

Empirical Model of Household's Earthquake Risk Mitigation Behaviors Using Path Analysis Method

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1. Introduction

How people manage risks and which variables influence on the process of risk management play a crucial role in providing productive urban disaster management and increasing public participation in the urban risk management programs. The purpose of this study is to better understand the motivations of residents in adopting reduction risk behaviors to protect themselves and their residents against earthquake risk. Understanding this process will help urban disaster management enhances participation in and implementation of their programs.

2. Study Area

The city of Tehran, which is adjacent to several major fault lines, was selected as a case study. Mosha-Fasham Fault is in the North of the city and the South Faults and Rey Fault are the most prominent faults in the southern plains. According to the Atlas of Tehran Metropolis, Tehran has had few severe injuries in an earthquake over the past 150 years. The largest historical earthquake in the region occurred in 958 (7/7 Mw magnitude) and its distance to the center of Tehran was less than 50 kilometers. Tehran has had about 1,000 large and small earthquakes recorded within a radius of 100 km of its center.

3. Material and Methods

Because earthquake risk mitigation behaviors are affected by both individual and social processes, to identify variables in this study a combination of psychological and cultural approaches were applied. We restricted our study to actual and intended behaviors. We developed a conceptual model based on the literature review. The instrument was a questionnaire with a sample size of 267 cases that was carried out from March 2013 until the end of April 2014. The questionnaire was designed with four sections. The first section includes some questions about the mediator variable of risk perception, the second section contains some questions about independent variables, the third section includes questions about the risk mitigation behavior variables as a depended variable,

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and the final section contains questions about demographic characteristics. To analyze the conceptual model and obtain the empirical model Path Analysis Method was used. Path Analysis was used to test the conceptual model empirically. Data were analyzed using SPSS version 20. To perform path analysis, we used linear regression analysis with the Enter method. The reliability of questions associated with earthquake risk perception in questionnaire was assessed using Cronbach's Alpha.

4. Results and Discussion

In terms of reliability we found out a Cronbach's Alpha of 0.83 for the collection of earthquake risk perception questions. The result of the study demonstrated that the earthquake risk perception of households were slightly higher than the mid level ($1 < 4.71 < 7$ with visionary mid 4). The results of Path Analysis showed that the correlation between perceived risk and actual behaviors was not significant while the Perceived risk and intended behaviors had a significant relationship. The results of path analysis on the dependent variable of actual behaviors showed that only four variables of knowledge, income, age and home ownership had direct effects on earthquake risk mitigation actual behaviors ($P > .05$). Despite our expectation, other variables were not significantly associated with the dependent variable of risk mitigation actual behaviors ($P > .05$). This research showed that in spite of household perception regarding safety and risk, there is a lack of adequate consideration and effective action on the threat of earthquake up to now. The results of path analysis on the dependent variable of intended behaviors showed that four variables of risk perception, controllability, trust in urban disaster management and length of residence in Tehran had significant relationship with intended behaviors ($P > .05$). Among these variables, only effect of risk perception was positive.

5. Conclusion

It seems that trust is an important factor that urban disaster management decision-makers should consider more and do more effort to increase public trust. As well, three variables contain age, self-efficacy and the need to be protected had a positive effect and two variables contain optimistic biases and income had a negative effect on intended behaviors through risk perception as a mediator variable. It is clear that there is a great need to provide a base in increasing public awareness and promoting their perception by the governments and authorities to reduce risks associated with earthquake in Tehran.

Keywords: Risk perception, Risk mitigation behaviors, Earthquake in Tehran, Path Analysis.

References (in Persian)

1. Badri, A. (2008, August). Perception of earthquake risk and post-disaster reconstruction: Comparative study of two residential neighborhoods on different socio-economic status in Tehran. *Paper presented at the International Disaster and Risk Conference (IDRC2008)*, Davos, Switzerland.

2. Kalantari, Kh. (2012). *Processing and the analysis of data on socio-economic research* (5th ed.). Tehran: Farhang-e Saba.

References (in English)

1. Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191-215.
2. Bickerstaff, K. (2004). Risk perception research: Socio-cultural perspectives on the public experience of air pollution. *Journal of Environment International*, 30(6), 827-840.
3. Boholm, A. (1998). Comparative studies of risk perception: A review of twenty years of research. *Journal of Risk Research*, 1(2), 135-136.
4. Bord, R., & O'Connor, R. (1992). Determinants of risk perceptions of a hazardous waste site. *Risk Analysis*, 12(3), 411-416.
5. Brenot, J., Bonnefous, S., & Marris, C. (1998). Testing the cultural theory of risk in France. *Risk Analysis*, 18(6), 729-739.
6. Burger, J., & Palmer, M. (1992). Changes in and generalization of unrealistic optimism following experiences with stressful events: Reactions to the 1989 California earthquake. *Personality and Social Psychological Bulletin*, 18(1), 39-43.
7. Cho, J., & Lee, J. (2006). An integrated model of risk and risk-reducing strategies. *Journal of Business Research*, 59(1), 112-120.
8. Craik, K. (1943). *The nature of explanation*. Cambridge: Cambridge University Press.
9. Dake, K. (1992). Myths of nature: Culture and the social construction of risk. *Journal of Social Issues*, 48(4), 7-31.
10. Dowling, G. R., & Staelin, R. (1994). A model of perceived risk and intended risk-handling activity. *Journal of Consumer Research*, 21(1), 119-134.
11. Duval, T. S., & Mulilis, J. P. (1999). A person-relative-to-event (PrE) approach to negative threat appeals and earthquake preparedness: A field study. *Journal of Applied Social Psychology*, 29(3), 495-516.
12. Finucane, M. I., Slovic, P., Mertz, C. K., Flynn, J., & Satterfield, T. A. (2000). Gender, race, and perceived risk: The white male effect. *Health, Risk and Society*, 2(2), 159-172.
13. Flynn, J., Slovic, P., & Mertz, C. K. (1994). Gender, race and perception of environmental health risks. *Risk Analysis*, 14(6), 417-429.
14. Helweg-Larsen, M. (1999). (The lack of) optimistic bias in response to the Northridge earthquake: The role of personal experience. *Basic and Applied Social Psychology*, 21(2), 119-129.
15. Jungermann, H., Pfister, H. R., & Fischer, K. (1996). Credibility information preferences, and information interests. *Risk Analysis*, 16(2), 251-261.
16. Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., Kasperson, J. X., & Ratick, S. J. (1988). Social amplification of risk: A conceptual framework. *Risk Analysis*, 8(2), 178-187.

17. Kleinhesselink, R. P., & Rosa, E. A. (1991). Cognitive representations of risk perceptions: A comparison of Japan and the United States. *Journal of Cross-Cultural Psychology*, 22(1), 11-28.
18. Kraus, N., Malmfors, T., & Slovic, P. (1992). Intuitive toxicology: Expert and lay judgments of chemical risks. *Risk Analysis*, 12(2), 215-232.
19. Lindell, M. K., & Perry, R. W. (2000). Household adjustment to earthquake hazard: A review of the literature. *Environment and Behavior*, 32(4), 461-501.
20. Lindell, M. K., & Prater, C. S. (2002). Risk area residents' perceptions and adoption of seismic hazard adjustments. *Journal of Applied Social Psychology*, 32(11), 2377-2392.
21. Lindell, M. K., & Whitney, D. J. (2000). Correlates of household seismic hazard adjustment adoption. *Risk Analysis*, 20(1), 13-25.
22. Loewenstein, G. F., Hsee, C. K., Weber, E. U., & Welch, N. (2001). Risk as feelings. *Journal of Psychological Bulletin*, 127(2), 267-286.
23. Marris, C., Langford, I. H., & O'Riordan, T. (1998). A quantitative test of the cultural theory of risk perceptions: Comparison with the psychometric paradigm. *Risk Analysis*, 18(5), 635-647.
24. Martin, I. M., Bender, H., & Raish, C. (2007). What motivates individuals to protect themselves from risks? The case of wildland fires. *Risk Analysis*, 27(4), 887-900.
25. Martin, I. M., Bender, H., & Raish, C. (2008). Making the decision to mitigate. In W. E. Martin, C. Raish, & B. Kent (Eds.), *Wildfire risk: Human perceptions and management implications* (pp. 117-141). Washington, DC: Resources for the Future Press.
26. Martin, I. M., Bender, H., & Raish, C. (2007). What motivates individuals to protect themselves from risks? The case of wildland and fires. *Risk Analysis*, 27(4), 887-900.
27. Maslow, A. (1968). *Toward a psychology of being* (3rd ed.). New York: Van Nostrand Co.
28. McCaffrey, S. (2004). Thinking of wildfire as a natural hazard. *Society & Natural Resources*, 17, 509-516.
29. McFarlane, B. L. (2005). Public perceptions of risk to forest biodiversity. *Risk Analysis*, 25(3), 543-553.
30. McGee, T. K., McFarlane, B. L., & Varghese, J. (2009). An examination of the influence of hazard experience on wildfire risk perceptions and adoption of mitigation measures. *Society & Natural Resources*, 22, 308-323.
31. Mileti, D. S., & Sorenson, J. H. (1987). Natural hazards and precautionary behavior. In N. Weinstein (Ed.), *Taking care: Understanding and encouraging self-protective behavior* (pp. 189-207). Cambridge: Cambridge University Press.
32. Mitchell, A. A., & Dacin, P. A. (1996). The assessment of alternative measures of consumer expertise. *Journal of Consumer Research*, 23(3), 219-239.
33. Mulilis, J. P., & Duval, T. S. (1995). Negative threat appeals and earthquake preparedness: A person-relative-to-event (PrE) model of coping with threat. *Journal of Applied Social Psychology*, 25(15), 1319-1339.

34. Mulilis, J. P., & Lippa, R. (1990). Behavioral change in earthquake preparedness due to negative threat appeals: A test of protection motivation theory. *Journal of Applied Social Psychology*, 20(8), 619-638.
35. Pedroso de Lima, M. L. (1993). *Percepcao do riscosismo* (Unpublished doctoral dissertation). University of Lisbon, Portugal.
36. Pidgeon, N., Hood, C., Jones, D., Turner, B., & Gibson, R. (1992). Risk perception. In Royal Society Study Group (Ed.), *Risk: Analysis, perception and management* (pp. 89-134). London: The Royal Society.
37. Renn, O., & Rohrman, B. (Eds.). (2000). *Cross-cultural risk perception*. Dordrecht: Kluwer Publishers.
38. Rohrman, B. (1998). The risk notion: Epistemological and empirical considerations. In M. G. Steward & R. E. Melchers (Eds.), *Integrated risk assessment: Applications and regulations* (pp. 39-46). Rotterdam: Balkema.
39. Shepperd, J. A., Helweg-Larsen, M., & Ortega, L. (2003). Are comparative risk judgments consistent across time and events? *Personality and Social Psychology Bulletin*, 29(9), 1169-1180.
40. Siegrist, M., & Cvetkovich, G. (2000). Perception of hazards: The role of social trust and knowledge. *Risk Analysis*, 20(5), 713-719.
41. Siegrist, M., Cvetkovich, G., & Rorh, C. (2000). Salient value similarity, social trust, and risk/benefit perception. *Risk Analysis*, 20(3), 353-362.
42. Sjöberg, L. (1999). Risk perception by the public and by experts: A dilemma in risk management. *Human Ecology Review*, 6(2), 1-9.
43. Slovic, P. (1987). Perception of risk. *Science*, 236, 280-285.
44. Slovic, P. (1993). Perceived risk, trust, and democracy. *Risk Analysis*, 13(6), 675-682.
45. Slovic, P. (2000). *The perception of risk*. London: Earth Scan.
46. Slovic, P., Fischhoff, B., & Lichtenstein, S. (1979). Rating the risks. *Environment*, 21(3), 14-20.
47. Spittal, M., McClure, J., Siegert, R., & Walkey, F. (2005). Optimistic bias in relation to preparedness for earthquakes. *Australasian Journal of Disaster and Trauma Studies*, 1, 2005-2011.
48. Thüning, M., & Jungermann, H. (1986). Constructing and running mental models for inferences about the future. In B. Brehmer, H. Jungermann, P. Lourens, & G. Seven (Eds.), *New directions in research on decision making* (pp. 163-174.). Amsterdam: North-Holland.
49. US Environmental Protection Agency. (1987). *Unfinished business: A comparative assessment of environmental problems*. US Environmental Protection Agency, Washington, DC.
50. Van der Pligt, J. (1996). Perceived risk, optimism and behavior. In J. Georgas, M., Manthouli, E. Besevegis, & A. Kokkevi (Eds.), *Contemporary psychology in Europe* (pp. 91-102). Seattle, WA: Hogrefe and Huber.
51. Weinstein, N. D. (1989). Effects of personal experience on self-protective behavior. *Psychological Bulletin*, 105(3), 31-50.

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52. Wynne, B., Waterton, C., & Grove-White, R. (1993). *Public perceptions and the nuclear industry in West Cumbria*. Lancaster: Lancaster University.
 53. Zhu, D., Xie, X., & Gan, Y. (2011). Information source and valence: How information credibility influences earthquake risk perception. *Journal of Environmental Psychology*, 31(2), 129-136.