

Why are flood and landslide victims less willing to take mitigation measures than the public?

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Abstract Almost annually, natural hazards such as floods and landslides cause a great deal of financial loss and human suffering in Taiwan. In order to gain a better understanding of disaster preparedness, this paper examines several factors in relation to hazard mitigation behavior: social economic status (education, income), psychological vulnerability (sense of powerless and helpless), risk perception (perceived impact and control) and social trust. The statistical analysis reported here is based on the “2004 National Risk Perception Survey of Floods and Landslides in Taiwan”. The main findings include: (1) in comparison with general public, victims are less willing to adopt risk mitigation measures than the public, even though they perceive larger impacts, worry more about the hazard, and pay more attention to hazard information; (2) trust, risk perception and social economic status are positive predictors for mitigation intentions, whereas psychological vulnerability is a negative predictor; and (3) psychological variables are stronger predictors for mitigation intentions than that of socio-economic variables. In light of these findings, the policy implications and intervention strategy are also discussed.

Keywords Flood · Landslide · Risk Perception · Powerless · Vulnerability · Hazard Mitigation

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1 Introduction

During the typhoon season (from early May to late November), floods and landslides often cause severe economic loss and human suffering in Taiwan. Despite their prior experiences with disasters, many residents in hazard-prone areas are reluctant to accept the government's risk mitigation plans or recommendations, such as relocation to a safer place or the purchase of flood insurance (National Science and Technology Center for Disaster Reduction 2006). This observation is not easy to explain from a decision-theory perspective (see Lindell et al. 1997; Mileti 1999, pp. 136–140), which suggests that those who perceive themselves at risk should be more willing to take preventive measures.

The main objective of this study is to assess how people perceive natural hazards, what they believe about natural hazards, and whether these perceptions and beliefs make a difference in adopting mitigation. In addition to demographic variables, this study focuses on psychological variables such as perceived vulnerability, risk perception and social trust. These psychological variables are not limited to a decision theoretical framework, which typically includes perceived likelihood of the hazards and severity of the impacts. Rather, they reflect attitudes (see Ajzen 1991) to natural hazards, such as fatalism belief and trust (cognitive component), worry and dread (affective component). According to attitude theory, the behavior of people can be predicted from relevant beliefs, affects and values. Thus, to know how these attitude components can be changed to increase the implementation of mitigation is essential to communication regarding risk and in proposing effective intervention strategy. As Lindell et al. (1997) once noted, many demographic variables are difficult or impossible to change (such as age). However, a better understanding of the psychological processes associated with aging may provide insight into behavior that can be changed.

2 Methods

From 1 July to 11 September 2004, there were two typhoons and a heavy rainfall in Taiwan, causing severe flood and landslide damage. About one month after this period, a "National Risk Perception Survey of Flood and Landslide" was conducted by the National Science and Technology Center for Disaster Reduction (NCDR). There were four groups of participants (2,914 households in total): general public flood group ($n = 1,090$) and flood victims group ($n = 250$) for the flood questionnaire, and general public landslide group ($n = 1,073$) and landslide victims group ($n = 501$) for the landslide questionnaire. Flood and landslide victims were drawn from the impacted population who had received the local government's emergency relief fund. The impacted areas included seven towns for flood and five towns for landslide. The general public for both the flood and landslide groups were drawn from all the administration divisions in Taiwan. A stratified random sampling procedure was used to obtain adult samples (over 20 years of age) in the households for all groups. The telephone survey was conducted by professional interviewers using the CATI (Computer Assisted Telephone Interviewing) system.

The results of the survey reported in this paper focus on the subjects' responses to the items in the following four categories (see Table 1): Risk Perception (seven items, revised from Fischhoff et al. 1978; Slovic 1987); Trust (three items); Vulnerability (five items); and Risk Mitigation Intentions (seven items). All items are measured on a 4-point bipolar scale. In the items related to mitigation intentions, participants are instructed to consider "In order to prevent severe losses from flood/landslide, would you be willing to take the

Table 1 Questionnaire items and the rating scales

Item type	Item	Key term and scale			
		1	2	3	4
Risk perception	In the community in which you live, how likely is it that a flood/landslide will occur?	<i>Likelihood</i>	Small	Large	Very large
	How clearly do you know what mitigation actions you can adopt?	<i>Knowledge</i>	Not clear	Clear	Very clear
	Do you think that you can control a loss due to a flood/landslide event?	<i>Controllability</i>	Cannot control at all	Cannot control	Can totally control
	To what extent would a flood/landslide threaten your life?	<i>Fatal</i>	Not severe at all	Severe	Very severe
	To what extent would a flood/landslide affect the "quality of your life"?	<i>Affect life quality</i>	Not severe at all	Severe	Very severe
	To what extent would a flood/landslide cause financial loss to you ?	<i>Financial loss</i>	Not severe at all	Severe	Very severe
	In general, how afraid are you of a flood/ landslide?	<i>Dread</i>	Not afraid at all	Afraid	Very afraid
	In general, do you trust the government's capability with regard to crisis management?	<i>Trust government</i>	Do not trust at all	Trust	Trust a lot
	In general, do you trust the capability of experts to give flood/landslide warnings?	<i>Trust expert</i>	Do not trust at all	Trust	Trust a lot
	In general, do you trust the mass media's capability to report flood/landslide warnings?	<i>Trust media</i>	Do not trust at all	Trust	Trust a lot

Table 1 continued

Item type	Item	Key term and scale			
		1	2	3	4
Vulnerability	Encountering a major flood/landslide disaster would be just due to fate of which I have little control over.	<i>Fatalism</i> Strongly disagree	Disagree	Agree	Strongly agree
	Do you often worry about the threat of flood/landslide in your daily life?	<i>Worry</i> Strongly disagree	Disagree	Agree	Strongly agree
	When flood/landslide occurs, you will likely feel helpless because of lack of assistance from your neighbors and friends	<i>Helpless neighbor</i> Strongly disagree	Disagree	Agree	Strongly agree
	When flood/landslide occurs, you will likely feel helpless because of assistance from the government	<i>Helpless government</i> Strongly disagree	disagree	Agree	Strongly agree
	You often feel helpless because of the lack of capability to better the livelihood of your family	<i>Helpless livelihood</i> Strongly disagree	disagree	Agree	Strongly agree
	Do you agree on the government's plan to alert the public about a flood/landslide hazard potential area?	<i>Announcement</i> Strongly disagree	Disagree	Agree	Strongly agree
	If you can afford it, would you be willing to relocate?	<i>Relocation</i> Very unwilling	Unwilling	Willing	Very willing
	If it is necessary, would you be willing to take mitigation measures at your own expense ?	<i>Own expense</i> Very unwilling	Unwilling	Willing	Willing Very
	Would you be willing to purchase a government's flood/landslide insurance plan to protect against potential loss?	<i>Insurance</i> Very unwilling	Unwilling	Willing	Very willing
	If it were necessary would you be willing to accept inconvenience in your life due to government's mitigation plan ?	<i>Accept inconvenience</i> Very unwilling	Unwilling	Willing	Very willing
Mitigation intentions					

Table 1 continued

Item type	Item	Key term and scale			
		1	2	3	4
	If it were necessary would you be willing to accept financial loss due to government's mitigation plan	<i>Accept financial loss</i>			
	How much attention to flood /landslide information did you pay?	Very unwilling <i>Information seeking</i>	Unwilling	Willing	Very willing
		Not at all attentive	Not attentive	Attentive	Very attentive

following preventive measures”. The main idea behind this design is to use risk perception, trust and vulnerability as predictors (15 items in total) for the mitigation intentions. Participants are also asked to state their overall risk rating (perceived risk) on flood, landslide risk, along with four other types of hazards. In the final section, the demographic information is collected.

3 Results and discussion

Factor analyses of the 15 items (out of the categories of trust, risk perception and vulnerability) are first conducted for the flood group and the landslide group (each group include both the victims and the general public), respectively. Since the resulting factor structures are the same for both groups, they are pooled together for an overall factor analysis. The resulting factor structure is presented in Table 2

As shown in Table 2, six out of seven risk perception items are grouped into two factors: perceived IMPACT and perceived CONTROL of the consequences. Perceived “likelihood” of the flood/landslide, however, is grouped with worry and fatalism (vulnerability items). A person who rated high in this factor indicated if he/she perceived the chances of a hazard to be high, often worrying about it, but believed that little can be done about the risk. Thus, we label this factor as POWERLESS. Factor HELPLESS contains three remaining vulnerability items, while three trust items constitute the TRUST factor. All together, five factors account for 61% of the variance. Because factor analysis here merely serves as a data reduction tool, all five factors are utilized in further analysis. The mean ratings are listed in Table 3. As expected, both flood and landslide victims have a much higher perceived risk than that of the public. On the other hand, victims’ level of education and family incomes are significantly lower than the public. As expected, victims feel the threat, but have less resource to cope with the situation.

Table 2 Factor loadings across fifteen predictors

<i>N</i> = 2914	Impact	Powerless	Trust	Helpless	Control
Fatal	0.867				
Affect life quality	0.884				
Financial loss	0.879				
Dread	0.656				
Knowledge					0.823
Controllability					0.644
Likelihood		0.780			
Worry		0.785			
Fatalism		0.587			
Helpless neighbor				0.768	
Helpless government				0.744	
Helpless livelihood				0.552	
Trust government			0.718		
Trust expert			0.775		
Trust media			0.619		
Variance explained	20.9	12.5	11.0	9.0	7.5

Note: Factor loadings are the result of varimax rotation

Table 3 Mean ratings of the survey items

	Flood			Landslide		
	Victim	Public	(V-P)	Victim	Public	(V-P)
Perceived risk	3.53	2.06	1.47**	2.56	1.64	0.92**
Education (years)	8.82	12.47	-3.65**	9.48	12.4	-2.89**
Family Income(thousands/month)	46.53	78.62	-32.08**	41.0	74.81	-33.81**
<i>Control</i>						
Known mitigation actions	2.90	2.71	0.19**	2.57	2.38	0.19**
Able to control	1.92	2.29	-0.37**	1.91	1.77	0.13**
<i>Impact</i>						
Fatal	2.86	2.52	0.34**	3.11	3.06	0.05
Affect life quality	3.31	2.79	0.52**	3.12	2.96	0.16**
Financial loss	3.30	2.63	0.67**	2.99	2.93	0.03
Dread	3.43	2.65	0.79**	3.37	3.10	0.27**
<i>Powerless</i>						
Likelihood	3.06	1.45	1.62**	2.25	1.16	1.09**
Worry	3.13	2.11	1.02**	2.98	1.88	1.10**
Fatalism	2.38	2.13	0.25**	2.47	1.98	0.49**
<i>Helpless</i>						
Helpless livelihood	2.37	2.29	0.08	2.41	2.32	0.09*
Helpless neighbor	2.27	2.37	-0.10	2.44	2.57	-0.13**
Helpless government	2.77	2.79	-0.02	2.74	2.87	-0.13**
<i>Trust</i>						
Trust government	2.36	2.40	-0.04	2.36	2.24	0.12**
Trust expert	2.70	2.70	0.00	2.53	2.75	-0.22**
Trust mass media	2.68	2.64	0.04	2.72	2.59	0.13**
<i>Mitigation</i>						
Announcement	3.33	3.60	-0.27**	3.32	3.68	-0.35**
Relocation	3.07	3.42	-0.35**	2.95	3.55	-0.60**
Own expense	3.05	3.23	-0.18**	3.05	3.23	-0.18**
Insurance	2.69	2.58	0.10	2.86	2.84	0.02
Accept inconvenience	3.13	3.10	0.03	3.01	3.15	-0.14**
Accept financial loss	2.91	3.05	-0.14**	2.80	3.13	-0.33**
Information seeking	3.47	3.00	0.47**	3.19	2.81	0.37**

** Significant at 0.01 level; * at 0.05 level

There are also important differences between flood and landslide responses. First, the difference in perceived impact between victims and public is greater for flood than landslide (e.g., difference in *Dread* is 0.79 for flood and 0.27 for landslide). Interestingly, the differential perceived impact is not due to difference between victims (e.g., for *Dread*, 3.43 for flood and 3.37 for landslide), but mainly because the general public has a higher perceived impact from landslide than flood (e.g., for *Dread*, 2.65 for flood and 3.10 for landslide). In Taiwan, compared to landslide many more people face the threat of flood, yet most people perceive landslide disaster as more dreadful than flooding occurrences.

Second, regarding the mitigation intentions (see the bottom of Table 3), both flood and landslide victims pay more attention to hazard information than the public; they are,

however, less willing to adopt mitigation measures. Why are victims, who often live in risk-prone areas and are probably most in need of risk reduction, less willing to take such actions? The results in Table 3 provide some insight into this question. Across both the flood and landslide surveys, victims had a higher perceived impact than the public, but they had an even higher sense of powerless than the public. We suspect that while perceived impact promotes intention towards risk mitigation, the sense of powerlessness may inhibit it.

3.1 Predicting mitigation intentions

Prior to further analysis, single measures of IMPACT, CONTROL, POWERLESS, HELPLESS, and TRUST are constructed by calculating the average responses of the items for each factor (see Table 2). For example, TRUST is represented by the average score of the trust of the government, experts and the mass media. The multiple regression analyses are then conducted to examine the relative importance of the five psychological variables and the two social-economic status variables (education and income) in predicting each of the seven mitigation intentions.¹ Among other demographic variables, education and income are selected because they have been found to be associated with risk mitigation behaviors (e.g., Edwards 1993).

The significant standardized regression coefficients are listed in Tables 4 (flood) and 5 (landslide). Across both hazards, social trust (TRUST), risk perception (IMPACT, CONTROL) and social economic status (EDUCATION, INCOME) are positively associated with mitigation intentions. However, psychological vulnerability (POWERLESS, HELPLESS) is a negative predictor for all mitigation intentions, except that POWERLESS is positively associated with “information seeking”. These findings shed some light on the earlier question as to why victims are less willing to adopt mitigation measures than the public. Recall that victims typically have higher perceived impact (positive predictor) and

Table 4 Standardized regression coefficients for predicting flood risk mitigation

Predictors	Mitigation intentions						
	Announce	Relocation	Expense	Inconvenience	Financial loss	Insurance	Seeking information
TRUST		0.07*	0.12**	0.12**	0.13**	0.20**	0.08*
IMPACT	0.10**		0.15**	0.12**	0.08*	0.12**	0.14**
CONTROL	0.11**		0.09**	0.08*		0.09*	0.18**
POWERLESS	-0.20**	-0.20**	-0.13**		-0.09*		0.17**
HELPLESS				-0.09*			-0.14**
EDUCATION	0.18**	0.11**	0.15**		0.09*		
INCOME		0.08*	0.09**				
R^2	0.10	0.09	0.09	0.04	0.04	0.07	0.11
F value	12.61**	10.51**	10.88**	4.27**	4.52**	7.66**	14.45**

** Significant at 0.01 level; * at 0.05 level

The strongest predictor for each mitigation intention is highlighted in bold

¹ The correlation coefficients between these seven predictors are low. They are below 0.32 for flood and 0.30 for landslide.

Table 5 Standardized regression coefficients for predicting landslide risk mitigation

Predictors	Mitigation intentions						
	Announce	Relocation	Expense	Inconvenience	Financial loss	Insurance	Seeking information
TRUST		0.09**		0.10**	0.15**	0.11**	
IMPACT	0.10**	0.07*					0.16**
CONTROL							0.22**
POWERLESS	-0.26**	-0.30**	-0.09*	-0.10**	-0.20**		0.16**
HELPLESS							
EDUCATION	0.14**	0.13**	0.08*				
INCOME							
R ²	0.13	0.14	0.03	0.03	0.07	0.02	0.10
F value	18.05**	20.93**	3.28**	3.42**	9.29**	2.02*	12.35**

** Significant at 0.01 level; * at 0.05 level

The strongest predictor for each mitigation intention is highlighted in bold

higher sense of powerlessness (negative predictor) than the public, a response pattern that predicts conflicting attitudes toward risk mitigation. However, as the POWERLESS factor outweighs the impact factor, it is conceivable that there is less willingness to employ mitigation measures.

For both flood and landslide, the psychological factors are clearly stronger predictors for hazard mitigation than that of demographic variables (education and income). Among the five psychological factors, HELPLESS is the least important predictor of all, whereas, for the demographic variables, the effect of INCOME is negligible.

POWERLESS and TRUST are strong predictors for both flood and landslide mitigation. In particular, POWERLESS is the most dominant predictor for landslide mitigation. On the other hand, the effects of perceived IMPACT and CONTROL seem to be hazard dependent, in this case, they are strong predictors for flood mitigation, but weak in predicting landslide mitigation.

4 Conclusions and policy implications

Recently, there has been increasing research on the components of social vulnerability, which is often described using the demographic characteristics of people (education, income, age, gender). This research agenda suggests that socially vulnerable people lack access to resources to carry out mitigation measures (Blaikie et al. 1994; Cutter et al. 2003). In addition to demographic variables, the present study focuses on the attitude components of people: such as how do they perceive and feel about the threats, and what do they believe about the hazards and the effectiveness of mitigation measures. One may argue that attitudes are merely the product of one’s demographic background and other pre-existing conditions. However, after controlling for education and income variables (by including them in regression model), the results indicate that perception and belief attitude components outweigh the demographic variables in predicting mitigation intentions.²

² In an analysis not reported here, we also include age and gender in the regression model. The results were similar to the present findings.

The results of this study may provide policy-makers with some insight for formulating and implementing future mitigation policies and intervention strategies. This study identifies a set of positive indicators for hazard mitigation, namely, social trust, risk perception (IMPACT, CONTROL), and social economic status variables (education, income). We also identify psychological vulnerability (POWERLESS, HELPLESS) as a negative predictor for hazard mitigation. In the literature, acceptance of risk has been linked to the trust in risk management (Starr 1985; Slovic 1993, 1997). This study finds that trust also plays a critical role in the acceptance of risk mitigation policies. Thus, it is very important to promote policies that can enhance mutual trust among the people, government and the media.

In the past, many hazard awareness programs focused on making people aware of the threat of natural hazards. However, the linkage between risk perception and mitigation behavior is compelling but far from perfect (Lindell et al. 1997). From our perspective, this strategy of hazard awareness works partially because it heightens the perceived impact of the hazards. However, this strategy may soon suffer from the ceiling effect, because victims' perceived impact is high enough. Alternatively, we should ask "What prevents people from engaging in mitigation activities?" or "How can the influence of negative factors that reduce engagement be decreased?" This study has identified an important factor of negativity, namely, the sense of powerless, which can be characterized as a fatalistic belief when facing risky or catastrophic situations. Thus, an effective intervention strategy may involve convincing people that there are indeed things that they can do to effectively reduce the risk.

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