Chapter 6

What determines willingness to take preventive actions in areas experiencing severe flooding?

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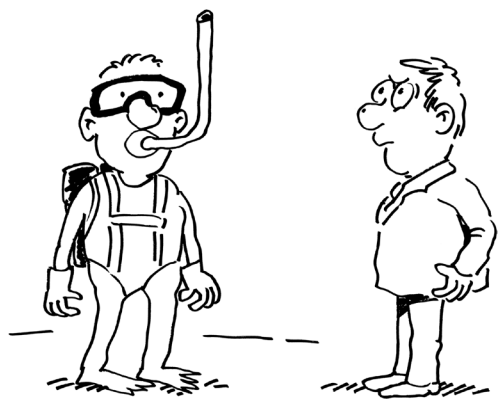
6.1 INTRODUCTION



Negative events such as floods or other natural hazards generally cannot be prevented, but one can try to anticipate them and to take actions aimed at reducing their negative consequences. In order to minimize possible losses the decision-maker needs to: (1) accurately perceive the danger, and (2) take adequate precautionary measures. In the present research we focus on both of these issues. The first issue is how inhabitants of areas exposed to frequent flood hazards perceive this threat, including perceived magnitude and probability of damage, and how much they worry about the next flood. The second issue concerns willingness to adopt precautionary measures.

The purpose of the research was therefore to identify the crucial factors determining both the perception of flood threat and the willingness to adopt means of prevention among people exposed to flood hazards. Numerous studies (see quotations below) show that several factors influence these perceptions and behaviors. Among the factors that determine willingness to take protective actions, the most frequently discussed are the following:

- previous personal experience of disasters
- social norms concerning preparedness for disasters
- perception of the threat

As shown by Weinstein (1989), the most crucial factor which determines both threat perceptions and decisions to adopt precautionary measures seems to be previous personal experience of a disaster. Weinstein (1989) claimed that personal experience affects risk perception: victims see the hazard as more frequent than non-victims, and this in turn increases willingness to take precautionary actions. In particular, severity of past damage increases hazard preparedness. However, Kunreuther (1978) showed that this effect is more complex. In Kunreuther's study, severity of flood damage led to more protective measures, but severity of an earthquake had little effect. Moreover, Siegrist and Gutscher (2008) showed that crucial in determining whether precautionary measures are taken is the extent to which negative emotions are associated with a disaster experience. People who had recently been affected by a flood disaster were more likely to take preventive action due to the strong negative affect associated with a flood. Still, the authors found that while negative experience increased willingness to invest time and money in preventive measures, it did not guarantee that such action would be taken (a large proportion of subjects who experienced flooding did not intend to take any remedial measures to forestall the effects of future floods). Indeed, research by Zaalberg *et al.* (2009) showed that the relationship between self-protective behavior and personal experience tends to be mediated by beliefs about the effectiveness of protective measures. In the present study almost all residents supplying data had experienced flooding. Therefore the subject of our research was the degree of flood severity rather than the presence or absence of previous flood experience.

The second most frequently mentioned factor in the context of willingness to adopt precautionary measures is social norms concerning preparedness for disasters. When an individual is uncertain of the correct course of action in a given situation they often

follow established social norms. Indeed, in their study of evacuation behavior at the Three Mile Island nuclear power plant accident in 1979, Cutter and Barnes (1982) found that the actions of friends and neighbors strongly influenced residents' decisions to evacuate. Similarly, Mileti and Darlington (1997) emphasized the influence of neighbors and relatives on disaster preparedness. Many other researchers (e.g., Major, 1993) have also shown that social norms can have a strong impact on decisions to take precautionary actions. Again, this factor was taken into account in this study.

A third set of factors that possibly influence willingness to adopt precautionary measures are those related to risk perception. Two crucial components of risk perception are the perceived magnitude and probability of future damage. As noted by van der Pligt (1998), decision theory, the theory of reasoned action (Ajzen & Fishbein, 1980) and the theory of planned behavior (Ajzen, 1991) all predict that the probability and severity of consequences are prime determinants of attitudes towards precautionary behaviors. However, research findings concerning the impact of perceived risk on precautionary behaviors are mixed (see van der Pligt, 1998). In particular, Schade *et al.* (2012) demonstrated that worry was much more important than subjective probability in determining willingness to pay for insurance. This suggests that risk-taking behavior may be better explained by the risk-as-feelings hypothesis (Loewenstein *et al.* 2001) or emotion-imbued choice model (Lerner *et al.* 2015) than the rational decision theory.

Within the framework of the decision theory model, two other factors should also have an impact on a decision-maker's willingness to take preventive measures. One is that their actions can make a difference in preventing damage, a positive correlation being expected here. In line with this expectation, Kievik and Gutteling (2011) found that, in the context of flood risk, there was a high correlation between efficacy beliefs and declared intention to engage in self-protective behaviors. Similarly, one can expect a negative correlation between decision-makers' willingness to adopt means of prevention and the belief that in the case of a negative event one can obtain outside help (e.g., from local government). These factors were also included in our research along with factors related to the perceived risk.

In addition to the above factors we considered the effects of technical infrastructure protecting against flooding. We believed that this factor might affect both perceptions of the flood threat and willingness to adopt means of prevention against flood hazards. This factor has not been studied very often in the context of natural disasters. Our interest in this topic started from a remark by Kundzewicz (1999) that *'a flood protection system guaranteeing complete safety is an illusion'* (p. 559). However, it is likely that people whose safety has subsequently been improved by the introduction of technical infrastructure after severe flooding might be subject to a safety illusion, believing that the probability of future flood damage is extremely low. This might decrease willingness to take preventive action. This second claim is in line with the risk homeostasis theory (Wilde, 1982). According to this theory, after the introduction of a new safety measure people become less cautious and risk returns to its preceding level.

To study the effects of introducing new safety measures we took advantage of having access to inhabitants of villages which have frequently experienced floods. We decided to compare the perceptions and behaviors of inhabitants of two different types of flooded area. First, the villages of Ciezkowice and Gnojnik were selected. These are situated in sub-mountainous regions where relatively steep slopes cause flash floods – a type of flood characterized by a very short time between precipitation and a flood wave. Between the years 1997 – 2010 lower or higher flood levels occurred very often in both places: nine times in Ciezkowice and ten times in Gnojnik. These two areas are not protected by levees. Second, the village of Swiniary was selected. This village is protected by levees which results in floods occurring only rarely. The levees protect this area against small and medium sized floods, but in the rare instances when a flood overtops the levees, inhabitants are faced with a catastrophic situation: the depth of the water exceeds two or three metres in many places. In 1972 such a flood occurred in this area and in 1997 and 2010 the water came so close to the top of the levees that inhabitants were evacuated.

Summarizing, the first two areas (Ciezkowice and Gnojnik) are not protected by levees and floods affect local societies relatively often causing small or medium losses. The third area (Swiniary) is protected by levees and flooding is a rare occurrence, but when it does occur losses are very high. In studying these two different types of area it was not possible to separate the impact of the existence of levees and frequency of flooding since these two factors were necessarily confounded. Irrespective of the existence of levees, regularity of flood occurrence may have its own effects on assessment of probability related to the next flood and on willingness to protect oneself against the flood. We know that when people observe even a very short sequence of a single type of event they tend to expect a continuation of the trend (Huettel *et al*. 2002); this is known as the positive recency effect. Thus, in our field study we formed hypotheses concerning the joint effect of two factors: existence of levees and regularity of flooding.

H1. Inhabitants of the area protected by levees (resulting in rare experience of floods) will perceive the probability of flooding as lower than inhabitants of the areas unprotected by levees (resulting in frequent experience of floods).

H2. Inhabitants of the area protected by levees (resulting in rare experience of floods) will be less ready to adopt protective actions against floods than inhabitants of the areas unprotected by levees (resulting in frequent experience of floods).

Naturally, as mentioned above, the levees are not the only determinant of willingness to adopt protective actions against floods. Thus, we formed Hypothesis 3.

H3. Willingness to adopt protective actions against floods will be affected by the severity of previous negative experiences, perceived social norms concerning protecting oneself against floods, and the perceived threat of floods.

6.2 METHOD

Participants and materials: One hundred and fifty-one residents of three areas experiencing severe flooding (44% male and 56% female) participated in the study. In the recent past, all three areas had experienced regular floods. Two of them were still not protected by levees and were frequently flooded, causing small or medium losses for residents. The third area was recently protected by levees, causing floods to occur less frequently. All participants completed a questionnaire consisting of 20 questions.

Three questions concerned willingness to undertake preventive actions. First, respondents were asked to directly answer the question '*do you undertake any preventive actions against floods?*' Secondly, they were asked to specify the amount of money they were willing to spend on a government-subsidized prevention program. Finally, they were asked to indicate which of 12 preventive actions listed they actually took.

Other questions concerned possible determinants of willingness to undertake preventive actions against floods. Issues tapped were as follows:

- personal experience (have you ever personally experienced a flood?)
- the water level in a person's house during the largest flood experienced
- the perceived probability of damage caused by floods
- the perceived magnitude of damage caused by floods
- worries about flooding (how much are you worried about flooding?)
- social norms (do your neighbors undertake any preventive actions against the consequences of floods?)
- the belief that one's action can make a difference

A five-point Likert-type scale (from 1 to 5) was used to respond to most of these questions. Responses to the question about personal experience took the form of a yes-no answer. Responses to the item about the water level in houses during the largest flood experienced were given in centimetres.

A few additional questions which are not analyzed in this paper were also asked (e.g., Does local government protect this area against floods in any way? During flood seasons are you provided with all the necessary information? A question about insurance, etc.).

6.3 RESULTS

No statistical differences were found between the two unprotected regions, therefore we concentrate upon differences between the unprotected regions and regions protected by flood levees. As mentioned in the Introduction, high percentages of residents in both types of region had personally experienced a flood (85% and 86% respectively).

6.3.1 How did inhabitants of the areas exposed to flood hazards perceive the threat?

Table 6.1 shows the results of independent samples t-tests comparing perceptions of the flood threat of people in the region protected against flooding by embankments versus perceptions of those in the two non-protected regions. As can be seen, inhabitants of both types of region declared a high level of worry linked to the possibility of floods. Here, the difference between the two means was non-significant. On the other hand, the perceived probability of damage was significantly lower in the region protected against floods compared to the non-protected regions. This supported the hypothesis that the presence of levees (resulting in only rare experience of floods) influenced perceived probability of floods.

Table 6.1 Mean judgments of factors potentially determining willingness to take preventive actions against floods in the two types of region.

	Unprotected Region		Protected Region		*t*	*df*	*p*
	N	Mean	*N*	Mean			
Water level in the house	101	58.9	50	218.7	–9.010	149	<0.000
Perceived probability of damage	101	78.7	50	49.1	5.400	149	<0.000
Perceived magnitude of damage	101	3.88	50	4.82	–5.523	149	<0.000
Worry about flooding	101	4.09	50	4.42	–1.459	149	0.147

Moreover, Table 6.1 shows that inhabitants of both types of region expected extensive material damage if a flood were to occur, but perceived magnitude of damage was significantly higher in the region protected against flooding by embankments than in the non-protected regions. This is consistent with a finding that inhabitants of the region protected against floods previously experienced significantly higher water levels in their houses than those living in the non-protected regions.

As shown in Table 6.2, we found significant positive correlations between judgments of worry and perceived probability of damage ($r = 0.34$), and perceived magnitude of damage ($r = 0.46$). Interestingly, separate analyses for the two types of region showed that for the inhabitants of unprotected regions judgments of worry were positively correlated with both, perceived probability of damage and with perceived magnitude of damage, while for the inhabitants of the protected region there was only a significant correlation for perceived magnitude of damage.

Table 6.2 Pearson correlations between judgments of worry and both perceived probability of damage and perceived magnitude of damage in two types of region.

	Total	Protected Region	Unprotected Region
		Worry	
Perceived probability of damage	0.34**	0.10	0.56**
Perceived magnitude of damage	0.46**	0.39*	0.48**

*Correlation significant at the 0.005 level
**Correlation significant at the 0.001 level

6.3.2 Determinants of willingness to take preventive actions against flood hazard

As can be seen in Table 6.3, both groups of residents declared a general willingness to take preventive actions. The difference between the two means was not significant. However, inhabitants of the regions unprotected against floods reported significantly more (around twice as many) concrete preventive actions than inhabitants of the region protected by flood levees. Figures 6.1 and 6.2 show how many preventive actions were reported as being undertaken in the two unprotected regions versus the region protected by levees. Similarly, in the regions unprotected against floods, the inhabitants declared that they were prepared to spend significantly more money on government-subsidized prevention programs. Thus, Hypothesis 2 was supported for two of the measures of willingness to take preventive actions: residents of the regions unprotected against floods reported a higher number of preventive actions and declared that more money should be spent on government-subsidized prevention programs than inhabitants of the region protected by flood levees.

Table 6.3 Means of three measures of willingness to undertake preventive actions in the two types of region.

	Unprotected Region		Protected Region		*T*	*df*	*p*
	N	Mean	*N*	Mean			
Declared willingness to take preventive actions	101	3.13	50	2.86	1.027	149	0.31
Number of protective actions	101	3.88	50	1.90	2.219	146	0.03
Amount of money willing to spend on the government prevention program	98	1092 PLN	50	440 PLN	5.023	149	0.001

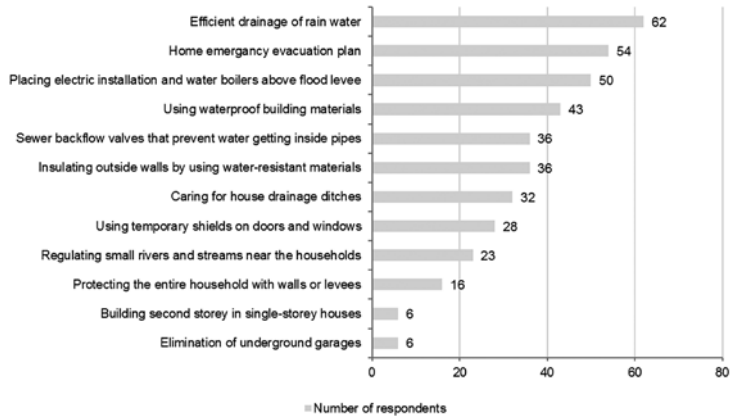


Figure 6.1 Distribution of the number of preventive actions taken in the two unprotected regions.

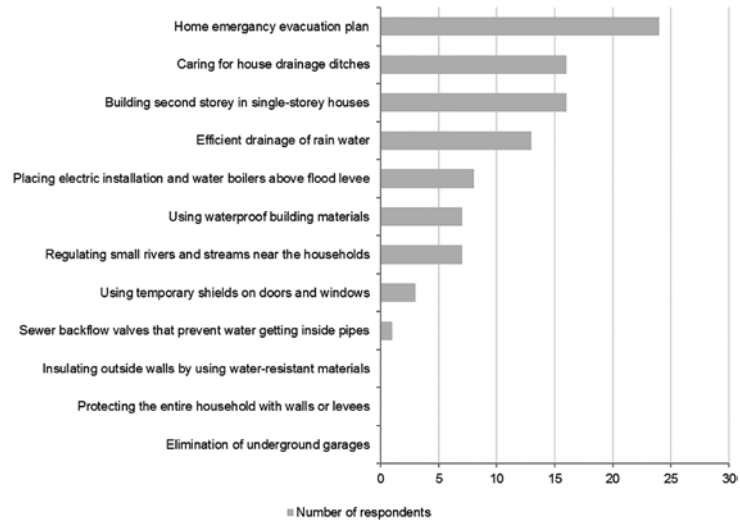


Figure 6.2 Distribution of the number of preventive actions taken in the region protected by flood levees.

Moreover, we found a significant positive correlation ($r = 0.48$, $p < 0.001$) between number of preventive actions taken and extent of willingness to take preventive actions in the unprotected regions, but no such correlation for the protected region. Also, no significant correlations were found between the amount of money spent on government-subsidized prevention programs and the two other measures of willingness to take preventive actions.

To test Hypothesis 3, we performed three regression analyses to identify variables influencing willingness to take preventive actions. Potential predictors were as follows:

- protected versus unprotected region type
- perceived magnitude of damage
- perceived probability of damage
- worry about flooding
- perceived social norm concerning protection of oneself against a flood
- water level in a person's house during the largest flood experienced

Two measures of the willingness to take preventive actions were used as dependent variables: general declaration, and number of preventive actions taken. Since we found no significant correlations between the amount of money spent on government-subsidized prevention programs and the two measures of willingness to take preventive actions, we do not regard the amount of money spent on prevention programs as another measure of willingness to take preventive actions.

Results of these analyses are presented in Table 6.4 As can be seen, declared willingness to undertake preventive actions was significantly influenced only by the perceived social norm. The number of protective actions taken was significantly influenced by the type of region, perceived social norm, and marginally by the water level in a person's house during the largest flood experienced. When we applied regression analysis to predict the number of protective actions taken separately for the two unprotected regions' data only, we found significant effects for the perceived social norm and the water level in a person's house during the largest flood experienced.

Table 6.4 Summary of multiple regression analyses for variables predicting different measures of willingness to protect oneself against a hazard.

Predictor	Declared Willingness to Take Preventive Actions		Number of Preventive Actions Actually Taken		Number of Preventive Actions Actually Taken for Two Unprotected Regions	
	B	*SE*	*β*	*SE*	*β*	*SE*
Water level in the house	0.027	0.094	0.143	0.093	0.335*	0.092
Perceived probability of damage	0.050	0.091	0.083	0.090	0.117	0.107
Perceived magnitude of damage	0.153	0.094	0.027	0.092	–0.116	0.106
Worry about flooding	–0.042	0.090	0.014	0.088	0.093	0.111
Perceived social norm	0.400*	0.077	0.235*	0.076	0.381*	0.089
Type of region	0.083	0.109	0.413*	0.107	–	–
N	151		151		101	
R^2	0.203		0.229		0.228	
F	6.098		7.112		7.686	

Neither perceived probability of damage nor perceived magnitude of damage had a significant impact on any measure of willingness to protect oneself against the hazard.

6.4 CONCLUSIONS

In the present research we compared residents of two types of region with respect to their perceptions and willingness to take preventive actions against natural hazards. One type of region had previously experienced severe flooding but had recently been protected by raising embankments to hold back water, while the other type remained unprotected and regularly experienced severe flooding. As far as perception of risk was concerned, we found that the two groups of inhabitants differed markedly with respect to perceived probability of flooding. Inhabitants of the unprotected regions with regular experience of severe flooding perceived the probability of the flooding as high, while inhabitants of the protected region perceived the probability of the flooding to be much smaller. This confirms several previous findings that the frequency and recency of events strongly affects the perceived probability of the occurrence of another event (see Weinstein, 1989; for a review). Obviously the present research did not allow us to determine whether the perceived probability of damage was more highly influenced by the presence of levees or by the frequency and recency of flooding since these two factors were necessarily confounded.

Interestingly, however, residents of both types of region were equally highly worried about flooding. Thus, the presence of embankments and lack of recent experience of flooding did not reduce inhabitants' judgments of worry. Moreover, we found differences between the two groups of residents with respect to relationships between judgments of worry, perceived probability of flooding, and perceived magnitude of possible damage. Judgments of worry in residents of the unprotected regions were positively correlated with both the perceived probability of flooding and perceived magnitude of damage. On the other hand, judgments of worry in residents of the protected region were positively correlated with the perceived magnitude of possible damage, but not with the perceived probability of damage. Taken together, these results demonstrate that worrying about flooding is not only contingent upon recent negative experience; it may be elicited by old but severe experience of damage as well. Indeed, as shown in Table 6.1, residents of the protected region had previously experienced more damage than residents of the unprotected regions (as measured by the water level in a person's house during the largest flood experienced).

Inhabitants of both types of region declared a high level of willingness to take preventive action. However, inhabitants of the regions not protected by levees reported a relatively high number of specific actions taken to prevent flooding, in addition to a greater readiness to spend more money on the government-subsidized prevention program. Thus, only in the case of inhabitants of the unprotected regions were high feelings of worry and high declared willingness

to take preventive action accompanied by taking specific preventive actions and readiness to spend relatively high amounts of money on the government-subsidized prevention program. Equally high feelings of worry and declared willingness to take preventive action did not translate into such behaviors in inhabitants of the region protected by levees. Inhabitants of the unprotected regions reported taking significantly more specific preventive actions than inhabitants of the protected region. Similarly, inhabitants of the unprotected regions declared significantly higher readiness to spend money on the government-subsidized prevention program than inhabitants of the protected region. Moreover, there was only a significant correlation between making a general declaration of willingness to take preventive actions and the declared number of actions undertaken for inhabitants of the unprotected regions (there was no such correlation for inhabitants of the region protected by flood levees). This may suggest that general declarations of willingness to protect themselves against the flood threat by inhabitants of the flood protected region were just 'cheap talk'. Taken together, these results suggest that inhabitants of the region where the safety measures were introduced felt well protected against the flood and were not motivated to take additional preventive actions. This may be interpreted as showing overconfidence in safety measures or an illusion of safety. It is interesting that this overconfidence in safety measures, while seemingly reducing inhabitants' willingness to protect themselves against a flood threat, did not reduce declared feelings of worry.

The present research supports previous findings on the impact of personal experience and perceived social norms on willingness to take preventive actions against hazards. The importance of both of these factors has been reported in several previous studies. They are also discussed in many theoretical approaches, including Lindell and Perry's (2011) Protective Action Decision Model. Although the effect of personal experience on self-protective behavior is commonly recognized, there is some disagreement about the mechanism involved. Some researchers emphasize the severity of previously experienced disasters (Weinstein, 1989) and other factors related to perceived risk (e.g., perceived vulnerability). Others have shown that negative emotions associated with personal experience of a flood disaster are crucial in determining willingness to take precautionary measures. For example, Siegrist and Gutscher (2008) found that people who had not been affected by a flood disaster experienced difficulty in taking the position of a flood victim and imagining their emotions during a flood. Interestingly, the present research implies that the impact of a given factor on willingness to protect oneself against a hazard may depend upon the type of protective behavior measured. Thus, the amount of money that participants declared that they were willing to spend on a government-subsidized prevention program was significantly related to worry about flooding. On the other hand, when willingness to protect oneself against a hazard was measured through the number of preventive actions actually taken by an individual, water level in a person's house during the largest flood experienced was a significant determinant of the behavior.

As with much other previous research (Cutter & Barnes, 1982; Major, 1993; Mileti & Darlington, 1997), in the present study social norms were a key factor determining willingness to take preventive actions against hazards. This was true irrespective of how willingness to protect oneself was measured: by (1) a general declaration; (2) the amount of money that participants declared they were willing to spend on a government-subsidized prevention program; or (3) the number of preventive actions actually taken by an individual.

Perhaps the most intriguing finding was the absence of a relationship between decision-makers' willingness to undertake preventive actions and factors related to risk perception: perceived probability of damage and perceived magnitude of loss. This runs contrary to decision theory, which suggests that these two factors should motivate an individual to protect oneself against a hazard. Naturally, many psychological theories (e.g., the theory of reasoned action) assume that when an individual considers taking an action they first form an intention to take the action. However, such an intention does not necessarily lead to actual behavior. A person can face several barriers (lack of resources, lack of time, etc.) which prevent them from taking the planned actions. This is also considered in Lindell and Perry's (2011) Protective Action Decision Model, where the authors recognize that the behavioral response of an actor depends not only on intentions to take preventive actions but also on various situational impediments.

Finally, we found somewhat mixed results concerning the impact of worry on willingness to protect oneself against flood hazard. When residents of endangered regions were asked about the amount of money that they were willing to spend on a government-subsidized prevention program their answers were influenced by their feelings of worry. This finding agrees with that of Schade *et al.* (2012) who found that worry was very important in determining decisions to purchase insurance against disasters. Perhaps the decision to spend money on a government-subsidized prevention program was considered by residents as a type of behavior similar to purchasing insurance against a disaster. By contrast, when residents were asked about the number of preventive actions actually taken, this measure of willingness to protect oneself against a hazard was not correlated with worry about flooding. Here, when undertaking various preventive actions, perhaps the residents of the threatened regions had learned that such actions did not reduce the risk to a high degree. In fact, more than 70% of residents of the threatened regions believed that their actions would make no difference. Thus, since the inhabitants of the unprotected areas did not believe in efficient self-protection, their decisions to take protective actions against the threat could hardly be based on their threat perceptions. We speculate that inhabitants of the unprotected areas, experiencing a type of learned helplessness (Seligman, 1975), did not base their prevention activities on cognitive dimensions of threat appraisal, but, rather, based them on their previous personal experience of disasters and perceived social norms instead.

REFERENCES

Ajzen I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, **50**, 179–211.

Ajzen I. and Fishbein M. (1980). Understanding Attitudes and Predicting Social Behavior. Prentice-Hall, Englewood Cliffs, NJ.

Cutter S. and Barnes K. (1982). Evacuation behavior and Three Mile Island. *Disasters*, **6**, 116–124.

Huettel S. A., Mack P. B. and McCarthy G. (2002). Perceiving patterns in random series: dynamic processing of sequence in prefrontal cortex. *Nature Neuroscience*, **5**(5), 485–490.

Kievik M. and Gutteling J. M. (2011). Yes, we can: motivate Dutch citizens to engage in self -protective behavior with regard to flood risks. *Natural Hazards*, **59**, 1475–1490.

Kundzewicz Z. W. (1999). Flood protection – sustainability issues. *Hydrological Sciences Journal*, **44**, 559–571.

Kunreuther H. C. (1978). Disaster Insurance Protection. Public Policy Lessons. Wiley, New York, NY.

Lerner J. S., Li Y., Valdesolo P. and Kassam K. S. (2015). Emotion and decision making. *Annual Review of Psychology*, **66**(1), 799–823.

Lindell M. K. and Perry R. W. (2012). The Protective Action Decision Model: theoretical modifications and additional evidence. *Risk Analysis*, **32**, 616–632.

Loewenstein G., Weber E. U., Hsee C. K. and Welch N. (2001). Risk as feelings. *Psychological Bulletin*, **127**, 267–286.

Major A. M. (1993). A test of situational communication theory: public response to the 1990 browning earthquake prediction. *International Journal of Mass Emergencies and Disasters*, **11**, 337–349.

Miceli R. and Sotgiu I. M. (2008). Disaster preparedness and perception of flood risk: a study in an alpine valley in Italy. *Journal of Environmental Psychology*, **28**, 164–173.

Mileti D. S. and Darlington J. D. (1997). The role of searching in shaping reactions to earthquake risk information. *Social Problems*, **44**, 89–103.

Schade C., Kunreuther H. C. and Koellinger P. (2012). Protecting against low-probability disasters: the role of worry. *Journal of Behavioral Decision Making*, **25**, 534–543.

Seligman M. E. P. (1975). Helplessness: On Depression, Development, and Death. Freeman, San Francisco.

Siegrist M. and Gutscher H. (2008). Natural hazards and motivation for mitigation behavior: people cannot predict the affect evoked by a severe flood. *Risk Analysis*, **28**, 771–778.

van der Pligt J. (1998). Perceived risk and vulnerability as predictors of precautionary behaviour. *British Journal of Health Psychology*, **3**, 1–14.

Weinstein N. D. (1989). Effects of personal experience on self-protective behavior. *Psychological Bulletin*, **105**, 31–50.

Wilde G. J. S. (1982). The theory of risk homeostasis: implications for safety and health. *Risk Analysis*, **2**, 209–225.

Zaalberg R., Midden C., Meijnders A. and McCalley T. (2009). Prevention, adaptation, and threat denial: flooding experiences in the Netherlands. *Risk Analysis*, **29**, 1759–1778.

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