



# Association between disaster experience and quality of life: the mediating role of disaster risk perception

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## Abstract

**Purpose** Disasters may impair people's quality of life (QoL) indirectly through disaster risk perception. We intended to address this point by analyzing the correlation between disaster experience and QoL with a test of the mediating effects of risk perception at the example of earthquake.

**Methods** We employed the 2013 Taiwan Social Change Survey data as the data source ( $N = 1481$ ). Unadjusted ordinal logistic regression models examined the correlation of disaster experience with QoL and earthquake risk perception at first. Another set of ordinal regressions were conducted to explore the mediating effect of earthquake risk perception between earthquake experience and QoL.

**Results** Earthquake experience had negative impact on QoL measured by self-reported happiness, general health status, and life satisfaction. People who had earthquake experience perceived higher earthquake risk compared to those who had never experienced an earthquake. Risk perception measured by perceived likelihood of future earthquake as a mediating factor for the impact of earthquake experience on QoL from the dimensions of both self-reported happiness and life satisfaction was confirmed.

**Conclusions** Findings are consistent with existing reports about the association between disaster experience and QoL. Research using multi-dimensional measures of disaster risk perception and QoL is needed to inform post-disaster recovery programs.

**Keywords** Disaster experience · Quality of life · Risk perception · Taiwan

## Introduction

Quality of life (QoL) can be measured in three dimensions: self-reported happiness, general health status, and life satisfaction [1–3]. Previous studies from different countries have shown that exposure to natural disasters impairs people's QoL [4–10]. Other risk factors associated with poor QoL among disaster survivors include but are not limited to being female, higher age, living alone, disadvantaged living conditions, lower socio-economic status, ethnic minorities, being

injured, and deaths of loved ones during emergencies [3, 4, 11]. Meanwhile, social capital regarding either social support or trust has been found to be protective factors that help mitigate the negative impact of disaster events on survivors' QoL [12–17].

Studies have also indicated that individuals' experiences of hazard events predict their perceptions of higher disaster risk, but these studies mainly focus on the correlation between individuals' risk perception and disaster preparedness [18–20]. More recently, Berlemann [21] suggested about the indirect effect of natural disasters on individual well-being through disaster risk perception. But little empirical evidence is yet available for the mediating effect of individual risk perception between disaster experience and QoL.

Therefore, the goal of this research was to explore the associations between disaster experience and QoL under the mediating influence of disaster risk perception. We employed the Taiwan Social Change Survey (TSGS) data in 2013 as the data source in this paper. Earthquake is one of

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the most severe natural-induced disasters in Taiwan [22], and thus earthquake was treated in this study. Based on previous research evidence, we hypothesized that (1) earthquake experience impacts on an individual's QoL negatively; (2) earthquake experience has a negative effect on individual risk perception; (3) earthquake risk perception has a negative effect on QoL controlling for earthquake experience; and (4) earthquake risk perception operates as a mediating factor between earthquake experience and QoL.

## Methods

### Participants and sampling

TSGS is a long-term, large-scale social survey conducted annually in Taiwan since the 1980s. The project was implemented by the Institute of Sociology, Academia Sinica, one of the most reputable research institutes in Taiwan, from June to December 2013. According to the report of 2013 TSGS, all the adults older than 18 were the sampling population, and 4082 individuals were sampled in total, but only 2005 responded and finished all the survey questions. The cases with missing values of our selected variables were dropped in the analysis, and 1481 observations were included in our models eventually.

This research was designed following the ethical standards of the 1964 Declaration of Helsinki and its later amendments. It was reviewed and approved by the research ethics committee of the Division of Humanities and Social Sciences at the Academia Sinica, Taiwan.

### Measurements

**Quality of life:** In light of previous studies [1–3], QoL in our study was captured by three variables including perceived happiness (“Overall, do you feel happy about your current life?”), satisfaction with current life (“Overall, how do you satisfied with your current life?”), and perceived general health (“Overall, how do you feel about your health?”). All the three variables were measured by five Likert scales ranging from 1 to 5, representing the increased degree of each indicator.

**Earthquake experience:** Earthquake experience was set as a dummy variable. The original question about earthquake experience was “how many times have you ever been experienced an earthquake?” If a respondent had experienced at least one earthquake, he/she was designated as “experienced earthquake,” and thus the disaster experience variable was coded as “1.” Otherwise, it was coded as “0.” Overall, 22.69% of the 1481 respondents experienced earthquakes, while another 77.31% had not.

**Earthquake risk perception:** Two items were adopted to indicate earthquake risk perception, one was perceived probability of a potentially disruptive earthquake in this region, and the other was the degree of worrisome to the potential earthquake. Both items were measured by five Likert scales, from 1 to 5 indicating “very low probability/not worried at all” to “very high probability/worried a lot.”

**Controlled variables:** Basic socio-economic and demographic variables like family income, perceived social status, years of residence in the current community, age, gender, religious status, education attainment, and marital status were the primarily controlled variables included. Social capital, indicated by trust in authorities and social network measured by both neighborhood cohesion and organizational membership [23], was also included in the analysis as controlled variables.

### Data analysis

A descriptive analysis of all the variables examined in this study was first conducted using earthquake experience as the stratum. Secondly, we used unadjusted ordinal logistic regressions to indicate the correlation of earthquake experience with QoL and earthquake risk perception. Finally, the role of earthquake risk perception for the impact of earthquake experience on individuals' QoL was analyzed using ordinal regression. The data analysis was implemented by Stata 13.1 MP version.

## Results

Frequencies and percentages for categorical variables, means, and standard deviations for continuous variables for the entire sample are reported in Table 1.

Table 2 reports the correlation between earthquake experience and QoL and earthquake risk perception. The results indicated that earthquake experience was negatively associated with all the three measures of QoL, but the correlation with perceived general health was not statistically significant within the current sample. Meanwhile, earthquake experience had positive correlations with both of the two measures of earthquake risk perception with strong statistical significance, i.e., 0.81 for probability ( $p < 0.001$ ) and 0.41 for worrisome ( $P < 0.001$ ).

The results of regression analyses on QoL with earthquake experience and risk perception as independent variables while controlling for socio-demographic and social capital variables are shown in Table 3. It indicates that, on the one hand, the correlation of earthquake experience and perceived happiness became non-significant, and the coefficient decreased simultaneously (from 0.21 to 0.1); the correlation between earthquake experience

**Table 1** Distribution by earthquake experience ( $N=1481$ )

	No experience		Having experience	
	Freq.	Percent	Freq.	Percent
<b>Happiness</b>				
Not happy at all	27	2.36	16	4.76
2	133	11.62	46	13.69
3	113	9.87	30	8.93
4	679	59.30	188	55.95
Very happy	193	16.86	56	16.67
<b>Life satisfaction</b>				
Not satisfied at all	22	1.92	17	5.06
2	166	14.50	62	18.45
3	73	6.38	24	7.14
4	724	63.23	188	55.95
Very satisfied	160	13.97	45	13.39
<b>General health</b>				
Very poor	114	9.96	36	10.71
2	301	26.29	101	30.06
3	442	38.60	107	31.85
4	239	20.87	73	21.73
Very healthy	49	4.28	19	5.65
<b>Education</b>				
Primary	163	14.24	37	11.01
Middle	117	10.22	32	9.520
High	91	7.950	36	10.71
College+	774	67.60	231	68.75
<b>Marriage</b>				
Single	306	26.72	99	29.46
Married	740	64.63	207	61.61
Divorced	56	4.890	17	5.060
Widowed	43	3.760	13	3.870
<b>Having children</b>				
Yes	471	41.14	134	39.88
No	674	58.86	202	60.12
<b>Religion</b>				
Yes	899	78.52	278	82.74
No	246	21.48	58	17.26
<b>Gender</b>				
Female	534	46.64	154	45.83
Male	611	53.36	182	54.17
<b>Continuous variables (min–max)</b>				
	Mean	SD	Mean	SD
Probability (1–5)	2.67	1.12	3.15	1.17
Worrisome (1–5)	3.63	1.31	3.94	1.16
Neighborhood cohesion (1/2–10)	5.93	2.09	6.21	2.16
Organizational membership (0–12/9)	0.90	1.50	1.14	1.67
Trust in authorities (0/2–50/49)	31.29	7.870	32.13	7.59
Years of residence (1–7)	5.37	1.60	5.41	1.52
Social status (1–10)	4.68	1.69	4.60	1.83
Family income/month (1–26)	9.23	5.02	9.23	5.06
Age (20–95/87)	46.17	16.04	45.63	15.98
Total	1145	100	336	100

**Table 2** Unadjusted ordinal logistic regressions on quality of life and risk perception ( $N=1481$ )

	Happiness	Life satisfaction	General health	Probability	Worrisome
Earthquake experience	- 0.21* (0.11)	- 0.33** (0.11)	- 0.14 (0.10)	0.81*** (0.10)	0.41*** (0.10)
Pseudo $R^2$	0.001	0.002	0.000	0.011	0.003

Standard errors in parentheses; \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

**Table 3** Ordinal regression on quality of life with adjusted variables ( $N=1481$ )

	Happiness	Life satisfaction	General health
Earthquake experience	- 0.10 (0.13)	- 0.33* (0.13)	- 0.04 (0.12)
Probability	- 0.19*** (0.05)	- 0.15** (0.05)	- 0.06 (0.05)
Worrisome	- 0.04 (0.05)	0.01 (0.05)	- 0.09* (0.04)
Neighborhood cohesion	0.08** (0.03)	0.12*** (0.03)	0.06* (0.02)
Organizational membership	0.08* (0.04)	0.10** (0.04)	0.07* (0.03)
Trust in authorities	0.03*** (0.01)	0.03*** (0.01)	0.01 (0.01)
Years of residence	- 0.08* (0.04)	- 0.09* (0.04)	- 0.03 (0.03)
Having children	- 0.02 (0.12)	- 0.10 (0.12)	0.00 (0.11)
Social status	0.25*** (0.03)	0.27*** (0.03)	0.17*** (0.03)
Family income/month	0.02 (0.01)	0.04*** (0.01)	0.03** (0.01)
Gender	- 0.28** (0.11)	- 0.09 (0.11)	0.43*** (0.10)
Age	0.01 (0.01)	0.01* (0.01)	- 0.01 (0.00)
Education (primary as reference)			
Middle	- 0.34 (0.23)	- 0.22 (0.23)	0.14 (0.22)
High	- 0.38 (0.25)	- 0.25 (0.25)	0.24 (0.24)
College+	- 0.38 (0.20)	- 0.47* (0.20)	0.37 (0.19)
Religion	- 0.23 (0.13)	- 0.14 (0.14)	0.14 (0.12)
Marriage (single as reference)			
Married	0.00 (0.17)	- 0.18 (0.17)	0.09 (0.15)
Divorced	- 0.42 (0.27)	- 0.35 (0.28)	- 0.13 (0.25)
Widowed	0.11 (0.35)	- 0.18 (0.35)	0.10 (0.32)
Pseudo $R^2$	0.051	0.061	0.039

Standard errors in parentheses; \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

and life satisfaction stayed significant, but the coefficient also decreased slightly if counted by three decimal points (from 0.334 to 0.326); the correlation between earthquake experience and health was still not significant, but the coefficient decreased by 0.1. On the other hand, when earthquake experience was controlled, the perceived likelihood of an earthquake correlated with happiness and life satisfaction significantly, but the degree of worrisome had significant positive association only with perceived

health status. Moreover, the coefficient of the relationship between worrisome degree and general health (0.09,  $p < 0.05$ ) was even higher than the coefficient of the relationship between general health and earthquake experience (0.04,  $p > 0.05$ ).

## Discussion

In this study, the role of disaster risk perception as a mediating factor for the impact of natural disaster on QoL was examined. The results clearly supported our hypothesis 1 that earthquake experience negatively impacted on QoL measured by three commonly reported indicators, which was also consistent with previous studies [4, 9, 10, 24, 25]. Our study also confirmed hypothesis 2, as earthquake experience significantly predicted higher earthquake risk perception. With earthquake experience being controlled, earthquake risk perception was also found to be negatively correlated with QoL (expect the degree of worrisome and life satisfaction), thus hypothesis 3 was partially supported, similar to Berlemann's study that [21] hurricane risk negatively impacts on individual well-being.

Moreover, we expanded upon previous work by investigating the indirect effect of risk perception between disaster experience and QoL, thus hypothesis 4 was proposed. Our results revealed that individuals' risk perception measured by perceived likelihood of future earthquake explained part of the negative effects of earthquake experience on perceived happiness and life satisfaction, which could possibly be interpreted as experiencing an earthquake would make individuals perceive higher occurrence possibility of an earthquake in the first place, which subsequently made them feel unhappy and led to their lower satisfaction with current life at the same time. Therefore, one practical implication can be proposed is relate to interventions aiming at reducing survivors' unreasonable anticipation of disaster occurrence possibility as well as the excessive worry of future disaster damages in post-disaster recovery programs. However, as with all cross-sectional studies, the findings of this study were limited because we did not really get the causal effects conclusion for the factors under study.

## Conclusion

Earthquake experience could impact on the degree of individual perception of happiness and life satisfaction directly and indirectly through the effect of risk perception measured by the perceived likelihood of a future earthquake. Further research using multi-dimensional measures of disaster risk perception and QoL is needed to fully comprehend the influencing mechanism of disaster experience on individual well-being.

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## References

- Abdel-Khalek, A. M. (2010). Quality of life, subjective well-being, and religiosity in Muslim college students. *Quality of Life Research*, 19(8), 1133–1143. <https://doi.org/10.1007/s11136-010-9676-7>.
- Gill, T. M., & Feinstein, A. R. (1994). A critical appraisal of the quality of quality-of-life measurements. *JAMA: Journal of the American Medical Association*, 272(8), 619–626.
- Wang, Z., & Xu, J. (2017). Association between resilience and quality of life in Wenchuan Earthquake Shidu parents: The mediating role of social support. *Community Mental Health Journal*, 53(7), 859–863. <https://doi.org/10.1007/s10597-017-0099-6>.
- Ardalan, A., Mazaheri, M., Vanrooyen, M., Mowafi, H., Nedjat, S., Naieni, K. H., & Russel, M. (2011). Post-disaster quality of life among older survivors five years after the Bam earthquake: implications for recovery policy. *Ageing & Society*, 31, 179–196. <https://doi.org/10.1017/S0144686X10000772>.
- Khachadourian, V., Armenian, H. K., Demirchyan, A., & Goenjian, A. (2015). Loss and psychosocial factors as determinants of quality of life in a cohort of earthquake survivors. *Health and Quality of Life Outcomes*, 13, 13. <https://doi.org/10.1186/s12955-015-0209-5>.
- Lin, M.-R., Huang, W., Huang, C., Hwang, H.-F., Tsai, L.-W., & Chiu, Y.-N. (2002). The impact of the Chi-Chi earthquake on quality of life among elderly survivors in Taiwan – A before and after study. *Quality of Life Research*, 11(4), 379–388. <https://doi.org/10.1023/A:1015543113448>.
- Papanikolaou, V., Adamis, D., & Kyriopoulos, J. (2012). Long term quality of life after a wildfire disaster in a rural part of Greece. *Open Journal of Psychiatry*, 02(02), 164. <https://doi.org/10.4236/ojpsych.2012.22022>.
- Priebe, S., Marchi, F., Bini, L., Flego, M., Costa, A., & Galeazzi, G. (2011). Mental disorders, psychological symptoms and quality of life 8 years after an earthquake: findings from a community sample in Italy. *Social Psychiatry and Psychiatric Epidemiology*, 46(7), 615–621. <https://doi.org/10.1007/s00127-010-0227-x>.
- Wang, X. D., Gao, L., Zhang, H. B., Zhao, C. Z., Shen, Y. C., & Shinfuku, N. (2000). Post-earthquake quality of life and psychological well-being: Longitudinal evaluation in a rural community sample in northern China. *Psychiatry and Clinical Neurosciences*, 54(4), 427–433. <https://doi.org/10.1046/j.1440-1819.2000.00732.x>.
- Wen, J., Shi, Y., Li, Y., Yuan, P., & Wang, F. (2012). Quality of life, physical diseases, and psychological impairment among survivors 3 years after Wenchuan Earthquake: A population based survey. *PLoS ONE*, 7(8), e43081. <https://doi.org/10.1371/journal.pone.0043081>.
- Chou, F. H. C., Chou, P., Lin, C., Su, T. T. P., Ou-Yang, W. C., Chien, I. C., ... Chen, M. C. (2004). The relationship between quality of life and psychiatric impairment for a Taiwanese community post-earthquake. *Quality of Life Research*, 13(6), 1089–1097. <https://doi.org/10.1023/B:QURE.0000031337.73269.64>.
- Charyton, C., Elliott, J. O., Lu, B., & Moore, J. L. (2009). The impact of social support on health related quality of life in persons with epilepsy. *Epilepsy & Behavior*, 16(4), 640–645. <https://doi.org/10.1016/j.yebeh.2009.09.011>.
- Chung, L., Pan, A.-W., & Hsiung, P.-C. (2009). Quality of life for patients with major depression in Taiwan: A model-based study of predictive factors. *Psychiatry Research*, 168(2), 153–162. <https://doi.org/10.1016/j.psychres.2008.04.003>.
- Hommerich, C. (2012). Trust and subjective well-being after the Great East Japan Earthquake, Tsunami and Nuclear Meltdown: Preliminary results. *International Journal of Japanese Sociology*, 21(1), 46–64. <https://doi.org/10.1111/j.1475-6781.2012.01169.x>.
- Ke, X., Liu, C., & Li, N. (2010). Social support and quality of life: A cross-sectional study on survivors eight months after the 2008 Wenchuan earthquake. *BMC Public Health*, 10, 573. <https://doi.org/10.1186/1471-2458-10-573>.
- Liang, Y. (2015). Correlations between health-related quality of life and interpersonal trust: Comparisons between two generations of chinese rural-to-urban migrants. *Social Indicators Research*, 123(3), 677–700. <https://doi.org/10.1007/s11205-014-0755-y>.
- Tokuda, Y., Jimba, M., Yanai, H., Fujii, S., & Inoguchi, T. (2008). Interpersonal trust and quality-of-life: A cross-sectional study in Japan. *PLoS ONE*, 3(12), e3985. <https://doi.org/10.1371/journal.pone.0003985>.
- Siegrist, M., Gutscher, H., & Earle, T. C. (2005). Perception of risk: the influence of general trust, and general confidence. *Journal of Risk Research*, 8(2), 145–156. <https://doi.org/10.1080/1366987032000105315>.
- Han, Z., Lu, X., Hörhager, E. I., & Yan, J. (2017). The effects of trust in government on earthquake survivors' risk perception and preparedness in China. *Natural Hazards*, 86(1), 437–452. <https://doi.org/10.1007/s11069-016-2699-9>.
- Han, Z., Wang, H., Du, Q., & Zeng, Y. (2017). Natural hazards preparedness in Taiwan: A comparison between households with and without disabled members. *Health Security*, 15(6), 575–581. <https://doi.org/10.1089/hs.2017.0025>.
- Berlemann, M. (2016). Does hurricane risk affect individual well-being? Empirical evidence on the indirect effects of natural disasters. *Ecological Economics*, 124, 99–113. <https://doi.org/10.1016/j.ecolecon.2016.01.020>.
- Chang, J.-C. (1996). Natural hazards in Taiwan. *GeoJournal*, 38(3), 251–257. <https://doi.org/10.1007/BF00204716>.
- Han, Z., Sun, I. Y., & Hu, R. (2017). Social trust, neighborhood cohesion, and public trust in the police in China. *Policing: An International Journal of Police Strategies & Management*, 40(2), 380–394. <https://doi.org/10.1108/PIJPSM-06-2016-0096>.
- Nomura, S., Parsons, A. J. Q., Hirabayashi, M., Kinoshita, R., Liao, Y., & Hodgson, S. (2016). Social determinants of mid- to long-term disaster impacts on health: A systematic review. *International Journal of Disaster Risk Reduction*, 16, 53–67. <https://doi.org/10.1016/j.ijdrr.2016.01.013>.
- Tian, W., Jia, Z., Duan, G., Liu, W., Pan, X., Guo, Q., ... Zhang, X. (2013). Longitudinal study on health-related quality of life among child and adolescent survivors of the 2008 Sichuan earthquake. *Quality of Life Research*, 22(4), 745–752. <https://doi.org/10.1007/s11136-012-0201-z>.