8%	390 48.9%	2 0.3%	797 100%
Turkey	645 74.8%	208 24.1%	9 1.0%	862 100%
Total	2,491 76.4%	719 22.1%	49 1.5%	3,259 100%

Table 5 House types

	Single/ detached	Town house	Flat/ apartment	Sum
Indonesia	480 60.0%	263 32.9%	57 7.1%	800 100%
Pakistan	396 47.4%	440 52.6%	— —	836 100%
Nepal	236 29.8%	557 70.2%	— —	793 100%
Turkey	8 1.0%	16 2.1%	746 96.9%	770 100%
Total	1,120 35.0%	1,276 39.9%	803 24.2%	3,199 100%

Table 6 House structure

	Bricks without RC frame	Bricks with RC frame	Adobe (sun dried bricks)	RC	Others	Sum
Indonesia	79 9.9%	591 73.9%	31 3.9%	60 7.5%	39 4.9%	800 100%
Nepal	162 20.6%	566 71.9%	54 6.9%	5 0.6%	0 0%	787 100%
Turkey	3 0.4%	6 0.8%	1 0.1%	835 98.8%	0 0%	845 100%

* Data is not available for Pakistan

As shown in Table 6, local masons were the dominant means of house building in Indonesia (61%), Pakistan (90%), and Nepal (32%) while contractors were dominant in Turkey (83%). As shown in Table 7, most respondents in Turkey (85%), Pakistan (61%), and Indonesia (56%) had experienced earthquakes in the past. Table 8 shows the educational attainment of the respondents. School education was the attainment level of the majority in Indonesia, Pakistan, and Turkey while college/university was the majority in Nepal. The illiteracy rate was comparatively high in Pakistan (31%) and Nepal (9%). Regarding the monthly income of the household, the dominant amount was US\$48–96 in Pakistan, US\$75–150 in Nepal, less than US\$110 in Indonesia, and US\$700–1,400 in Turkey.

3.2 Risk perception and behaviour

(1) Future risk which may affect life

There were two questions about future risk which might affect the life of the respondents: ‘What do you think will most severely affect your life?’ and ‘What kind of disaster do you think will most affect your life?’ In Indonesia, Pakistan, and Turkey, respondents were most afraid of disasters while respondents in Nepal

Table 6 Who built your house?

	Your family/ neighbours	Local masons	Qualified masons	Contractors	Don't know	Sum
Indonesia	103 12.9%	490 61.3%	113 14.1%	24 3.0%	70 8.8%	800 100%
Pakistan	32 4.0%	720 90.3%	23 2.9%	4 0.5%	18 2.3%	797 100%
Nepal	50 6.4%	254 32.2%	105 13.3%	142 18.0%	237 30.1%	788 100%
Turkey	50 5.8%	29 3.4%	12 1.4%	146 83.4%	52 6.0%	862 100%
Total	235 7.2%	1493 46.0%	253 7.8%	316 9.7%	377 11.6%	3,247 100%

Table 7 Have you experienced any disasters? If yes, what kind(s) of disaster(s) you have experienced? (multiple answers)

	Flood	Earthquake	Other natural disaster	Accident	Any others	Have not experienced any
Indonesia	140 17.5%	446 55.8%	24 3.0%	62 7.8%	62 7.8%	193 24.1%
Pakistan	365 45.6%	489 61.1%	5 0.6%	7 0.9%	19 2.4%	25 3.1%
Nepal	48 6.0%	326 40.8%	18 2.3%	74 9.3%	14 1.8%	377 47.1%
Turkey	11 1.3%	731 84.5%	7 0.8%	21 2.4%	31 3.6%	3 0.3%
Total	564 17.3%	1,992 61.0%	54 1.7%	164 5.0%	99 3.0%	598 18.3%

were afraid of disease and unemployment (Table 9). Among the disasters, all the respondents were most afraid of earthquakes, particularly in Turkey (85%), Pakistan (59%), and Nepal (58%), as shown in Table 10.

(2) Estimated damage by earthquakes

In response to the question ‘What kinds of impacts do you anticipate due to a big earthquake?’, respondents anticipated both loss of themselves/family and loss of their house/property to the same extent (Table 11). There was no significant difference between countries.

Table 8 What is your academic qualification?

	Basic reading and writing	School education	College/ university	Cannot read/ write	Sum
Indonesia	20 2.5%	511 63.9%	262 32.8%	7 0.9%	800 100%
Pakistan	68 8.5%	420 52.7%	55 6.9%	254 31.9%	797 100%
Nepal	115 14.6%	284 35.9%	319 40.4%	72 9.1%	790 100%
Turkey	17 2.0%	637 73.6%	201 23.2%	10 1.2%	865 100%
Total	220 6.8%	1,852 56.9%	837 25.7%	343 10.5%	3,252 100%

Table 9 What do you think will most severely affect your life? *

	Unemployment	Disease	Accident	Disaster	Any other	Sum
Indonesia	218 27.3%	156 19.5%	34 4.3%	350 43.8%	41 5.1%	799 100%
Pakistan	240 26.6%	131 14.5%	11 1.2%	447 49.6%	73 8.1%	902 100%
Nepal	310 39.0%	224 28.2%	67 8.4%	122 15.3%	72 7.3%	795 100%
Turkey	87 10.5%	262 31.7%	54 6.5%	357 43.2%	66 6.3%	826 100%
Total	855 25.7%	773 23.3%	166 5.0%	1,276 38.4%	252 7.6%	3,322 100%

* Multiple answers in Pakistan

Table 10 What kind of disaster do you think will most affect your life? *

	Flood/land-slide	EQ	Storm cyclone	Famine	Any other	Sum
Indonesia	180 22.6%	384 48.2%	30 3.8%	163 20.4%	40 5.0%	797 100%
Pakistan	325 36.6%	521 58.7%	30 3.4%	5 0.6%	7 0.8%	888 100%
Nepal	67 8.4%	461 58.0%	31 3.9%	223 28.1%	13 1.6%	795 100%
Turkey	16 1.9%	730 84.8%	6 0.7%	91 10.6%	18 2.1%	861 100%
Total	588 17.6%	2,096 62.7%	97 2.9%	482 14.4%	78 2.3%	3,341 100%

* Multiple answers in Pakistan

(3) Actions to reduce the impacts of earthquakes

In response to the question ‘What have you done to reduce the impacts of earthquakes?’, the majority of respondents had done nothing in particular (Table 12). However, more than half of the respondents in Indonesia and about one third of the respondents in Pakistan had strengthened (retrofitted) their houses. (The ratios were particularly high in the communities that had been damaged seriously by a recent earthquake.) More than half of the respondents in Turkey had insured their houses. It should be noted that this ratio should be higher in Turkey according to obligatory disaster insurance system.

(4) Safety of the house

In response to the question ‘Do you think your house is strong enough to withstand a big earthquake?’, most respondents in Turkey answered ‘yes’, while the majority answered ‘no’ in Indonesia (71%), Pakistan (94%), and Nepal (62%), as shown in Table 13. To those who answered ‘no’, an additional question was asked: ‘Do you plan to make

your house safer? (Or do you plan to move due to the unsafe house?)' Approximately two thirds in Indonesia and Turkey answered 'yes', while two thirds in Nepal answered 'no'. To those who answered 'no' to the question about a future plan to make the house safer, one more question was asked: 'Are you worried about collapse of your house due to earthquakes?' More than half of the respondents in Indonesia answered 'no' while most of the respondents in Nepal (87%) and Turkey (80%) answered 'yes'.

Table 11 What kinds of impacts do you anticipate due to a big earthquake? (multiple answers)

	Loss of yourself/ family	Injuries	Loss of your house/ property	Loss of livelihood	None	Don't know/ others
Indonesia	688 39.0%	252 14.3%	467 26.5%	205 11.6%	4 0.2%	147 8.3%
Pakistan	607 30.2%	549 27.3%	577 28.7%	166 8.3%	3 0.1%	106 5.3%
Nepal	675 33.5%	433 21.5%	641 31.8%	196 9.7%	1 0.0%	68 3.4%
Turkey	553 27.6%	507 25.3%	602 30.0%	245 12.2%	34 1.7%	63 3.1%
Total	2523	1741	2287	812	42	384

Table 12 What have you done to reduce the impacts of earthquakes? (multiple answers)

	Built or purchased an earthquake-resistant house	Strengthened (retrofitted) the house	Insured the house	Secured safety of non-structural elements and furniture	Stored supplies of emergency goods/foods at home	Conducted awareness raising with family members	Conducted awareness raising with neighbours	None
Indonesia	392	449	86	35	69	292	275	22
Pakistan	98	274	33	18	91	104	70	427
Nepal	127	82	7	35	21	125	40	335
Turkey	70	90	437	148	126	166	35	236
Total	687	895	563	236	307	687	420	1,020

Table 13 Do you think your house is strong enough to withstand a big earthquake? *

	Yes	No	Sum
Indonesia	233 29.1%	567 70.9%	800 100%
Pakistan	45 5.6%	755 94.4%	800 100%
Nepal	298 38.1%	485 61.9%	783 100%
Turkey	689 80.6%	166 19.4%	855 100%
Total	1,265 39.1%	1,973 60.9%	3,238 100%

* Multiple answers in Pakistan

Table 14 Whom do you rely on for a safer house? *

	Family/ friends neighbours/	Masons	Engineers	Govern ment	None/ others	Sum
Indonesia	246 30.8%	201 25.1%	310 38.8%	43 5.4%	- -	800 100%
Pakistan	22 2.5%	357 40.5%	175 19.9%	327 37.1%	- -	881 100%
Nepal	72 9.1%	128 16.1%	574 72.4%	19 2.4%	- -	793 100%
Turkey	112 12.9%	18 2.1%	365 42.2%	346 19.8%	199 23.0%	865 100%
Total	452 13.5%	704 21.1%	1,424 42.6%	560 16.8%	199 6.0%	3,339 100%

* Multiple answers in Pakistan.

(5) Responsibility for housing safety

In response to the question ‘Whom do you rely on for a safer house?’, the majority answered ‘engineers’ in Indonesia (39%), Nepal (72%), and Turkey (43%), while the majority in Pakistan (41%) answered ‘masons’, as shown in Table 14. Respondents in Indonesia and Nepal did not appear to rely on the government for safer housing.

In response to the question ‘If your house collapsed and killed some of your family due to a big earthquake, who would you blame?’, the majority in Indonesia (71%) and Pakistan (42%) answered ‘don’t know’, while the majority in Nepal (42%) answered ‘myself’, and the majority in Turkey answered ‘house builders’ (34%) and ‘government’ (30%), as shown in Table 15.

In response to the question ‘If your house were to be severely damaged by an earthquake, what would be the causes for the weakness of the house?’, respondents in Indonesia tended to answer ‘built without design/supervision of engineers’ or ‘poor materials/work’ and respondents in Pakistan tended to answer ‘poor materials/work’, while people in Nepal tended to answer ‘poor materials/work’ or ‘lack of knowledge/information’. Respondents in Turkey tended to answer ‘cost cutting’, as shown in Table 16.

(6) Willingness to pay for safer housing

With regard to willingness to pay for safer housing, the respondents were asked two similar questions: ‘How much could you spend to protect your house/property from a big earthquake?’ and ‘How much could you spend to protect your family members from a big earthquake?’ The difference between the two questions is whether the concern is house/property or the life of family members. Regarding the question on protecting the house/property (Table 17), the majority in Indonesia (45%) and Pakistan (82%) answered ‘more than 5 years’ household income’. In contrast, the majority in Turkey (38%) answered ‘less than 1 month’s income’ and the majority in Nepal (22%) answered ‘1–3 months’ income’. Similar questions were asked to house renters. In Indonesia and Pakistan, the majority answered ‘less than a 5% increase in my rental fee would be acceptable’, while the majority in Turkey answered ‘an increase in my rental fee would not be acceptable’.

Table 15 If your house collapsed and killed some of your family due to a big earthquake, whom would you blame? *

	Gods	Govern- ment	House builders	Your- self	Others	Don't know	Sum
Indonesia	6 0.8%	26 3.3%	48 6.0%	77 9.6%	79 9.9%	564 70.5%	800 100%
Pakistan	27 3.4%	185 23.1%	32 4.0%	221 27.6%	2 0.3%	333 41.6%	800 100%
Nepal	132 16.7%	39 4.9%	133 16.8%	331 41.7%	16 2.0%	142 17.9%	793 100%
Turkey	174 20.1%	224 30.4%	297 34.3%	85 9.8%	18 5.3%	— —	865 100%
Total	339 10.4%	474 14.5%	510 15.7%	714 21.9%	115 3.5%	1,039 31.9%	3,258 100%

* For Turkey, the option ‘Gods’ was changed to ‘No one/faith’.

Table 16 If your house were to be severely damaged by an earthquake, what would be the causes for the weakness of the house?

	Cost cutting	Lack of knowledge/ information	Poor materials/ work	Built without design/ supervision of engineers	Others	Sum
Indonesia	109 13.63	122 15.3%	246 30.8%	291 36.4%	32 4.0%	800 100%
Pakis- tan	73 8.2%	87 9.8%	453 50.9%	139 15.6%	138 15.5%	890 100%
Nepal	95 12.1%	256 32.5%	282 35.8%	120 15.2%	35 4.4%	788 100%
Turkey	248 29.2%	113 13.3%	201 23.7%	189 22.3%	98 11.5%	849 100%
Total	525 15.8%	578 17.4%	1,182 35.5%	739 22.2%	303 9.7%	3,327 100%

In answering the question on protecting the family, the majority in Indonesia (34%) and Pakistan (33%) answered ‘2–5 years’ income’, as shown in Table 18. Compared with the former question, the amount decreased, meaning that they would pay less to protect their family than their house/property. On the contrary, the majority in Nepal (26%) answered ‘3–6 months’ income’ and the respondents who answered ‘more than 5 years’ income’ doubled. In Turkey, the majority (38%) answered ‘more than 5 years’ income’. Compared with the former question, the amount increased, meaning that they would pay more to protect their family than their house/property.

Table 17 How much could you spend to protect your house/property from a big earthquake? (in household income)

	< 1 month	1–3 months	3–6 months	6 ms–2 years	2–5 years	> 5 years	Sum
Indonesia	— —	6 0.9%	38 5.8%	117 17.9%	196 30.0%	296 45.3%	653 100%
Pakistan	1 0.1%	3 0.4%	13 1.7%	12 1.5%	114 14.5%	644 81.8%	787 100%
Nepal	61 15.5%	87 22.1%	71 18.1%	77 19.6%	50 12.7%	47 12.0%	393 100%
Turkey	228 37.7%	91 15.0%	107 17.7%	87 14.4%	26 4.3%	66 10.9%	605 1000%
Total	290 11.9%	187 7.7%	229 9.4%	293 12.0%	386 15.8%	1,053 43.2%	2,438 100%

3.3 Co-relation between attributes and risk perception/behaviour

By cross tabulation, it was confirmed that factors of sex, educational attainment, occupation, household income, house ownership, house size, house type, house structure, rental fee, disaster experience, and knowledge about retrofitting would influence the risk perception and behaviour of the respondents. For example, in Indonesia lower household income was correlated with the belief of respondents that their house was not safe against earthquakes, as well as with respondents not worrying about the safety of their house. In general, low income people rely on neighbours or masons for safer housing, while high income people rely on engineers. On the other hand, it was also confirmed that factors of age, family size, period of living in the house, and housing cost would not much influence the risk perception and behaviour of the respondents.

Table 18 How much could you spend to protect your family members from a big earthquake? (in household income)

	< 1 month	1–3 months	3–6 months	6 ms - 2 years	2–5 years	> 5 years	Sum
Indonesia	49 7.5%	19 2.9%	41 6.3%	119 18.2%	222 34.0%	203 31.1%	653 100%
Pakistan	48 6.1%	78 9.9%	56 7.1%	122 15.5%	258 32.8%	225 28.6%	787 100%
Nepal	11 2.8%	36 9.3%	99 25.5%	76 19.6%	78 20.1%	88 22.7%	388 100%
Turkey	157 26.1%	43 7.1%	63 10.5%	75 12.5%	37 6.2%	226 37.6%	601 100%
Total	265 10.9%	176 7.2%	259 10.7%	392 16.1%	595 24.4%	742 30.5%	2,429 100%

4. Conclusion: Implications for Disaster Reduction

This study has revealed that seismic risk perception differs from country to country, and from community to community. The findings of this study will be useful to develop policies and strategies for earthquake disaster reduction. For example, given that many people rely on engineers for housing safety in Indonesia, Nepal, and Turkey, policy implementation involving engineers would be effective in these countries. However, because people do not rely on the government in Indonesia and Nepal, it would not be effective for government to spearhead housing safety campaigns in these countries. People rely on masons and the government in Pakistan, so housing safety campaigns through these actors would be effective in that country.

Perceptions as to who should take the responsibility for housing safety also differ from country to country. For

strengthening (retrofitting) of houses, an effective strategy would be to target those who should be blamed if houses collapse, i.e., those who must take responsibility. In order to develop policies to promote retrofitting of houses, consideration should be given to the ability of residents to afford such measures, as well as what kinds of support would make residents decide to invest to strengthen or retrofit their houses. Many people tend to overestimate the cost of retrofitting, so disseminating information on practical and affordable technologies for retrofitting would be important. A certain number of people understand that their houses are not safe against earthquakes, and are willing to improve housing safety. A strategy targeting such people as a first step for retrofitting would be very effective. In order to motivate residents to retrofit their houses, the probable loss of their house or property should be emphasized in some countries like Indonesia and Pakistan, while the probable damage of their families should be emphasized in some other countries like Nepal and Turkey. In risk communication with community people, this should be also taken into account. We plan to conduct similar surveys on the risk perception of the residents, national and local government officers, and masons/house builders who are directly responsible for the safety of buildings. It is expected that the results of these surveys will help many earthquake-prone countries to develop more appropriate policies and strategies that take into account local socio-economic demographic conditions in order to promote housing safety, which is the most important task for mitigating earthquake disasters.

Reference

- 1) Korel Eraybar, Alper Ilki, Kenji Okazaki, "Seismic Risk Perception in Avcilar", Proceedings of Turkish Sixth National Conference on Earthquake Engineering, October 2007, Istanbul, Turkey, Vol. 2, p. 41 – p. 51
- 2) Kenji Okazaki "Incentives to Encourage Investment in Earthquake Safer Housing", Proceedings of International Conference on Earthquake Engineering and Disaster Mitigation (ICEEDM08) April 2008, Jakarta, Indonesia, p.47-57

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