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Discussions

Raising risk preparedness through flood risk communication

E. Maidl and M. Buchecker

Swiss Federal Research Institute for Forest, Snow and Landscape Research, Zuercherstr. 111, 8930 Birmensdorf, Switzerland

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Correspondence to: E. Maidl (elisabeth.maidl@wsl.ch)
and M. Buchecker (matthias.buchecker@wsl.ch)

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Abstract

During the last decade, most European countries have produced risk maps of natural hazards, but little is known about how to communicate these maps most effectively to the public.

In October 2011, Zurich's local authorities informed owners of buildings located in the urban flood hazard area about potential flood damage, the probability of flood events and protection measures. The campaign was based on the assumptions that informing citizens increases their risk awareness and that citizens who are aware of risks are more likely to undertake appropriate actions to protect themselves and their property.

This study is intended as a contribution to a better understanding the factors influencing flood risk preparedness, with a special focus on the effects of such a one-way risk communication strategy. We conducted a standardized mail survey of 1500 property owners in the hazard areas in Zurich. The questionnaire comprised items measuring respondents' risk awareness, risk preparedness, flood experience, information seeking behaviour, knowledge about flood risk, evaluation of the information material, risk acceptance, kind of property owned, attachment to the property, trust in local authorities, and socio-demographic variables.

Multivariate data analysis revealed that the average level of risk awareness and preparedness was low, but our results confirmed that the campaign had a statistically significant effect on the level of preparedness. The main factors influencing the respondents' intention to prepare for a flood were the extent to which they evaluated the information material positively and their risk awareness. Those who had never taken any interest in floods previously were less likely to read the material. For future campaigns, we therefore recommend repeated communication of relevant information tailored to the needs of the target population.

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1 Introduction: risk communication

During the last decade several valuable tools for predicting natural hazards such as risk maps have been developed and implemented in an increasing number of countries (de Moel et al., 2009). This development was promoted by the 2007 European Flood Directive and mirrors a new paradigm of integrated risk management. In this integrated approach, risk maps potentially not only provide information for natural hazard experts and city planners, but could also be made available for the public. Risk management has moved away from the traditional danger-based approach towards another in which the inhabitants of risk areas and property owners are regarded as responsible actors in risk management social components are generally considered relevant (Bradford et al., 2012; Renn, 2008).

The availability of sophisticated risk assessment tools for experts and the building of protective structures certainly improve hazard protection, but in terms of risk reduction the effect of such structural measures is limited, because they encourage an illusion of safety (Tobin, 1995; Demeritt et al., 2011). Risk managers in municipalities, civil protection agencies and insurances are therefore to raise people's awareness of risk and in particular their preparedness. Inhabitants of risk areas, especially homeowners, need to be aware of their role as responsible actors in risk management.

The communication of risk-related information has become an important element in risk governance that concerns various stakeholders (Renn, 2008). Despite the broad consensus on the importance of raising public awareness by effective communication (Burningham et al., 2008; Krasovskaia et al., 2007), little research has been done on effects of particular risk communication strategies (Höppner et al., 2012). The emphasis has been on communication formats rather than strategies. The literature on risk communication suggests that two-way communication is more efficient than one-way communication, but two-way communication limits to which the wider public can be reached as many people are not prepared to attend information meetings or workshops (Höppner et al., 2008; Junker et al., 2007). In result of such limitations, one-way

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strategies are still common in practice and therefore it is important to understand the possible effect of such campaigns. With our study we address this gap in research. In particular, we wanted to find out to which extent one-way communication can increase risk awareness and risk preparedness, how these effects interact and which other factors influence risk preparedness.

The first part of this article gives a brief overview of major developments in the risk communication discourse and major findings of previous research, followed by a definition of key concepts used in this study. The methods section deals with the sample and the items used in the standardized questionnaire. We also provide an overview of items included in the survey in Table A1. In the results section, bivariate correlations and the main factors influencing people's preparedness are presented. These results are discussed referring to potential influencing factors identified in other relevant studies.

2 Relevant findings and open research questions on risk preparedness and risk communication

Little of the large body of literature on risk preparedness and its influencing factors deals with dependent risk communication variables, but draws the attention of researchers in different disciplines to the topic. The number of empirical studies on the effects of risk communication is still limited, and it seems that further research is needed (Kellens et al., 2013; Bubeck et al., 2012). Most studies show that survey participants are seldom concerned about natural hazards, and their level of preparedness (Botzen et al., 2009a). If investigated, it appeared to be correspondingly low (Terpstra et al., 2009; Siegrist and Gutscher, 2006; Thieken et al., 2007). This supports the assumption that there is an inter-relation between risk awareness and mitigation behaviour. However, empirical evidence on the relation between risk awareness and hazard preparedness is ambiguous. Some studies suggest a significant correlation (Lindell and Perry, 2000; Lin et al., 2008), but others question whether there

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is a linear relationship between awareness and behaviour. They rather assume that other influences might be more important (Scolobig et al., 2012).

Other interacting factors that seem to play a role are: cultural context (Ge et al., 2011), prior knowledge (Thieken et al., 2007), emotions (Terpstra, 2011; Slovic, 2010), and trust in public risk management (Löfstedt and Perri, 2008; Lin et al., 2008). These factors should be considered when researching response to information. The role of knowledge especially has to be clarified since it is the aim of communication about potential risk through increasing knowledge. The ambiguity of results on the topic is thought to be a consequence of using different measurement methods and theoretical frameworks. No general agreement on standardized measures has been developed and the operationalization of key concepts is not coherent (Bubeck et al., 2012).

Today, social aspects are recognized as important components of risk management in research. The recognition of social determinants of people's response to natural hazards goes back to Gilbert White's work in the 1940s. Since then, the emergence of empirical studies following the psychometric approach (Slovic, 1987; Fischhoff, 1995) has paved the way for further developments in empirical research on the individual perception of risks. Others maintain that risk perception rather depends on the cultural context (Douglas and Wildavsky, 1982; Kahan et al., 2011). This research provided further theoretical models such as protection motivation theory (Rogers and Prentice-Dunn, 1997; Floyd et al., 2000; Grothmann and Reusswig, 2006), which distinguishes between coping appraisal and threat appraisal to explain people's responses to floods and mitigation behaviour.

Although research is embedded in different theoretical directions, there are some factors that seem to generally influence risk preparedness. Most studies on protective behaviour confirm that people who have experienced floods are more likely to prepare for a future event (e.g. Siegrist and Gutscher, 2008). Nevertheless, the role of experience as a predictor of protective behaviour is not straightforward (Takao et al., 2004; Thieken et al., 2007). Recent studies have found that experience tends to be rather mediated by beliefs about the effectiveness of protective measures (Zaalberg

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et al., 2009), by the negative emotions it may be associated with (Harries, 2012) and by how long back in time the experience occurred. Interestingly, Terpstra (2011) showed that the impact of past experience on individuals lasts longer if the consequences of a severe event are thus anchored in the public mind.

Various other interdisciplinary approaches to risk research provide valuable insights for research on risk communication, but cannot be fully discussed here (see Renn, 2008).

As a general tendency, empirical findings show that rational action and factual knowledge have limited power to explain protective behaviour. Research within the heuristics paradigm especially highlight that individuals seldom make decisions based on reflecting on all possible facts and outcomes (Keller et al., 2006; Slovic et al., 2004).

Recognizing the significance of social and psychological determinants in risk management has also influenced recommendations for risk communication. As Demeritt et al. (2011) pointed out, early approaches were based on the assumption that a layperson's risk awareness and behaviour depend merely on what information is available and how correct it is. According to this deficit model, providing appropriate information is enough to ensure adequate response to floods. This rationale is still common in risk communication. In a review of risk communication strategies in Europe, Höppner et al. (2012) revealed a gap between practice, which tends to follow traditional approaches, and recent research, which recommends two-way communication and more deliberative approaches tailored to the needs of the population (Renn, 2008; Martens et al., 2009).

Although risk communication is thought to mitigate flood damage, the number of empirical studies on the effect of risk communication strategies on people's behaviour is still limited. The most important findings can be summarized as follows:

According to Lindell and Perry (2004), risk communication is necessary as a substitute for personal experience in areas at-risk that are seldom affected by hazards. For such risk communication to be effective, it needs to evoke underlying beliefs (Slovic et al., 2004; Keller et al., 2006; Zaalberg et al., 2009; Terpstra, 2011;

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Visschers et al., 2012). In particular, "worry" was identified as an important factor to explain whether people were motivated to prepare for a flood and should therefore be addressed in risk communication (Raaijmakers et al., 2008; Miceli et al., 2008).

The importance of understanding emotions was also highlighted in a comparative empirical study on communication strategies focusing on residents' responses to flood warning in four European countries (O'Sullivan et al., 2012). In line with Höppner et al. (2012), they found one-way risk communication had limited effectiveness, because it fails to address the multi-dimensional determinants of people's behaviour, such as emotions.

Another study that focused particularly on the effect of two-way communication on homeowners' perception of flood risks, however, also found only limited changes in the respondents' perceptions (Terpstra et al., 2009). The communication strategy involved deliberative elements like workshops and focus groups, in which participants could express their views and discussion them with others. The results showed only a weakly significant influence of risk communication on the dimensions of risk perception, which were measured according to the psychometric paradigm.

Apart from experience and emotions, the perceived responsibility of authorities was also found to influence risk preparedness (Botzen et al., 2009a; O'Sullivan, 2012; Eiser et al., 2012). Terpstra et al. (2006) found no such correlation, and their results indicated that the influence of perceived responsibility is more related to attitudes towards governments, especially trust. How much citizens trust governments varies according to political and cultural circumstances. Strong reliance on public authorities may weaken individual motivation to take action. On the other hand, it may make it more likely that information provided will be taken serious by the target population.

Griffin et al. (2004) in a study on people's information seeking behaviour, found that the accessibility of information, its comprehensiveness and perceived credibility determine the effectiveness of communication strategies. In their study they also found that the respondents' self-estimated information need could be predicted by the degree of worry and also by other peoples' expectations. This result strengthens the view that

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attitudes towards risks are not just a matter of factual knowledge. According to this, the potential effect of communication strategies depends on how the people in areas at-risk perceive available information.

Although people's subjective perceptions and attitudes clearly affect their preparedness, this does not mean that the role of factual knowledge can be neglected. Thieken et al. (2007), showed that providing factual knowledge can improve preparedness through raising risk awareness. However, not all empirical studies have found a positive correlation between knowledge and awareness, and the nature of the link between risk awareness and preparedness has still not been clarified (Bubeck et al., 2009). Findings from empirical studies suggest that risk awareness does determine preparedness to some extent, but the correlations tend to be rather weak (Bubeck et al., 2012). Scolobig et al. (2012) recommend caution in interpreting positive correlations between awareness and preparedness, because the relationships between perceptions, attitudes and cultural or political context factors as well as the nature of risk are rather complex. This indicates that risk awareness is a multi-dimensional concept that needs to be studied in a more differentiated way using explorative methods (Miceli et al., 2008).

Own review revealed that most authors agree that risk communication is a means of increasing preparedness. However, clarification is required on the extent, to which risk awareness and other influences like knowledge, emotions or personal experience influence an individual's decision to take protective actions or not, and under which conditions risk communication is recognized and appropriate steps are taken by the target population.

2.1 Target of the study and research questions

Previous studies provide insights into the factors that can influence mitigation behaviour, but findings are often ambiguous, and so general conclusions about the effect of risk communication on hazard preparedness cannot be drawn yet. Since the major predictors are uncertain, it is difficult to understand how risk communication can

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affect whether people prepare for a flood or not. The lack of clear results is probably due to:

- The scarcity of empirical research on risk management and hazard mitigation behaviour.
- The way subjective attitudes are embedded in cultural and political contexts so that generalizing results is limited.
- In particular, the fact that key concepts such as risk perception or risk awareness are not well defined, or clearly distinguished, so that therefore operationalizing them for comparison is difficult.

In our study, we examined the effects of a risk communication strategy used in the city of Zurich in which risk maps were made available to transfer expert knowledge to the laypeople living in areas at-risk to encourage them to prepare for a flood event. Experts and laypeople tend to perceive risks in different ways and tend to use different terms to discuss them (Veland and Aven, 2013). Risk experts translated knowledge into risk maps, a visual state-of-the-art tool to explain important information about what it means to live in a flood risk area (Basic et al., 2009). People show a reat variety in how they respond to such information (Lindell and Perry, 2004). The first aim is to reach the attendance of a possibly high number of people at-risk and make them aware of the availability of the risk maps. They then need to be convinced that floods are relevant to their lives, and to be motivated to implement protection measures. Knowing how people respond to such communication therefore is important to unfold the value of risk maps as means of communication. Siegrist and Gutscher (2006) found that people living in Swiss Alpine regions who are familiar with natural hazards had rather similar perceptions of risk to expert assessments, whereas those living in regions that are seldom affected are hardly aware of risks.

In our study we aim to explore the effects of a communication campaign on property owners' flood risk preparedness in an urban context that is at-risk of floods but

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where the floods occur only seldom with a great damage potential. The study should contribute to a better understanding of the influence of way one-way strategies – as commonly applied in practice – on risk preparedness and awareness.

The following research questions are addressed:

Question 1: To what extent does one-way risk communication improve flood preparedness?

We aimed to find out to what extent the campaign motivated property owners to implement the protection measures explained in the information material.

According to the logic of the campaign, providing knowledge would result in higher risk awareness, which itself would motivate property owners to implement such measures.

Question 2: What other factors influence the level preparedness?

We assumed that the campaign was not the only factor to influence the respondents' level of preparedness. We were particularly interested in the effects of the city context and in the influencing factors found in previous studies.

3 Methods

3.1 The case study: a campaign in the city of Zurich

Switzerland is a country frequently affected by natural hazards. Nation wide risk maps are available and municipalities are obliged to take these into account in city planning and constructional design. They should also inform property owners about the flood risk in the area and any compulsory or voluntary protective measures. Zurich was among the first municipalities to develop a master plan for the implementation of the risk maps in an urban area in Switzerland. A coordination committee was established including experts from several departments and organisations who were involved in relevant city planning, emergency management and environmental protection. The committee sent out letters with information on the legal implications for property owners, most of whom

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are private homeowners. Those in areas at-risk were informed that their property is located in an area where a HQ100 flood could occur. To identify how they might be affected, they were encouraged to access the risk map online available. The map with the distinct risk areas marked red, blue, yellow, and yellow-white was explained in the accompanying letter. In the red and blue areas those constructing new buildings must comply with specific legal regulations. Homeowners in the yellow and yellow-white area need to inform the authorities whether they intend to take mitigation measures. They were not only informed about appropriate structural and temporary measures, but also about what to do in the case of an emergency.

3.2 Operationalization of the key concepts

3.2.1 Measurement of risk awareness and flood preparedness

No standardized measure of risk awareness is yet available. Bubeck et al. (2012) suggest that a common way to operationalize the topic is to measure the perceived probability of an event or its consequences (Thieken et al., 2007; Siegrist and Gutscher, 2006; Takao et al., 2004; Miceli et al., 2008; Lindell and Hwang, 2008). Other researchers apply combined measures of probability and consequences (Grothmann and Reusswig, 2006). Flood preparedness is either measured as the intention to implement protective measures, or in terms of already adopted protection measures. Information seeking behaviour is regarded as a dimension of protective behaviour.

Not only do researchers differ in how they operationalize key concepts, but also in the level of measurement. In some studies only one dimension, for instance, the response in case of an emergency is applied to measure risk preparedness, whilst others use multi-dimensional scales based on several items.

In this study, we chose question items and wording similar to those used in previous surveys on the perception and communication of risks (Zwick and Renn, 2002; Martens and Ramm, 2008) as far as they were applicable in the context of our study, and supplemented them with questions related to the information

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campaign. We operationalized the dependent variable "flood risk preparedness" as a set of six particular protection measures described in the information campaign. As the survey was cross-sectional, we measured the level of preparedness as the willingness to implement these measures in the future. Respondents could answer on a 6-point Likert-scale ("definitely no" was coded "1", "definitely yes" "5", and "already implemented" "6"). Principal component factor analysis indicated that five of the six preventive protection measures could be used for constructing the scale "preparedness" (Table A1). The only measure that was not included on the scale referred to "general restoration"[1]. Using the information on "already implemented measures" as a distinct variable allowed a comparison of people's the level of preparedness before and after the campaign.[2]

Our study design allowed us to identify the effects of the campaign on people's intention to prepare for a flood in comparison with factors influencing already implemented measures.

Risk awareness was operationalized as a set of items measured on 4–6-point Likert-scales, including emotional aspects (worry), perception of probability and severity of a flood, and items on the relevance of the topic of floods. Table A1 provides an overview of the characteristics of all scales we constructed and used for further analysis. Table A2 lists item characteristics of single variables that could not be used for scale construction. The overview comprises all items asked in the questionnaire, including descriptive measures of central tendency and standard deviations.

To measure people's knowledge, we distinguished between subjective knowledge and "objectively" measureable knowledge about flood risk. Subjective knowledge was operationalized as people's self-assessed knowledge before the campaign and at the

[1]A general restoration of a building cannot be treated as a particular flood protection measure, even if it contributes to mitigation, as the intention is not to prepare for a flood.

[2]The survey was conducted four months after the campaign. Since constructional measures take time to plan, and are usually not conducted during winter, we assume that already adopted measures represent the state of preparedness before the campaign.

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time of the survey, and "objective" knowledge about their location in a risk area in comparison with its actual location. This comparison was also treated as an additional indicator of risk awareness.

3.2.2 Additional variables and data analysis

The questionnaire comprised 34 questions with altogether 108 single items. In addition to risk awareness and preparedness, items also referred to: the information campaign and its evaluation, respondents' attitudes to other risks (fire, industrial accidents, ozone in the air and nuclear power plants), evaluation of the public discourse on these kinds of risks, general risk aversion, the priority of safety over other values (e.g. avoidance of public debt or regulation), personal flood experience and flood experience of acquaintances, risk acceptance, attitudes towards authorities (trust, responsibility), type of property, attachment to the property, and socio-demographic questions including a background in dealing with natural hazards as professionals or volunteers.

To address our research questions, we chose an explorative approach. First, we examined the descriptive results, then the bivariate relations of flood preparedness to other variables, followed by principal component factor analysis, and multiple linear regressions.

3.2.3 Survey and sample distribution

The questionnaire was mailed out in two rounds between February and April 2012 after a pre-test with randomly selected respondents from the target population in November 2011 ($n = 100$). It was conducted four months after the property owners received the municipalities' information letters. A standardized questionnaire was sent out to 1500 randomly selected homeowners, i.e. 14 % of the total number of property owners (10 500 owners) in all hazard areas in the city area, structured according to the three risk areas (blue, yellow, yellow-white). The response rate was 34 %, amounting

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to 460 returned questionnaires. It was highest in the blue area (37 %), and lowest in the least risky yellow-white area (28 %).

A comparison with data from population census about homeownership showed that the data set is representative of homeowners in Zurich with respect to age and type of ownership (private, condominium[3], or organization). Regarding the level of education and gender, well educated males were over-represented in comparison to the overall population in Zurich.

4 Results

4.1 Little concern about flood risks and a low level of preparedness

Data analysis revealed that homeowners in Zurich generally felt little concern about flood risks (see Table A1) according to the responses to all risk awareness items included in the questionnaire.

A vast majority of (82.8 %) of the respondents regarded the flood risk in the area where their property is “rather low” or “low”, and altogether only 15.4 % assumed that the risk was “high” or “rather high”. This is 7 % less than the proportion of respondents who perceived the flood risk for the city as high or rather high. Altogether only 11.0 % of the homeowners in the sample “agreed” or “rather agreed” with the statement “I am worried about flood risks”. Interestingly, respondents who assumed the flood risk to be high seemed to be generally cautious people as they also regarded the risks of fire and industrial accidents as high and thought that the risks associated with e.g. nuclear energy or genetic engineering were rather underestimated in the media. These findings suggest that individual risk awareness is partly rooted in personal attitudes towards risks. Compared to other risks like house fire or industrial accidents, the perceived risk of a flood was perceived similarly, e.g. 15.0 % of the respondents perceived the fire risk as “rather high” or “high”.

[3]Private co-ownership.

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Although the flood risk tended to be rather under-estimated, a detailed look at the single "relevance" items (see Table A1) showed that the majority (68.7 %) of the respondents were at least rather interested in natural hazards, and for nearly (39.2 %) flood was a relevant topic. At least 13 % had sought specific information on flood risks generally, and even more (23.6 %) had obtained specific information on the situation in Zurich. Respondents with a high level of awareness were more willing to collect information using different media (see Table 1, bivariate correlations).

The self-reported level of preparedness corresponded with the generally low level of flood risk awareness. The majority of the respondents had not, or hardly considered implementing the protective measures described in the information material. For instance, 47.7 % of the respondents said they were unlikely to install technical building equipment like heating in a flood-proof way ("probably not" and "definitely not"), 13.0 % were undecided, 14.4 % were willing to implement this in the future ("probably yes" and "definitely not"), and another 11.1 % had already installed flood-proof equipment. On average, 16 % intended to implement flood-protection measures sometime in the future. In comparison, 43.0 % of the property owners reported they were willing to carry out general restoration not specifically related to flood protection. Correspondingly, out of the 41.0 % of homeowners who already implemented one or several measures, in most cases these were general restoration measures.

4.2 Other attitudes towards risks

A glance at respondents' reported risk acceptance revealed a certain discrepancy between their willingness to prepare for a flood and their willingness to accept potential damage. On average, possible damage caused by a HQ100 flood appeared to be very acceptable to the respondents, especially concerning damage to the area where they own property (Table A1). On the other hand, respondents showed a tendency to prefer to bear the consequences of a flood to investing in prevention measures (Table A2),

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even if they reported having the capacity to implement such measures[4]. In terms of general risk-aversion, the results show that on average, the respondents are not averse to taking risks (Table A2).

4.3 Experience, knowledge and information behaviour

In Zurich, property owners' knowledge about floods seems to be primarily based on information received through the media and public information. We also included questions on preferred information media: the respondents were more willing to use printed information, e.g newspapers (83.6 %) or information letters (83.2 %) than the internet, TV or radio (each less than 80 %).

Not many of the respondents had had personal experience with flood. The majority (79.1 %) had never been affected by flood, 12.8 % were affected once, and only 6.3 % of the respondents had experienced several flood events.

The information campaign was considerably well received. Two thirds of the respondents said they had studied the brochures, but only a third used the online information, which was the only way to access the risk map and identify their own risk area. In consequence, the number of property owners who could specify the risk area correctly was astonishingly low (17.4 %). Most (27.4 %) underestimated the risk level, and many (26.1 %) did not know which risk area applied to their property. Nearly a quarter (23.9 %) did not answer this factual knowledge question. In contrast, 44.1 % agreed or rather agreed with the statement on the self-assessed knowledge that "I am well informed about the flood risk in Zurich.". When asked to assess their knowledge before the information campaign, only 14.6 % thought it was "good" or "rather good". This result shows that the information campaign increased the respondents' self-assessments of their own knowledge. Correspondingly, most respondents reported a knowledge gain as a result of reading the information brochures, or as a result of

[4]There was no significant statistical relation between the self-assessed ability to implement measures and preference to invest in safety.

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accessing the online information. Interestingly, subjective (self-assessed) knowledge correlated with high interest in the topic of floods[5] as well as high information need[6].

4.4 Bivariate correlations with flood risk preparedness

Table 1 provides a comprehensive list of all variables that significantly correlated with risk preparedness. It seems the decision to prevent flood damages is rooted in a variety of influencing factors. The main ones have to do with individual perceptions, attitudes and variables related to information seeking. Further, people's relationship with their property, i.e. how they use it and how long they have lived there, which in turn correlated with emotional attachment to the object, were significant.

Regarding the question on how much one-way communication can influence risk awareness, the variables on information behaviour correlated relatively strongly with preparedness. Respondents who were willing to implement measures expressed more need for further information than those who did not consider taking any action, and they were also prepared to seek information using different media. Focusing on the campaign in Zurich, those respondents who studied the information material intensively showed a high level of preparedness (and vice versa). This did not, however, apply to the amount of time dedicated to the online material: the more time respondents spent on it, the lower was their level of preparedness.

Another striking result relevant for risk communication is that neither the level of self-assessed knowledge about floods nor personal flood experience was related to the level of preparedness.

4.5 Predictors of preparedness

Table 2 shows three regression models. Models 1 and 2 indicate the influence of risk awareness on preparedness, but only model 3 includes all significant predictors.

[5] $r(447) = 0.371$, $p < 0.001$

[6] $r(439) = 0.369$, $p < 0.001$

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All models confirmed that the campaign had a motivating effect on risk preparedness. In particular, how positively the respondents evaluated the information material was the strongest predictor of their preparedness to implement measures in all models. In contrast, the level of preparedness of respondents did not differ significantly between those who studied the material and those who did not. The main effect of the campaign was therefore that it was positively perceived rather than it led people pay attention to the content.

The effect of the second main predictor, information need, was nearly as strong as the positive evaluation of the campaign, followed by risk awareness in model 3. Considering the results of bivariate correlation, risk awareness was more strongly related to preparedness than information need. Since these predictors also relate to each other ($r(443) = 0.409$, $p < 0.001$), we compared two regression models using only one of the two variables in each model to determine mediating effects. Comparison of model 1 and 2 revealed that information need is a more powerful predictor of the level of preparedness than risk awareness. Excluding risk awareness from analysis only slightly reduced the explained variance.

How respondents evaluated the cost-benefits of protection measures affected their preparedness: the less respondents believed that investments in protective measures were worth the effort, the less they intended to implement such measures. In contrast, the respondents' belief in the effectiveness of particular measures to prevent flood damage had no explanatory power.

Table 3 shows the results of a regression analysis of the current state of preparedness (number of already implemented measures) with the intention to implement such measures. Since the period of time between the campaign and our evaluation study was only 4 months, we assume that already adopted measures had been implemented before the campaign.

The factors mainly influencing the respondents' decisions were the evaluation of cost-benefits, followed by a low level of acceptance of the risk of being evacuated. The third strongest predictor was the respondents' self-assessed level of knowledge

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before the campaign[7]. Those who reported being being well informed had implemented more protective measures than others. In particular, respondents who had been professionally or voluntarily involved in dealing with natural hazards were more likely to implement measures. How long homeowners' had lived there had some influence, but less than other predictors. Further, respondents' general risk aversion significantly correlated with their willingness to implement of measures. Length of residence also had some influence, but risk awareness was not a significant factor (stand. β: 0.043, $p = 0.423$) and adding it to the regression model did not increase the explanatory power of the model. Apart from respondents' cost-benefit evaluations, no predictor correlated with both outcome variables, respondents' intention to prepare and their current state of preparedness.

To better understand the effects of the campaign, we conducted further regression analyses with the main predictors of preparedness, namely a positive evaluation of the campaign and risk awareness[8]. We cannot give the details here, but the two main predictors of risk awareness were the intensity with which respondents reported studying the information material (stand. $\beta = 0.310$, $p < 0.001$) and their self-assessed knowledge about floods before the campaign (stand. $\beta = 0.207$, $p < 0.001$)[9]. A positive

[7]Question wording: "How would you assess the knowledge about flood risk before the information campaign?"

[8]Information need, the second main predictor was itself most strongly explained by risk awareness.

[9]$R = 0.488$, $F(9,350) = 38.300$, $p < 0.001$. Other predictors were: preparedness (intention), rather bear consequences of a flood than invest in prevention, information need, perceived under-estimation of flood risks in media, personal flood experience, perceived responsibility of political institutions, and attachment to property.

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evaluation of the campaign was most strongly influenced by trust in the authorities (stand. $\beta = 0.360$, $p < 0.001$)[10].

5 Discussion

Probably most common form of distributing risk information is in a written campaign. We therefore evaluated an information campaign for affected property owners that referred to Zurich's risk map flood hazard map using a standardised survey to see how such a campaign can contribute to a better risk awareness and risk preparedness of the wider public. We found evidence that generally such a written information campaign can increase the public's risk awareness and risk preparedness, but only to a limited degree.

5.1 Effects of risk communication on flood risk preparedness

We identified three major effects of the risk communication campaign in the City of Zurich. (1) It increased property owners' intention to implement flood protection measures as well as their risk awareness, (2) especially that of respondents who had intensively studied the information material. This was more relevant than the length of time they had spent studying it. (3) The adoption of the information provided was closely related to a positive perception of the communication campaign.

The campaign was well received by a considerable number of property owners in the areas at-risk and significantly influenced their intention to prepare for a flood event. According to our regression analysis, a considerable proportion of the respondents reported that the campaign had motivated them to implement protection measures. This motivating effect appears to be strongly related to a positive evaluation of the

[10] $R = 0.350$, $F(6,298) = 27.604$, $p < 0.001$. Other predictors: risk awareness, intensity of attention paid to the information material, preparedness (intention), talked about the topic of flood in private, perceived self-responsibility.

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communication campaign. A second important predictor of the intention to prepare for a flood event is risk awareness, which was especially high among respondents with a high information need and those who reported having intensively studied the material. It seems that risk awareness can be shaped by appropriate risk communication.

Interestingly, we found risk awareness, information need, (subjective) knowledge, the intensity of studying the material and the readiness to use different media to gather further information as strongly inter-related. It is difficult to interpret the casual direction of these correlations, but they confirm that the campaign not only directly increase flood risk preparedness, but also improved the conditions under which such information is likely to be recognized and adopted by the public in future.

A new empirical finding is that the more intensively respondents read the information material the more motivated they are to apply individual prevention measures. In contrast, the amount of time they spent studying the information material had no positive effect on their willingness to prepare for a flood. The same correlation pattern was found for risk awareness.

Another condition affecting the effectiveness of risk communication is trust in the distributers of information material, as other studies have also shown (Demeritt et al., 2011; Löfstedt and Perri, 2008; Terpstra, 2011). Our results show in particular that trust affects risk communication by shaping the perception and evaluation of the information material. The agencies responsible for risk communication need to take into consideration how they are perceived in public, and how important it is to gain trust in risk management. As Veland and Aven (2013) point out, gaining the trust of lay people is crucially related to the communication of uncertainties. However, building up trust is rather complex and requires further research attention. In particular, understanding the trust building effects of participatory decision making processes is important in risk management.

One variable that had no significant effect on respondents' intention to implement protection measures was how much time they dedicated to studying the information material. Although the campaign had a positive effect on subjective (self-assessed)

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knowledge, receiving factual knowledge about risk areas had no measurable influence on flood risk preparedness. Siegrist and Gutscher (2006) found that little factual knowledge was drawn from the risk map. The campaign in our study was not successful in motivating property owners to access information about their situation using the online risk map. This highlights the importance of finding out about target groups' information behaviour and preferred media.

5.2 Other influencing factors

Some predictors of people's readiness to implement protection measures in the future not related to the campaign in Zurich have mainly to do with individual characteristics of the respondents. Prioritizing the value of safety over that of avoiding public debt and regulations represents a personal attitude that correlated with no variables related to the campaign. It therefore appears not to be influenceable by risk communication. Similarly, general risk aversion increased people's readiness to adopt safety measures.

We identified only one significant socio-demographic predictor of people's intention to prepare for a flood. Women tended to be more willing to implement protection measures in the future, but had implemented the same number of measures as men. The distinction between the intention to take protective actions and the actual level of preparedness helps to explain the rather contradictory findings of other studies about the influence of gender on risk preparedness (Grothmann and Reusswig, 2006; Miceli et al., 2008).

Age had no significant effect on property owners' risk preparedness, but those with higher education tended to be slightly better prepared. However, no negative effect was measured among less educated respondents. Age had some influence on risk awareness, but not on preparedness.

A more interesting predictor is professional background, as those with previous involvement in recovery activities as a professional or volunteer were usually well prepared. In contrast to respondents who had no such background, they were significantly more critical towards the authorities in their judgement of public risk

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management. Involvement in hazard management therefore seems to influence self-responsibility and critical reflection of public risk management. Overall, experience of active involvement seems to be more important than personally having experienced flood damage. Finally, those owners who planned to reconstruct their property anyway, were mostly willing to consider flood prevention measures. This indicates that effective risk communication should especially address property owners planning to build on their property.

Unlike in many previous studies (Siegrist and Gutscher, 2006; Grothmann and Reusswig, 2006; Lindell and Hwang, 2008), found no direct influence of personal flood experience on risk preparedness. Experience had no significant effect on either the intention to implement protective measures nor the current state of preparedness. However, personal flood experience resulted in increased risk awareness. We assume that the effect of such an experience vanishes with time and hence had little relevance for those living in Zurich. In our study, we did not distinguish between whether the flood experience was recent or older, nor did we consider the quality of such experience, e.g. whether it positive or negative, or whether it had strengthened the person's feeling of self-efficacy. Future research should examine these aspects.

Perceived responsibility for private flood preparation may also play a role, but in our study, it was not a significant predictor in the regression models. However, bivariate correlation showed that it does have an effect on risk preparedness. Respondents who thought the authorities should have the main responsibility for risk prevention tended to accept risks less. In contrast, respondents who perceived it more as their own responsibility were more willing to accept risks. Further research is required to see whether risk communication can affect the feeling of self-responsibility. Self-responsibility was not found to be at an opposite pole to responsibility attributed to authorities or civil protection agencies as the respondents tended to perceive responsibility as being shared between all actors involved in flood protection. This indicates that the respondents are open towards the idea of integrated risk management. A person's sense of self-responsibility and its effect on their risk

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preparedness is influenced by the cultural context. For instance, a study conducted in England and Wales (Bicherd and Kazmierczak, 2012) showed that property owners who thought the authorities were more responsible, were less ready to take protective action.

The comparison of factors influencing a person's intention to take measures in the future and their current state of preparedness revealed that only one factor, the evaluation of costs and benefits of particular measures, influenced both, their intention and their current state of preparedness. It also highlights how the intention to implement measures cannot be interpreted as a sufficient indicator of the current level of flood preparedness. It also highlights that the perception of measures should be considered in research on individuals' risk preparedness, as already indicated by Grothmann and Reusswig (2006). To what extent risk communication can influence such evaluations is a matter for future research.

5.3 Raising awareness, knowledge and information behaviour

A key finding is that the effective communication of risk maps or other tools of risk prevention is still a special challenge when implementing integrated risk management, as it relies on the involvement of all responsible actors, including the owners of properties in risk areas. Unless they are not aware of the risks they are exposed to, and informed about protection measures, only a small minority of them can be motivated to gather further information and to prepare for a flood event.

Although the campaign had a measurable influence on the public's awareness and preparedness our results revealed that the impact is still rather low. This indicates that a single campaign is not enough risk information and raising awareness over a longer period of time is required. Continuous information provides fruitful basis for future risk communication. Our results show that with a certain level of risk awareness and knowledge about floods, people are more likely to spot the information in the first place.

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Findings of other studies, however, indicate that the relationship between awareness and preparedness is ambiguous (Scolobig et al., 2012; Botzen et al., 2012). Empirical findings do not support the conclusion that a clear linear relation can be generally assumed. Our results clearly showed that awareness strongly influences property owners' intentions to act, but there is no evidence that awareness results in actual protective behaviour. Hence, the mediating effect of other variables and context factors needs to be examined further to better understand how raising awareness contributes to flood preparedness.

We also examined several variables related to awareness including knowledge and information behaviour. Factual knowledge about flood risk areas was strikingly deficient, but did not seem to be relevant for the respondents in deciding whether to take protective actions. In contrast, subjective knowledge was important first, as a predictor of whether respondents had already adopted measures. Secondly, the more self-assessed knowledge a respondent reported, the more interest they took in the topic of flood and the more they wanted further information. This finding shows how risk communication encouraged property owners' to seek information as it was clearly in their interests.

Factual knowledge about risk areas turned out to be distinct from risk awareness, which was more a matter of interest (relevance), perceived probability of severe flood damage and worry about such damage. We therefore recommend considering these items as separate dimensions of risk awareness in studies on risk preparedness and communication. We support the view that effective risk communication involves more than merely transferring expert knowledge to laypeople. It should also address emotions and raise the addressees' interest in the topic.

As Parker et al. (2009) claims, effective flood communication stimulates the addressees to wonder about their environment and to question their safety in it. Our data confirmed that the campaign motivated almost half of the respondents to talk about the topic in private circles. By talking about flood risks, people act as multiplicators in risk communication and potentially motivate others to obtain

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information about the topic. Our findings showed that risk awareness was higher among respondents who know someone who was affected by a flood, and it was also higher among those who talked about the topic in private. This is important, because our findings suggest that raising awareness begins by stimulating information need, e.g. making property owners or residents take interest in the topic and realize that they live in a flood-prone area.

In particular, we found that information need was a predictor of both, whether respondents were ready to prepare for a flood as well as whether they had already implemented measures. The dynamic of information sufficiency should be understood better. As previous studies (Kievik and Gutteling, 2011; Mileti and Darlington, 1997; Paton et al., 2001; Kellens et al., 2011), our results confirm a positive relationship between information seeking and the intention to prepare for a flood. Unlike Kellens et al. (2012), respondents with strong information needs put more effort into information seeking (studying the material intensively) and were less reluctant to use different means of communication (such as newspapers, TV, and internet). Long-term residents, in particular, reported more intensive information-seeking behaviour and a higher level of self-assessed knowledge about flood risks. This was also confirmed by a qualitative study on risk awareness among property owners in the UK (Burningham, 2008).

Another relevant aspect of information processing is, according to Griffin et al. (2004) the role of emotions towards managing agencies. They found that apart from individual risk awareness, anger and low trust in authorities increased active information seeking. In our study, respondents seemed to have high levels of trust in public flood risk management, which enhanced a positive perception of the official information material. On the other hand, high trust in authorities did not make the respondents more open to gain additional information from other sources. It should be noted that not only the authorities, but also insurance companies are relevant players in risk communication and attitudes toward such companies should also be taken into account in future research on risk communication (Botzen et al., 2009b).

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5.4 Limitations

This study analysed the effect of a risk communication campaign in a survey of property owners in Zurich. Of those who filled out the questionnaire, 34 % completed it, which is a high response rate. We do not have, however, reliable information about risk awareness and the level of preparedness in the whole population. It can be assumed that those who did not return the questionnaire are less interested in the topic. Those who answered the questionnaire probably were more concerned about flood risks than those who responded only after receiving a reminder ($F(1,460) = 4.919$, $p < 0.05$). Our results may therefore be slightly biased towards an over-estimation of risk awareness and the intention to adopt protection measures.

6 Conclusion and recommendation for risk communication practice

The study contributes to understanding better property owners' willingness to implement preventive protection measures, and shows that their decisions can be influenced through risk communication. However, the efficacy of information campaigns is limited by certain context factors and some underlying indirect factors may also influence the effects of risk communication. In our case study, the way respondents evaluated the campaign turned out to be crucial.

This result shows once again that information needs to be tailored to the information needs of addressees in terms of their preferred information media and content. It is important to connect information with what people already know to ensure they pay attention to it. Their knowledge and interests vary according to age, gender, previous hazard experience and other factors. Therefore the designers of risk communication need to be aware of the information needs of the target population and the best means of communication. Elderly people in our study were less likely to access online information, and few respondents accessed the online risk map to check the location of their property in the risk area.

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The effect of a single communication campaign is limited. Such information should be distributed regularly and different target groups addressed with the content and means of communications. We also recommend providing detailed information on the benefits of different protection measures and the efforts required to implement them.

The positive evaluation of the information material in the campaign we studied was shaped mainly by the property owners' trust in the authorities who distributed the material.

In sum, any effort taken to anchor flood risks in the public mind can be a step towards reducing future flood damage and increasing the chances that new information will be noticed. Awareness of flood risks strongly relies on media and campaigns that attract public attention, especially in areas where flood danger is a topic issue.

Supplementary material related to this article is available online at http://www.nat-hazards-earth-syst-sci-discuss.net/2/167/2014/nhessd-2-167-2014-supplement.pdf.

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Table 1. Bivariate correlations of "risk preparedness" with other variables.

Variable	r^{d}	n
Evaluation – subscale risk map[e]	0.319[c]	361
Risk awareness – subscale perception[e]	0.318[c]	459
Risk awareness – subscale relevance[e]	0.278[c]	455
Information need	0.308[c]	445
Readiness to seek flood-related information in different media[e]	0.276[c]	434
Reason not to implement measures: cost-benefit	−0.267[c]	460
Number of reasons not to implement measures	−0.222[c]	460
Evaluation – subscale mail information[e]	0.245[c]	347
Sex (female = 1, male = 2)	−0.214[c]	445
Preference to invent in flood protection (against keeping public debt and regulation low)	0.203[c]	439
Perceived responsibility politics	0.181[c]	421
General intention to renovate property	0.178[c]	448
Self-assessed ability to prevent flood damage	0.177[b]	445
Perceived risk of house fire	0.164[b]	459
Perceived risk of industrial accident	0.163[b]	457
Intensity of attention paid to the information material	0.162[b]	450
Perceived responsibility of civil protection organizations	0.163[b]	393
Perceived responsibility of other actors	0.574[b]	28
Perceived under-estimation of flood risks in public discourse	0.156[b]	427
Perceived responsibility of insurance companies	0.153[b]	401
Would access special website for hazard information	0.140[a]	441
Perceived under-estimation of nuclear energy in public discourse	0.140[a]	435
Professional or voluntary background related to natural hazards	0.138[a]	460
Talked to nobody about flood	−0.135[a]	460
Owner of a house	−0.132[a]	264
Assumption that flood damage will increase in future	0.116[a]	455
Length of time spent on consulting the online risk map	−0.115[a]	451
Talked about floods with friends and acquaintance	0.111[a]	460
Highest level of education: university	−0.108[a]	460
Priority of flood protection vs. public green space	0.109[a]	432
Property use: live there	−0.102[a]	460
General risk-aversion	0.101[a]	448
Trust in authorities	0.100 ($p = 0.054$)	432
Owner of business offices	0.098 ($p = 0.055$)	63
Perceived risk area (1 = low risk, 2 = medium risk, 3 = high risk)	0.110 ($p = 0.056$)	350

[a] $p < 0.050$; [b] $p < 0.010$; [c] $p < 0.001$. Notes: [d] The coefficient given in the table represents Pearson's correlation for interval scaled variables, and Spearman's rank correlation for ordinal scaled variables. [e] Scales are highlighted in bold.

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Table 2. Predictors of preparedness (future intention).

	Model 1	Model 2	Model 3
Model summary	$R^2 = 0.244$, $F(6,320) = 18.116$, $p < 0.001$	$R^2 = 0.256$ $F(6,317) = 19.142$, $p < 0.001$	$R^2 = 0.269$, $F(7,309) = 17.611$, $p < 0.001$
Independent variables	Stand. Beta (SE)	Stand. Beta (SE)	Stand. Beta (SE)
Evaluation	0.187^{c} (0.079)	0.238^{c} (0.062)	0.195^{c}(0.065)
Information need	excluded	0.221^{c}(0.046)	0.186^{c}(0.047)
Risk awareness	0.186^{b} (0.066)	excluded	0.141^{a}(0.081)
Cost-benefit evaluation of protection measures	-0.168^{b} (0.094)	-0.188^{c}(0.092)	-0.164^{b}(0.093)
Priority of security	0.163^{b} (0.050)	0.148^{b}(0.050)	0.133^{b}(0.049)
Sex	-0.158^{b} (0.097)	-0.133^{a}(0.097)	-0.135^{b}(0.097)
Reconstruction intention	0.167^{b} (0.062)	0.153(0.062)	0.150^{b}(0.061)

[a] $p < 0.050$; [b] $p < 0.010$; [c] $p < 0.001$.

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Table 3. Predictors of already adopted measures (current state of preparedness).

Model summary	Dependent variable
Independent variables	$R^2 = 0.132$, $F(6,392) = 10.915$, $p < 0.001$
Cost-benefit evaluation	−0.200 (0.88)[c]
Risk acceptance (evacuation)	0.170 (0.40)[c]
Self-assessed knowledge	0.134 (0.40)[b]
Professional or voluntary background in natural hazards	0.131 (1.38)[b]
General risk aversion	0.129 (0.58)[b]
Duration of residence	0.092 (0.27), $p = 0.075$

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Table A1. Reliability.

Scale name	Items used for construction	*N*	*M* (Range)	SD	*α*
Preparedness	Intend to: – install building flood-proof equipment – adopt temporary measures (e.g. mobile brrier) – inform tenants – work out emergency plan – not use certain rooms (e.g. cellar)	405	2.20 (1 to 5)	0.952	0.877
Risk awareness	All items	459	−0.20 (−1 to 1.5)[a]	0.676	0.836
	Subscale "risk perception": – perceived risk in Zurich – perceived risk for own building – probability of experiencing a flood in Zurich – worry about flood risk	459	−0.035 (−1 to 1.5)	0.744	0.748
	Subscale "relevance": – interest in natural hazards – flood is relevant topic – followed flood-related information – followed specific flood-related information in Zurich	455	3.00	0.919	0.803
Risk acceptance	All items	419	2.75	0.520	0.919
	Subscale "risk acceptance city": – interruption of water and electricity supply – water and electricity supply disturbed – restoration of public and private buildings – distruction of central infrastructure – economic life stands still	447	2.92	895	0.841
	Subscale "risk acceptance own property": – interior has to be partly replaced – building equipment has to be replaced – building temporarily not usable – building has to be destroyed – psychological or physical damage	443	2.62	1.012	0.912
Perception of flood risk compared to other risks[b]	Own property: – perceived flood risk	–	–	–	–
	City area: – perceived flood risk				

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Table A1. Continued.

Scale name	Items used for construction	*N*	*M* (Range)	SD	α
Evaluation of the information material	All items	370	3.64 (1 to 5)	0.760	0.887
	Print material (letter, brochure) is: – useful – comprehensible – knowledge-gain	347	3.75	0.730	0.753
	Risk-map (online) is: – useful – comprehensible – comprehensive – helpful for decision making – knowledge-gain – makes me think	361	3.57	0.884	0.863
Value of safety (compared with other values)[b]	– priority of safety vs. public debt – priority of safety vs. regulation				
Trust in public risk management	All items	432	4.14 (1 to 6)	0.855	0.929
	Local authorities (City of Zurich) – take my interests seriously – are competent in flood protection – provide safety	422	4.16	0.908	0.883
	Cantonal authorities – take my interests seriously – are competent in flood protection – provide safety	413	4.13	0.865	0.889
Perceived responsibility	Own responsibility – perceived responsibility of property owners – perceived responsibility of citizens	392	4.15 (1 to 6)	1.14	0.878
	Responsibility of the authorities – local authorities – cantonal authorities – federal authorities	421	4.85	0.900	0.876
	Responsibility of emergency agencies – civil protection agencies – fire brigade	393	4.14	1.31	0.915
Attachment	– length of occupancy of building – attachment to the object – attachment to the city	425	3.42 (1 to 5)	1.17	0.701

[a] The variable was z-transformed due to different scale-width of items.
[b] Scale consists only of 2 items, therefore reliability analysis was not conducted.

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Table A2. Single items (not used for scale construction).

Items	*N*	*M*[a]	SD	Range (interpretation of values: 0 = don't know, 1 = applies least highest value = applies most)
Perceived fire risk of fire to own property	491	2.02	0.837	0–5
Perceived risk of industrial accidents in the City of Zurich	491	2.01	0.794	0–5
Perception of public discourse: underestimation of risks (industrial accident, nuclear energy, ozone in air)	471	3.2939	0.81967	1–5
Self-assessed knowledge about flood risks (feel well informed)	456	3.33	1.092	1–5
Self-assessed knowledge about flood risks before the campaign	487	2.60	0.995	1–5
Prefer to bear the costs of flood damage than invest in mitigation	480	2.47	1.136	1–5
Ability to implement prevention measures	479	2.50	1.196	1–5
Perceived location in a risk area (red, blue, yellow, yellow-white)	350	"don't know"	1.107	0–4
General risk-aversion	448	3.30	0.881	1–6
Priority of safety vs. green spaces	465	2.87	1.279	1–5
Perceived responsibility of insurance companies	401	4.1	1.371	1–6
Read printed information material	480	0.73	0.444	0–1
Accessed online risk map	485	0.31	0.461	0–1
Average time taken to study print material (minutes)	491	11.44	16.809	0–210
Average time taken to study online risk map (minutes)	492	4.87	16.336	0–300
Intensity of studying the material	483	1.43	0.975	0–4
Information need	477	2.77	1.064	1–5
Preference for information sources (media) other than information letters	30	2.6556	0.97176	1–5

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Table A2. Continued.

Items	*N*	*M*[a]	SD	Range (interpretation of values: 0 = don't know, 1 = applies least highest value = applies most)
Talked about the topic in private circles	460	0.41	0.493	0–1 (no-yes)
Talked about the topic to experts	460	0.08	0.276	0–1 (no-yes)
Number of flats owned	489	6.57	36.899	0–600[b]
Number of houses owned	264	2.16	4.498	0–50
Number of offices owned	92	3.26	7.785	0–50
Live in own property	491	0.66	0.474	0–1
Sex	477	1.65	0.478	1–2 (1 = female, 2 = male)
Number of objects (flats, houses)	492	18.87	143	0–2091
Age	394	61.44	13.576	23–102
Highest level of education	451	University degree (32 %)	1.32	1–5
Household size	393	2.45	1.137	1–7
Have children	483	"yes" (75 %)	0.439	0–1
Number of already implemented measures	428	0.64	0.944	0–6
Could imagine selling the property	456	2.05	1.284	1–5
Feeling of responsibility for the object	460	4.09	1.242	1–5
Floods in the city of Zurich can reliably be predicted	458	3.03	1.137	1–5
Flood damage will occur more frequently in future	488	3.46	1.165	1–5
The printed information material motivates me to take precautionary measures	368	2.31	1.158	1–5

[a] For the categorical variables, the median category is given instead of the mean value.
[b] Apart from private property owners, the sample included non-private owners like companies or housing associations (number of non-private owners in the sample: $n = 48$). Private respondents owned 19 objects (houses, flats, office rooms) on average. (Remark: here, the term "private" is not used in contrast to "public" or "governmental", but in contrast to organizations).

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