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# Risk communication in relation to an imminent rockslide and tsunami

Thesis for the degree of Philosophiae Doctor

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Norwegian University of Science and Technology  
Faculty of Medicine  
Department of Neuroscience



**NTNU – Trondheim**  
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**Norsk sammendrag**  
**Det å leve med fare for ras og flodbølge. Konsekvenser for risikokommunikasjon**

Et mulig fjellskred fra Åknes på Sunnmøre kan i verste fall føre til at 54 mill. m<sup>3</sup> stein faller i fjorden og skaper en flodbølge. Opp mot 3000 mennesker i inntil 10 kommuner vil da være i fare. Åknes/Tafjord Beredskap, som leder arbeidet i samarbeid med de berørte kommunene, står for overvåkning 24 timer i døgnet og har som mål å varsle befolkningen minst 72 timer før raset.

Denne avhandlingen tar for seg hvordan innbyggere i fire bygder kan oppfatte risikokommunikasjon knyttet til rasfaren. Geiranger og Hellesylt kan utsettes for de høyeste oppskyllinger av bølger (inntil 63 og 82 meter). Tafjord og Fjørå ble rammet av en tilsvarende hendelse i 1934, Tafjord-ulykken, der 40 mennesker omkom.

For det meste har forskning om risiko vurdert sannsynlighet og konsekvenser av negative hendelser. Risikokommunikasjon har dermed formidlet analyse av fakta til mennesker og til dels forventet at de fleste responderer rasjonelt og noenlunde likt på opplysninger. Denne avhandlingen har en annen innfallsvinkel til risikokommunikasjon.

Avhandlingen omfatter tre vitenskapelige artikler. Hver av dem fokuserer på ulike forhold som kan være med og påvirke hvordan risikobudskap blir oppfattet og fortolket av dem som skal leve med usikkerhet i forkant av en mulig naturkatastrofe.

Til undersøkelsene er både egenutviklede og standardiserte spørreskjemaer benyttet for å kartlegge hvordan innbyggerne opplever nytten av kommunikasjon, relasjoner til ekspertene, villigheten til å etterleve evakueringsordrer, og bekymring, med hensyn til den truende naturkatastrofen. Studiet tar også for seg om psykososiale forhold, livssituasjon og personlighetsdimensjoner påvirker innbyggernes holdning til risikokommunikasjon.

Innbyggerne i bygdene som hadde en forhistorie med et tilsvarende fjellras og flodbølge (Tafjord-ulykken) oppfattet risiko og risikokommunikasjon annerledes enn de øvrige: De var minst fornøyde med myndighetenes folkemøter, men samtidig villige til å følge evakueringsprosedyrene. Særlig foreldre til barn som oppholder seg i den mulige faresonen for flodbølgen fant informasjon om risikoen nyttig. Andre som var positive til å følge myndighetenes råd om evakuering var ofte høgt utdannet, de hadde tillit til ekspertene og syntes risikokommunikasjonen var nyttig. Innbyggere i lokalsamfunn med én hjørnesteinsvirksomhet (her: turisme) bekymret seg mest for konsekvensene av raset. Dialog med og tillit til ekspertene synes å være forbundet med adekvat bekymring for rasfare. De med denne type bekymring var godt motivert til å følge evakueringsprosedyrene. Konklusjonene fra avhandlingen peker mot at man også bør vektlegge psykososiale livsvilkår og forhold egnet til å vekke emosjoner i dialogen med innbyggere som er truet av en naturkatastrofe.

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# Contents

Acknowledgements.....	5
List of papers.....	6
Abbreviations, acronyms, and symbols.....	7
Summary.....	9
Introduction to study.....	13
Rationale of study.....	14
Review of research.....	14
Risk communication.....	14
Areas with a disaster history and place identity.....	16
Trust and relations.....	17
Compliance with evacuation instructions.....	18
Worry, affect, and emotion.....	19
General aim of dissertation.....	21
Research questions addressed in this dissertation.....	21
Methods.....	23
Participants, procedure.....	23
The questionnaire – selection of items.....	23
Focus groups and personal interviews.....	25
Composite variables and basic items.....	28
Operationalization of central topics.....	29
Table 1.....	35
Psycho-social variables – assets and history.....	36
Individual differences by standardized questionnaires – a brief overview.....	37
Statistical analyses.....	39
Summary of results.....	41
Paper I: Communicating risk to parents and those living in areas with a disaster history.....	41
Paper II: Risk communication and the willingness to follow evacuation instructions in a natural disaster.....	43
Paper III: Risk communication and worried publics in an imminent rockslide and tsunami situation.....	45
Discussion.....	48
Main findings.....	48
Social influences.....	49
Worry and compliance.....	51
Strengths and limitations.....	52
Conclusions.....	54
References.....	55
Paper I-III.....	67



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Sverre Kjetil Rød

# List of papers

## **Paper I**

Rød, S. K., Botan C., Holen A., (2011). Communicating risk to parents and those living in areas with a disaster history. *Public Relations Review* 37(4), 354-359

## **Paper II**

Rød, S. K., Botan C., Holen A., (2012). Risk communication and the willingness to follow evacuation instructions in a natural disaster. *Health, Risk & Society* 14(1), 87-99

## **Paper III**

Rød, S. K., Botan C., Holen A (2012). Risk communication and worried publics in an imminent rockslide and tsunami situation. *Journal of Risk Research*, 15(6), 645-654



## Abbreviations, acronyms and symbols

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<b>COR</b>	Conservation of resources (COR) stress model
<b>DV</b>	Dependent variable
<b>FTT</b>	Fuzzy-trace theory
<b>M</b>	Mean
<b>MIC</b>	Mean inter-item correlation
<b>N</b>	Number of respondents
<b>n.s.</b>	Non-significant
<b>SARF</b>	Social amplification of risk framework (SARF)
<b>SD</b>	Standard deviation
<b>SE</b>	Standard error
<b>B</b>	Unstandardized beta
<b><math>\beta</math></b>	Standardized beta
<b><math>\alpha</math></b>	Cronbach's alpha
<b><math>r</math></b>	Pearson's correlation coefficient
<b><math>\chi^2</math></b>	Chi-square



# Summary

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## **Background and objective**

Approximately 3000 people live in a tsunami danger zone on the west coast of Norway. Modern technology and human expertise continuously observe the site where 54 million cubic metres (1.9 billion cubic feet) of rock may fall into the fjord and cause a tsunami. A challenge of the study was to explore aspects of how the inhabitants at risk perceive and process the provided risk communication.

To a moderate degree have risk managers focused on how people with different personal and contextual characteristics process risk communication and how they relate to adverse events. Most research on risk shows that experts aim to convey analytically the probabilities and the consequences of hazards, often to the exclusion of additional needs and concerns within a diverse public. Because risk also is manifested socially, it may prove useful for risk communicators to address people's needs, both on the rational and on the emotional levels. Not acknowledging this delicate complexity may make people perceive the risk communication less useful and less relevant; the messages may even be subject to misunderstanding or distrust.

Effects of personal or familial experience of hazards have been explored over the past three decades (Grothmann & Reusswig, 2006; Van den Berg et al., 2009; Weinstein, 1989; Zaalberg et al., 2009). However, a limited amount of research has explored whether the publics living in communities with a disaster history or who are parents may perceive risk communication differently than those without such backgrounds. Studies demonstrate that the participants' 'place identity,' i.e., attachment to home, embedded in tradition, family, and a rural lifestyle, has a significant effect in the understanding of risk (Jardine et al., 2009; Luginaah et al., & Eyles, 2002; Wakefield et al. & Eyles, 2001; Ali, 1997; Baxter & Eyles

1997). A threatening tsunami may interrupt the positive aspects of 'place identity,' causing the publics to become increasingly worried.

Research on worry, which is different from anxiety, has demonstrated both positive (Davey 1993; Davey et al. 1992; Miceli, Sotgiu, and Settanni 2008) and negative (Davey 1994; Ladouceur et al. 1998; Stöber et al. 2000) correlations with problem solving or dealing with the risk. Kaspersen et al. (1988) argued by the social amplification of risk framework (SARF) that the perception of risk is depending on the individual's interpretation of the threat. According to MacGregor (1991), worry, which is one of the topics of this dissertation, may create useful mental scenarios or images preparing people to meet future events, but may also get them to act in the opposite direction.

Emotions may have a stronger impact on the publics' perceived probability assessments than logic and facts. According to Slovic et al. (2004), there are two fundamental systems by which humans understand risk. The *analytical* system which uses probability calculus, formal logic, and risk assessment, and the *experiential* system which uses intuition and is much faster, almost automatic, and not characterized by conscious awareness. "The experiential system encodes reality in images, metaphors, and narratives to which affective feelings have become attached" (P. Slovic et al., 2004, p. 316).

Sattler and his colleagues (2000) suggested that there is a relationship between disaster experience and disaster preparedness. People who live in areas where natural disasters occur, are more likely to adhere to evacuation warnings than those who never have been exposed to any such risks (Sattler et al. 2000, Drabek & Boggs 1968). Numerous studies have documented correlations between people's trust in the government and their willingness to comply with the official evacuation orders (West 2001, Granatt 2004, Burton et al. 2006, West & Orr 2007). The more people trust government officials and evacuation orders, the more willing are they to comply (West & Orr 2007).

The aims of this study have been to explore the usefulness of various channels of risk communication; the effects of publics' trust in the experts; the differences among the publics in complying with evacuation instructions; determinants of worry related to the disaster; and the relevance of emotion, individual differences, place identity, and psycho-social aspects.

## **Methods**

In February 2008, 875 booklets with 136 items, including 46 generated by focus groups and personal interviews run by the first author, were distributed via regular mail to the adult population of four communities; twenty two of the generated items were used in this study.

Seventy six items were from established standardized questionnaires: Plutchik's Life Style Index (LSI-R) revised (Endresen 1991), Eysenck's Personality Questionnaire - Revised (EPQ-R) (Eysenck et al., 1985), Locus of Control of Behavior (LCB) (Craig et al., 1984), and The Generalized Self-Efficacy Scale (GSE). The remaining 14 items contained general socio-demographic information. A total of 382 people (43.6%) from the four relevant communities responded.

## **Results**

Publics who lived in the communities that had a similar disaster in 1934 found public meetings less useful than the written or mediated information. In contrast, parents of children exposed in the tsunami danger zones perceived all risk communication as useful. Those who were inclined to follow evacuation instructions lived more often in areas with a disaster history. Often they had university degrees, trustful relationships with the experts, and found the risk communication useful. Gender and individual differences did not separately

contribute significantly to the willingness to evacuate. Those who trusted the experts and had dialogues with them, tended to worry more than others, and this may suggest that they have adequate perceptions of the risks. Publics who reported more concern over other issues unrelated to the disaster, tended to worry less about the rockslide. Analyses also revealed that those who lived in a community with extraordinary assets, in this case the tourism industry, tended to worry the most.

To understand the nature of risk communication responses and to be able to save human lives, it seems necessary to foster dialogues with a diverse public. Therefore, one avenue for future research may include further explorations of how risk communication may deal with emotions, as well as social, psychological, and cultural dimensions of the inhabitants' lives.

## **Conclusions**

The study demonstrated that two sub-populations perceived risk communication rather differently; those who lived in areas with a disaster history, and those who were parents of children regularly exposed in the tsunami risk zones. When it comes to the reported willingness to adhere to the evacuation instructions, trustful relationships with the experts were essential, but also socio-demographic aspects, such as holding a university graduate degree. Individual differences, such as psychological defense mechanisms, personality traits, and locus of control did not add anything of significance. In the discussion, seven determinants of worry have been suggested for consideration in the case of large scale natural disasters. Those who live in areas with a disaster history may be useful allies; they were more inclined to comply with the evacuation instructions even though they perceived the public meetings as less useful.

# Introduction

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Over the past three decades, a large body of research has focused on how people in high risk areas adjust to natural hazards. Paying attention to evacuation warnings and preparing for emergency situations will save lives and reduce injuries when a disaster strikes. According to Drabek (1986), and Perry & Lindell (1990), there is a variety of factors that seem related to why a population at risk may or may not take self-protective measures. According to Davis et al. (2005), findings from such work can help in shaping more effective risk communication programs.

## **Imminent disaster**

As a potential natural disaster, the Åknes rockslide site has one of the highest severity potentials in Western Europe. Lasers, radar, remote video, and human staff keep a continuous watch over the site where the predicted 18–54 million cubic metres (635 million–1.9 billion cubic feet) of rock may fall into the fjord. In the worst case scenario, the tsunami may rise 82 metres (269 feet) above the shoreline five minutes after the rock slide in the community of Hellesylt. Most of the town, a local school, and an institution for the elderly will be inundated. After 10 minutes, the tsunami may strike the UNESCO-designated tourist community of Geiranger with a wave run-up height of 63 metres (206 feet), and destroy homes, at least one school, day care centers, and commercial establishments. The number of people at risk will be higher during the summer when this tourist community has many visitors. The wave heights are estimated to reach 13 meters (42 feet) up at Tafjord and 4 meters (13 feet) up at Fjørå. The horizontal distance from where the rockslide is likely to hit the water, measured along the fjord, is approximately 13 km (eight miles) to Hellesylt; 21 km (13 miles) to Geiranger; 28

km (17 miles) to Fjørå; and 35 km (22 miles) to Tafjord. A similar calamity called the “Tafjord disaster” struck the two latter communities in 1934, causing the deaths of 40 people.

## Rationale of study

As noted by Lemyre et al. (2009), most research on risk has traditionally taken the form of risk analysis and considered the probabilities and the consequences of hazards (Jardine et. al., 2009, Sandman, 1993, Kaplan & Garrick, 1981). To a lesser extent, the focus has been on how risk communication is perceived; socio-cultural and emotional aspects may influence how people respond to the risks. The technical focus may have lead “to an inaccurate belief that events affect all individuals equally” (Lemyre et al., 2009, p. 207). Lemyre and her colleagues have suggested that risk managers rarely focus on how people with different characteristics and socio-cultural backgrounds process risk communication and how they relate to disasters and its likes. This dissertation attempts in part to bridge some of the gaps between the two perspectives.

## Review of research

### **Risk communication**

The main distinction between risk communication and crisis communication is related to their appearance in the timeline. Crisis communication aims to avoid or limit the destructive impact of an ongoing dangerous event, and people’s recuperation from it. On the other hand, the goal of risk communication is to prevent potential or imminent threats from happening and from influencing behaviours and policies in unfortunate ways (Sellnow et al., & Littlefield, 2009). With regards to natural hazards, the principal rationale for risk communication is to initiate and direct protective action and to insure public safety.



Government agencies and experts tend to engage in one-way dissemination of information (McComas, 2003). Thereby they may fail to recognize risk communication as a dialogue which acknowledges that people perceive and interpret risks differently. This view on disseminating information seemed to be prevalent at the public meetings in the areas under scrutiny.

The National Research Council (NRC) in the US made an effort to revitalize the concept of risk communication in 1989 by coining it as a “democratic dialogue;” implying an interactive process of information exchange which is addressing multiple concerns, opinions, or reactions (Sellnow et al., 2009).

In the Åknes case, there have been two means of providing information to the public at risk: public meetings, and written and mediated information. Public meetings have in the past been one of the most common ways of disseminating information about controversial issues, and they have been regarded as the authorities’ flagship communication channel. Officials from the local government usually chair such meetings with the support of the experts. Written documentation including reading, seeing or hearing the information, either in print, audio-visually or digitally, has also been quite common of recent. The two approaches (Grunig & Grunig, 1992) may be assessed separately or together with regard to their communicative usefulness as perceived by the public. Various aspects of the key concept, perceived “usefulness”, was studied in this dissertation to explore how the communication was received by the publics.

In short, the difference between two concepts: *Risk communication* refers to a dialogic exchange in the communication process, whereas *risk information* reflects the more traditional one-way dissemination of information.

### **Areas with a disaster history and place identity**

Over the past three decades, a body of research has focused on how publics who live in risk areas adapt to natural disasters. People tend to interpret hazards in accordance with their 'cultural bias.' This is supported by Weinstein (1989), who concluded that risk perception goes beyond the individual. It is also a social and cultural construct reflecting values, symbols, history, and ideology. With these aspects in mind, this study explored whether the publics who live in areas with a disaster history perceived and processed the risk communication differently.

Many studies, such as those carried out by Kraus and Slovic (1988), Weinstein and Nicolich (1993), and Rohrman (1994), have reported correlations between risk perception and the subsequent preventative behaviour. According to the social amplification of risk framework (SARF), the perception of risk may be intensified or attenuated depending on each individual's interpretation of the threats (Kasperson et al., 1988). The SARF was constructed by Kasperson to bridge the gap between experts' technical interpretation of risk and the socio-cultural and emotional responses that created public perceptions of risk. This dissertation also included 'place identity' as an object of inquiry. Living in the same community as ones' ancestors could create a caring and emotional attachment to the 'place', that otherwise might not be acknowledged. "In the risk communication literature, there is still little or no attention given to the importance of place attachment and 'place-identity' with all the implications these have on an individual" (Wester-Herber, 2004, p. 114). There is a growing body of work investigating 'place-based' understandings of risk (Luginaah et al., & Eyles, 2002); (Wakefield et al. & Eyles, 2001); (Baxter, Eyles, & Elliott, 1999); (Ali, 1997). Externally introduced risks may serve to disrupt aspects of place-identity, and result in heightened worry or even anxiety. Such disruption may be the impending tsunami threatening a precious 'place', i. e., the home community where people have lived for generations. Masuda and

Garvin (2006) showed that place is an important component in contentious debates about environmental risk issues.

The conservation of resources (COR) stress model (Norris et al. 2006; Hobfoll, 1991; Hobfoll, 1989) found a positive relationship between resource loss caused by natural hazards, and psychological distress, such as worry. According to Freedy et al. (1992) resource loss was not only positively related to psychological distress, but it also dominated over personal characteristics and coping behavior in the prediction of such distress.

### **Trust and relations**

As noted by Sjöberg (2004), social trust, i.e., trust in experts or organizations, plays a major role in the individuals' acceptance of risk messages. According to Luhmann (1979, 1988) and Giddens (1990), trust in the experts and the authorities reduce uncertainty among people. Numerous studies have documented correlations between people's trust in the government and people's willingness to comply with the official evacuation orders (West 2001, Granatt 2004, Burton et al. 2006, West & Orr 2007). The more people trust the government and the evacuation orders, the more willing they are to comply (West & Orr 2007). On the other hand, non-protective responses may relate to the local culture, to socio-demographic aspects, prior experiences, individual differences, and the relationships with the experts. This dissertation investigated in part if trust in the experts and the perceived usefulness of the risk communication were determinants of reported evacuation compliance.

As already mentioned, studies of personal or familial experiences with hazards have suggested a relationship between evacuation compliance and risk communication (Grothmann & Reusswig, 2006; Van den Berg et al., 2009; Weinstein, 1989; Zaalberg et al., 2009). Half of the respondents in this study (180) were parents of children exposed daily in the tsunami risk zones. As a rule, parenthood is associated with strong emotional attachments to family

members and to one's children in particular. Accordingly, the contrast in responses between parents and non-parents in relation to risk communication was explored in this study.

### **Compliance with evacuation instructions**

According to Sattler and his colleagues (2000), there is a correlation between those who have experienced a disaster and those who take preventative action. People who live in areas with a history of natural disasters are more inclined to comply with the evacuation warnings than others (Sattler et al. 2000, Drabek & Boggs 1968). In dangerous areas and in emergency situations, there are laws in Norway requiring people to act and evacuate in accordance with the instructions of the government officials. As in the Åknes case, based on permanent surveillance of the site, geologists will advise the local governments and the police when to issue evacuation instructions. The more trusted and the more useful the risk communication is perceived prior to a calamity, the more compliance with the evacuation orders is expected.

Even so, there is a well established body of research indicating that some individuals 'at risk' tend to ignore health warnings (see for example Heller et al. 2005, Lindell & Perry 2000, Rohrman 2000). Such non-protective responses may be explained by denial, distrust, wishful thinking, or fatalism (Grothmann & Reusswig 2006). Otherwise, the responses may be related to poor communicator skills, ambiguous risk communication or unscheduled influence through informal social networks and news media (Heller et al. 2005, Fischhoff 2000, Rohrman 2000, Slovic 2000). Research by Dow and Cutter (2000) suggested that the cognitive and socio-cultural processes related to being ready for such adherence may be more important than merely exploring the most effective evacuation warnings.

### **Worry, affect and emotion**

We all see and hear about natural disasters in the news media, see pictures, and perhaps we even know someone who has experienced such dangers. Consequently, it is predicted that one hardly can evaluate a risk source analytically without some sort of affective influence. Peoples' analytical assessment of risk depends on objective characteristics of the risk situation, such as the probability and the severity of various threatening outcomes. In contrast, people's emotional responses depend rather on other factors – such as the vividness of the imagined consequences, their emotional state, past exposures, personality, and their history of conditioning.

MacGregor (1991) defined worry as a cognitive state related to thinking about uncertainties about the future; it is a natural concern related to realistic threats. Thus, it is different from anxiety, the latter is inclined towards overreactions and irrationality. According to him, there are five ways of coping with worry: Do nothing; continue to worry; accept discomfort; escape from the source of the worry; or take direct action to reduce the consequences. Forms of avoidance may also involve psychological defense mechanisms such as denial or displacement; for example being more concerned about other issues than those related to the imminent threat. Baron et al. (2000, p. 426) claimed that “even though worry is an unpleasant emotion, it may be important in moving people to protect themselves against harm.” The scenarios or images of impending worrisome occurrences may help us understand “ways in which future events might be realized and could be useful in preparing to meet them” (MacGregor, 1991, p. 316).

It has been found that the feelings of risk are largely insensitive to changes in the factual probabilities, whereas analytical evaluations are. Anticipatory emotional responses sometimes diverge considerably from the cognitive evaluations, and when they do, the responses often exert a dominating influence on behaviour (Loewenstein et al., 2001).

Examples of such responses from this study may be the family members' vivid images of a tsunami destroying their precious home instigating worries about their children, themselves, their local assets, i. e., tourism, as well as their community. For those living in the relevant area, the emotions related to the "Tafjord disaster" in 1934 may also reinforce preventative behaviours due to images and fears that tacitly may have been passed on for generations. For such reasons, home location in the area struck by the local disaster of the past was of interest to this study.

In explaining the cognition of risk, Slovic and his colleagues (2004) claimed that people understand risk in two different ways. While the evidence-based *analytical system* uses formal logic and reasoning, the *experiential system* is fast, intuitive, and based on affect — "a faint whisper of emotion" (Slovic et al. 2005, p. 35). These two ways of coping with risk may be related to the filtering process described by the SARF. People may evaluate risk cognitively and through social learning, but they react to it intuitively and emotionally (Loewenstein et al. 2001, Thalmann & Wiedemann 2006). The fuzzy-trace theory (FTT) (Reyna & Brainerd 1995; Reyna, Lloyd, & Brainerd 2003, Reyna 2004; Finucane & Holup 2006), referring to *verbatim* (analysis) and *gist* (emotion), is another approach that focuses on this two-fold concept of understanding risk.

In this dissertation, the designations "emotion" and "affect" have been used interchangeable and carry the same meaning. Thus, there are dual processes swaying both the perceptions and the interpretations of risk and risk communication. The concept of worry related to potential disasters, and as addressed in this dissertation is not to be regarded as of a psychiatric nature, which for example may be the case for anxiety. Rather, the concept 'worry' encompasses a cognitive acknowledgement of danger with specific and adequate fears of everyday life; here in relation to an imminent disaster. For this reason, the psychiatric scales capturing a person's level of anxiety or related symptomatology would not serve the

purpose. Accordingly, variables directly related to the adequate situational fear or worry have been developed for the study.

## General aim of dissertation

The general aim of this dissertation has been to identify relevant determinants of how publics at risk of imminent disasters such as a rockslide and a tsunami may respond to risk communication in terms of how they perceive its usefulness. Likewise, to study whether socio-demographic aspects of people's lives, their relationships with experts, and individual differences may influence emergency compliance and a willingness to follow the evacuation instructions. Finally, the study differentiated between publics who worry, and discussed the implications for risk communication.

## Research questions addressed in this dissertation

### **In Paper I:**

- Do publics from communities with a disaster history perceive the usefulness of risk communication differently than publics in communities without such a history?
- Do parents of children exposed to risk perceive the usefulness of risk communication differently than non-parents?

### **In Paper II:**

- How do socio-demographic characteristics, individual differences, and relationships with experts relate to compliance and the willingness to follow evacuation instructions in a natural disaster?

**In Paper III:**

- What are the determinants of the publics' worry in an imminent disaster?
- Do members of the public in a community with extraordinary assets worry more than those from communities with regular assets?



# Methods

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## Participants

Of the 382 (43.6%) respondents, 53.3% were females ( $n = 200$ ) and 46.7% males ( $n = 175$ ). The gender distribution adequately reflected the local population which was 51% females and 49% males. By community, 39.8% of the respondents came from Geiranger, 41.6% from Hellesylt, 40.4% from Tafjord and 51.5% from Fjørå. The total response rate within the age group 18–33 years was 34.8%; the response rate in age group 34–49 years was 52.7%; in the age group 50–65 years the rate was 41.1%, and in the age group 66 years and above the response rate was 42.9%.

## Procedure

In February 2008, 875 booklets with the survey questionnaire were distributed by mail to all adults in the four communities irrespective of the persons' age. Those under age 18 were not included. The booklet also contained background information about the study. Two reminders were sent at one-month intervals. The completed questionnaires were returned by mail and treated anonymously in accordance with the policies of the Norwegian Social Science Data Services (NSD).

## The questionnaire – selection of items

The survey questionnaire contained 136 items. Forty six of them were unique to this study. They were generated by focus groups, and also, by personal interviews with the four survivors still alive from the 1934 disaster. Twenty-two of the generated items were used in

the analyses of this study, while the rest was not a part of this dissertation; they will therefore not be covered any further here. The personal interviews with the elderly survivors from the Tafford disaster were carried out in their homes. One of them had moved to another location, while three still lived in the same area.

Seventy six items in the questionnaire were taken from established standardized questionnaires. Finally, fourteen items covered socio-demographic information. Thus, the questionnaire was compiled of components of various origins. Briefly, they include:

1. Generated disaster related items from focus groups and personal interviews.

Twenty-two basic items (of a total of 46 items) were used to address the topics of this dissertation

2. Psycho-demographic data: simple, factual and categorical information (14 items).
3. Standardized inventories (76 items)

Thus, in this dissertation, a total 112 items were used. The psychometric properties of single items and derived composite variables related to the topics under scrutiny, and the variables or subscales from the standardized instruments used in the analyses will be presented subsequently in the method section. The approach used in the generation of disaster related items calls for a more elaborate description which will be given below.

### **Generation of disaster related items**

Most disasters have unique features. Accordingly, it is a major task of any researcher to capture the specific situational and contextual elements of that particular event. The ways to identify valid, relevant and unique features may differ. In some instances, the researchers use items covering simple and objective facts. In other cases, opinions and beliefs are wanted, and the relevant items have been lined up a priori. Alternatively, elaborate approaches may be

employed as was done in this study. Two focus groups and three personal interviews were utilized to capture salient and unique dimensions of the imminent disaster situation, and also, to disclose opinions, beliefs, emotions, as well as potential behaviours related to the imminent disaster situation among the participants.

Elicited by open-ended prompts, a number of simple or complex and diverse views from the participants emerged in the focus groups, and also, in the personal interviews. Several independent sources of information contribute toward the improvements of a survey in terms of breadth and depth (Malterud, 2012; Frey et al., 2000; Morgan, 1993, O'Brien, 1993; Wolff et al., 1993).

### **Focus groups and personal interviews**

In general, focus group interviews are directed by a facilitator encouraging “a small group of people in a relatively open discussion about a specific product or program” (Frey et al., 2000, p. 219). According to Olson et al. (2005) and Zimmerman et al. (2010, p. 917), “focus groups have been used extensively in the context of disasters to understand perceptions, test messages, and conduct emergency needs assessments”. Therefore, ideas about risk communication have often been elicited as a result of focus groups discussions (Desvousges & Smith, 1988, Lundgren & McMakin, 2009).

In this study, the author led two separate focus groups. There were five persons in each, and they came from two different communities. One group had members from a location with a disaster history, and the other was without. The participants had different ages, gender, occupations, and socio-demographic backgrounds. The group members were prompted by the facilitator with regard to their perceptions of several relative dangers, but also views and worries about the imminent rockslide and tsunami at various times during the group sitting or in the interviews unless the topics emerged independently from the group.

In more detail, the facilitator aimed at using these questions as prompts in the focus groups and interviews:

- 1) How do you perceive the rockslide- and tsunami risk from the Åknes site?
- 2) How do you cope with such an ongoing risk?
- 3) How would you compare this risk with other risks in your lives? What are your worries in relation to the rockslide and tsunami?
- 4) To what extent do you feel protected?
- 5) What is your attitude towards the experts at the Åknes/Tafjord project? To what extent do you trust them?
- 6) To what extent would you comply with the emergency plans and evacuation procedures?
- 7) What kind of information about the risk do you find useful?
- 8) To what extent do you feel your knowledge about living with such a risk is acknowledged by the experts?
- 9) Do you feel that your needs in times with such uncertainty are taken well care of by the authorities?
- 10) What are your thoughts about the temporary building ban along the shoreline?

For this dissertation, the targeted topics derived from the prompts utilized in the focus groups and the interviews were related to the

- Usefulness of risk communication channels
- Trust and distrust in experts
- Emergency preparedness and evacuation compliance
- Worry and denial related to the rockslide and tsunami

In addition, the data were analyzed in relation to

- Community assets and disaster history
- Psycho-social information

The three separate personal interviews with the survivors from the 1934-disaster used the same prompts as the focus groups. Voluntarily, and emotionally the survivors described in details how they eye witnessed family members being killed by the tsunami: The smell of crushed rocks, and the screaming from their loved ones. They talked about preventative risk behaviours in response to their experiences, such as building new homes further up above the sea level. Likewise, they talked about strong attachment to their homes, assets and community. They continued to live with rockslide risks for generations. The personal interviews and focus group discussions lasted approximately one hour each; they were audiotaped and transcribed.

The views, beliefs and attitudes expressed were condensed by the facilitator into statements of an “I” and “me” format, and tested for support from the group or interviewee. Whenever required, the statements were modified until a final agreement was reached about the representativeness of the item. In this way, face validity was interactively established in part. The final versions of the items were subsequently included in the survey questionnaire. For some topics, several items were emerged, while for others just one or two.

The generated items of the various topics related to the aims of the study had both positive and negative directions. Inversion of items is a standard procedure in most questionnaires and inventories to achieve unidirectionality in the scoring. In this study, inversion of some items was also required to avoid distorted composite variables, or to counteract that some items would nullify the values of other items.

Generated items from the focus groups and personal interviews were all scored on a five-point Likert-type scale ranging from 1 - suits me very poorly to 5 - suits me very well.

Item value 3 was a combination of “neither nor”, and “don’t know”, located between the positive and negative sides of the scale, and thus scored as a middle value. Likert scales are “widely used in instruments measuring opinions, beliefs, and attitudes” (DeVillis, 2003, p. 79).

For publication, the items and the response options of the Likert scale have been translated from the original Norwegian version (nynorsk) into English. The Norwegian term “*passar*” has been translated into “suits me” as the nearest English equivalent. Although “suits me” may not be an appropriate response option for a general audience in, for example in the United States and UK, it is appropriate in the original Norwegian. Some variables consist of single items, others of composite, unweighted mean scores.

### **Composite variables and basic items**

The original and partially face validated items derived from focus groups and personal interviews will be referred to as *basic items*; there are 22 of them used in this dissertation. They address the topics pertaining to the aims of the study.

A *composite variable*, on the other hand, has been given a unique name which is topic related, and it consists of several related basic items. When adequate inter-correlations had been found by a factor analysis, the construction of a more composite variable had obtained statistical legitimization. Moreover, according to Pallant (2007, p. 98), “for scales with a small number of items (e.g., less than 10), it is sometimes difficult to get a decent Cronbach alpha value (above .7) and you may wish to consider reporting the mean inter-item correlation value”. Briggs & Cheek (1986) recommend an optimal inter-correlation range of 0.2 to 0.4 for such scales. In this study, none of the scales had more than five items. The internal consistencies of the composite variables in Paper III were reported by using Cronbach alpha. In two other papers, the mean inter-item correlation value (MIC) was employed. For

coherence and overview purposes, MIC has been applied in the synopsis of this dissertation to characterize the degree of interrelations of the various composite variables. Two variables consisted of one item only; their mean values (M) and standard deviations (SD) have been reported. Furthermore, two composite variables included two items each; in those cases, the correlation between them has been given. Both MIC and Cronbach's alpha require at least three items to be applied.

The 22 basic items used in this dissertation are described verbatim below, as they appeared in the questionnaire. The composite variables derived from them, have also been included below. Table 1 of this synopsis summarizes the generated items and variables used in the analyses of this study.

## Operationalization of central topics

### **Topic: Risk communication usefulness – channel preferences**

In the Åknes case, the three channels of risk communication were: printed material such as brochures, letters, and reports; web-based material such as the Åknes/Tafjord home page; and finally, public meetings, which is the only information channel with a dialogic component. In the study, these three channels (Grunig & Grunig, 1992) have been assessed separately or together in various combinations to optimize the understanding of the various aspects of “perceived usefulness” as seen by the publics.

The three basic items related to the perceived usefulness as a topic were:

- “The public meetings about the rockslide risk give me useful information.”
- “The written documentation about the rockslide risk is useful to me,”
- “The Åknes/Tafjord web site gives me useful information.”

In a factor analysis, 59.5% of the total variance was contained by one latent factor including all the three items; the item correlations with the latent factor ranged from 0.67-

0.80. This indicates a high inter-correlation between them which underscores that they form a unified concept. Moreover, the minor differences between the three items have also been exploited in the analyses, e.g., the views regarding the written information versus the information given at the public meetings. Below, the various separate item and combined variables have been outlined. All combinations of items have been computed without assigning any weights to the items.

The predictor variable in Paper II “*Useful risk information*” (N=370, M 3.58, SD 0.79, MIC 0.40) was composed of all three basic items, the same also applies to “*Useful information combined*”; the two composite variables are almost identical. However, the items in them were combined in slightly different ways, such as a combination of one variable plus one basic item, as in “*Useful information combined*”. See more details below. The intention of “*Useful risk information*” was to capture how risk communication in general would influence the publics’ willingness to adhere to the evacuation instructions. The variables were named differently in two papers because they were used at different times and in slightly different ways. By combining several variables related to the perception of ‘usefulness’, it was possible in the analyses to distinguish between face-to-face (public meetings), and non face-to-face (written and mediated) risk information, but also to assess the combination of all the items.

The variable “*Useful public meetings*” (N=366, M 3.78, SD 0.99) consisted of one basic item; “The public meetings about the rockslide risk give me useful information”.

The composite variable “*Useful written and mediated information*” (N=365, M 3.48, SD 0.82, r 0.37) consisted of the two other basic items covering only written information: “The written documentation about the rockslide risk is useful to me,” and “The Åknes/Tafjord web site gives me useful information.”

The combined variable “*Useful information combined*” (N=363, M 3.65, SD 1.56, MIC 0.49) already mentioned, covered how the publics perceived the usefulness of the risk



communication, contrasting two different, traditional communication dimensions, i.e., face-to-face information on the one hand, and the written and mediated information (two items), on the other. The correlation between “*Useful public meetings*” and “*Useful written and mediated information*” was 0.49, which justified merging them into this additional higher order variable.

**Topic: Trust and distrust in experts**

The goal of this topic was to explore the relevance of trust in the experts, i. e., geologists. The topic also included people’s confidence in the presented facts and figures about risks and the potential scenarios related to the rockslide and the tsunami.

The five basic items that emerged within this topic related to trust were:

- “I have great trust in the experts of the emergency project”
- “The researchers exaggerate the risk of a potential rockslide”
- “If the rockslide comes, I think the magnitude will be much less than predicted by the experts”
- “People who have lived with such risk in generations know more than the experts about rockslides and tsunamis”
- “I think the local knowledge about the rockslide and the tsunami risk accumulated over generations is more valuable than the information from the experts”

By factor analysis, 47.6 % of the total variance was contained by the one latent factor including the five items; the item correlations with the latent factor ranged in absolute numbers from 0.42-0.83. This shows that there is a reasonably high inter-correlation between them.

The composite variable “*Trust in experts*” (N=374, M 3.48, SD 0.78, MIC 0.34) used in Paper II included the five basic items above. The last four of them were inverted to

obtain consistency of direction within the items. The same items were also turned around and used in the composite variable, “*Distrust in the experts*” (N=374, M 2.52, SD 0.77, MIC 0.34) in Paper III when exploring distrust in relation to worry. This is exactly the same variable, but the inversion has given it the opposite direction. This was done in order to accentuate another aspect of the items.

**Topic: Emergency and evacuation compliance**

One topic under scrutiny was the reported readiness to adhere to the emergency and evacuation procedures. The basic items that addressed this topic were:

- “I will follow the evacuation procedures when the authorities demand it”
- “If the evacuation warnings are triggered, I will follow my own intuition, not the orders from the authorities, to take care of my family and myself”
- “If the evacuation starts, and later is cancelled, I will lose faith in the experts because the rockslide didn’t happen”

By factor analysis, 50.6 % of the total variance was contained by the one latent factor including the three items; the item correlations to the latent factor ranged in absolute numbers from 0.67-0.76. This shows that there is a reasonably high inter-correlation between the three items.

The composite variable “*Willingness to adhere to evacuation instructions*” (N = 369, M 3.65, SD 0.86, MIC 0.26) in Paper II aimed at capturing the reported willingness for compliance in relation to the authorities’ instructions regardless of ambiguous eventualities. This composite, continuous variable was created from the thematically and statistically inter-correlated three basic items stated above. The last two items were included after having inversed the values of the items; that was done to obtain consistency in the item direction.

The variable “*Compliance with the evacuation procedures*” (N=365, M 4.15, SD 0.99) in Paper III was covered by one basic item only; “I will follow the evacuation procedures when the authorities demand it.” This item captured whether the respondent was utterly willing to adhere to the evacuation instructions. As described above, the item was also used in a more complex context in Paper II as a part of the composite variable “*Willingness to adhere to evacuation instructions*”.

### **Topic: Worry and denial**

How worry would influence the publics has been a major focus in this dissertation. Several basic items were related to worry; they were derived from discussions dealing with the uncertainties of living with risks. Thematically, the basic items fell into three categories or clusters: Worry about the rockslide, more concern related to other issues than the rockslide, and worry related to the dialogues with the experts. Composite variables were constructed in relation to these three clusters.

The generated basic items related directly to the concern for the imminent rockslide were:

- “I am concerned that the rockslide will come”
- “Thoughts of the rockslide influence many of my decisions”
- “I am concerned that the imminent rockslide and tsunami will destroy our community”
- “The “Tafjord disaster” in 1934 makes us concerned even today”
- “I often think that the rockslide and tsunami will happen”

By factor analysis, 58.5 % of the total variance was contained by one latent factor including the five items. This shows that there is a quite high inter-correlation between them; the item correlations with the latent factor ranged from 0.72-0.83.

From the five basic items, the composite variable “Worry about the rockslide” was computed (N=363, M 2.89, SD 1.00, MIC 0.49) and used in Paper III.

The next cluster of worry items are seen as reflecting a degree of denial or displacement of fear. This composite variable has been called “*More concern about other issues*” (N=365, M 3.51, SD 0.98, MIC 0.47), and it consists of four basic items. They were:

- “I am more worried about driving a car than the possible rockslide”
- “I think the risk associated with smoking is bigger than the risk of the possible rockslide”
- “I think the risk associated with drinking a lot of alcohol is bigger than the risk of the possible rockslide”
- “I am more worried about minor rockslides and avalanches along the roads than the risk of the possible rockslide.”

By factor analysis, 60.3 % of the total variance was contained by the one latent factor including the four items; the item correlations with the latent factor ranged from 0.67-0.87. This shows that there is a very high inter-correlation between them.

The last of these composite variables “*Dialogue with experts makes me apprehensive*” (N=366, M 2.29, SD 0.96, r 0.63) consists of two unweighted basic items:

- “I get apprehensive by sharing my thoughts about the rockslide risk with experts,”
- “I get apprehensive by sharing my thoughts about evacuation with experts.”

The Pearson correlation between the two items was 0.63 which clearly makes it possible to merge the two into one composite variable.

To include the full questionnaire in an appendix would imply considerable redundancies as this chapter has already given the full wording of the 22 basic items. In addition, Table 1 on the next page provides the psychometric properties of the various single items and combinations of items used in the analyses of this dissertation.

**Table 1.** Psychometric properties: Composite variables and single basic items from focus groups and personal interviews used in the analyses - N, mean, standard deviation, mean inter-correlations and Cronbach's alpha or Pearson's correlation.

COMPOSITE OR SINGLE ITEM VARIABLES (DY's IN BOLD) used in the analyses	ITEM NO.	BASIC ITEMS – BY TEXT OR NUMBERS	N	M	SD	MIC	Cronbach's alpha /r
Useful risk information	1	- The public meetings about the rockslide risk give me useful information	370	3.58	0.79	0.40	0.67
	2	- The written documentation about the rockslide risk is useful to me					
	3	- The <i>Alones/Tafford</i> web site gives me useful information					
Useful public meetings		- Basic item #1	366	3.78	0.99		0.37
		- Basic items #2, and #3	365	3.48	0.82		
		- Basic item #1	363	3.65	1.56	0.49	0.66
Useful written and mediated information		- Useful written and mediated information (variable)	374	3.48	0.78	0.34	0.72
		- I have great trust in the experts of the emergency project					
Trust in experts	4	- The researchers exaggerate the risk of a potential rockslide (inversed)					
	5	- If the rockslide comes, I think the magnitude will be much less than predicted by the experts (inversed)					
	6	- People who have lived with such risk in generations know more than the experts about rockslides and tsunamis (inversed)					
	7	- I think the local knowledge about the rockslide and tsunami risk accumulated over generations is more valuable than the information from the experts (inversed)					
	8	- Basic items #4 (inversed), #5, #6, #7, and #8					
Distrust in the experts	9	- I will follow the evacuation procedures when the authorities demand it	374	2.52	0.77	0.34	0.72
	10	- If the evacuation warnings are triggered, I will follow my own intuition, not the orders from the authorities, to take care of my family and myself (inversed)	369	3.65	0.86	0.26	0.51
	11	- If the evacuation starts, and later is cancelled, I will lose faith in the experts because the rockslide didn't happen (inversed)					
Compliance with evacuation procedures		- Basic item #9	365	4.15	0.99		
		- I am concerned that the rockslide will come	363	2.89	1.00	0.49	0.83
Worry about the rockslide	12	- Thoughts of the rockslide influence many of my decisions					
	13	- I am concerned that the imminent rockslide and tsunami will destroy our community					
	14	- The "Tafford disaster" in 1934 makes us concerned even today					
	15	- I often think that the rockslide and tsunami will happen					
	16	- I am more worried about driving a car than the possible rockslide					
More concern about other issues	17	- I think the risk associated with smoking is bigger than the risk of the possible rockslide	365	3.51	0.98	0.47	0.78
	18	- I think the risk associated with drinking a lot of alcohol is bigger than the risk of the possible rockslide					
	19	- I think the risk associated with drinking a lot of alcohol is bigger than the risk of the possible rockslide					
	20	- I am more worried about minor rockslides and avalanches along the roads than the risk of the possible rockslide					
Dialogue with experts makes me apprehensive	21	- I get apprehensive by sharing my thoughts about the rockslide risk with experts	366	2.29	0.96		0.63
	22	- I get apprehensive by sharing my thoughts about evacuation with experts					

N = number of respondents, M = mean, SD = standard deviation, MIC = mean inter-item correlation, Cronbach's alpha = Cronbach's alpha used when composite variables have more than two basic items, r = Pearson's correlation coefficient used when composite variables have only two items.

### **Psycho-social variables – assets and history**

“*Gender*” was coded dichotomously (1- female, 0 - male)

“*Age*”: The respondents were placed into four age groups as dummy variables - 18–33 (N=71), 34–49 (N=106), 50–65 (N=87), and 66 and older (N=89); four dichotomous variables were used.

The respondents were assigned to one of five groups depending on their highest level of “*Education*” - high school (N=58), vocational school (N=148), junior college (N=64), university undergraduate degree (N=56), or university graduate degree (N=41).

“*Having children*” referred to parents of children who either attended a school located in the tsunami risk zones, or whose school road or playing fields were within these zones. This factual item was included in the questionnaire because the notion of concern for the children elicited the strongest emotional responses during the interviews. The variable was coded dichotomously according to parenthood, or not (1 - children, 0 - no children).

The item “Where do you live?” identified in which of the four communities the respondents were living. From this item, two dichotomous variables were derived.

“*Community assets*” was coded dichotomously (1 – was given to respondents who lived in the community with extraordinary assets, i. e., tourism (Geiranger), 0 – for the remaining communities). The dichotomous variable “*Disaster history*” divided the respondents into those who lived in the communities with a disaster history - the calamity in 1934 of Tafjord and Fjørå, and the rest, (1 – living in such a community, 0 – not living in such a community). This past event reflects a milestone in the history of the area studied.

# Individual differences by standardized questionnaires – a brief overview

The standardized questionnaires used in this study were:

- Plutchik's Life Style Index (LSI-R) revised (Endresen 1991)
- Eysenck's Personality Questionnaire - Revised (EPQ-R) (Eysenck et al. 1985)
- Locus of Control of Behavior (LCB) (Craig *et. al.* 1984)
- Generalized Self-Efficacy Scale (GSE)

## **Psychological defense mechanisms - Plutchik's Life Style Index (LSI-R)**

Psychological defense mechanisms indicate the respondents' general relationships to fear, danger, and threats, i.e., how likely a person would respond inadequately to threats for psychological reasons. Seven subscales, each with six items, explored the traditional psychodynamic defense mechanisms by using Plutchik's Life Style Index (LSI-R) (Endresen 1991), shortened version. Explanations of the various defense mechanisms have also been given by Plutchik. The participants responded by agreeing or disagreeing to each item, 0 – No or 1 - Yes. One of Plutchik's original eight defense mechanisms, reaction formation, was not found relevant for the study and was omitted. Several of the scales were significantly correlated. The test reflected stable characteristics of the individuals (Endresen 1991); studies have confirmed the consistency between the scales and their correlations to stress, anxiety, health symptoms and immunological responses (Endresen et al., 1987; Værnes et al., 1988).

## **Eysenck's Personality Questionnaire - Revised (EPQ-R)**

To measure the personality trait "neuroticism" associated with a person's persistent propensity towards apprehension, pessimism and dysphoric affect, Eysenck's Personality

Questionnaire - Revised (EPQ-R) was applied (Eysenck et al. 1985). The questionnaire originally included 106 items; all the 12 items that addressed neuroticism were extracted and used separately in this study. Reliabilities of this revised version have been improved, distributions are closer to normal, and mean scores are higher (Eysenck et al. 1985). Birley et al. (2006) concluded that the separate use of the short EPQ-R with 12 items affects the stability or heritability just to a minor or negligible degree. The participants were asked to respond with a “yes” or a “no” to each of item. The sum of “yes” scores for each participant was counted: a higher sum suggested higher levels of neuroticism, i.e., a higher vulnerability to various nervous disorders, including psychological distress and emotional instability.

### **Locus of control (LCB)**

Externality was captured by the Locus of Control of Behavior (Craig et al. 1984), a scale designed to measure the extent to which the participants perceived responsibility for their lives or personal behaviour. The questionnaire included 17 Likert-style items, each with six response options. The scale has demonstrated good construct validity, and satisfactory internal reliability; moreover, the scale is not affected by gender, age, or social desirability, and also, its scores are stable over time in the absence of treatment (Craig et al.).

The participants were asked to indicate their agreement or disagreement to each. Item scores went from 0 (strongly disagree) to 5 (strongly agree). In accordance with the recommendations of Craig et al. (1984), six items covering the internal locus of control were inverted and added to the sum of those covering the external locus of control. In this way, the total score for all 17 items gave the final “Externality score” with a potential range from 0 to 85. Higher scores indicate external control, which implies that life tends to be seen by the responder as determined by fate, coincidence, or authority, while lower scores indicate



internal control, implying that the person sees himself as capable of shaping essential parts of his destiny.

### **Generalized Self-Efficacy Scale (GSE-5)**

The Generalized Self-Efficacy Scale (Schwarzer, 1993) assessed the strength of an individual's belief in his or her ability to respond to new or difficult situations, and also, to cope with a variety of stressors (Dieserud et al. 2001). The GSE Scale has shown acceptable internal consistency and test-retest reliability (Dieserud et al., 2001, Leganger, Kraft, & Røysamb, 2000; Schwarzer, 1993, 1998; Schwarzer et al., & Zhang, 1997) ( $\alpha = .90$ ). The shortened version (GSE-5) applied in this study has five items. Participants endorsed various statements on a four-point Likert scale ranging from 1 (not at all true) to 4 (exactly true). The total sum score ranged from 5 to 20; higher scores indicate higher perceived self-efficacy.

## **Statistical analyses**

For all the three papers, the analyses were carried out by using SPSS for Macintosh, version 16. Two-tailed p-values of .05 or lower were considered statistically significant.

In Paper I, the dependent measures were highly correlated. Accordingly, the effects of the dichotomous, independent variables were analyzed through the use of multivariate analysis of variance (MANOVA), testing the significance of group differences to the multiple dependent variables.

Point-biserial correlation coefficients mixing dichotomous and continuous variables were calculated for all variables in Paper II, as recommended by Tabachnick and Fidell (2007, p. 914). Variables that emerged with significant bivariate correlations to the dependent variables were subsequently used in the standard multiple regression analyses in Papers II and III.

Descriptive statistics were applied to find the mean values (M), and the standard deviations (SD). Possible differences between the groups with regard to categorical demographic variables were analyzed by Chi-square.

To test the coherence of items subsumed under each topic and represented by the composite variables, factor analyses were used. In this study, the total variance captured by one latent common variable ranged from 47.6 % to 60.3 %, which demonstrated inter-item correlations to be good. This justified further elaborations of the items within the framework of each topic or composite variable. As the composite variables contained five items at the most, Cronbach's alpha has generally been avoided for reasons explained elsewhere in this synopsis. Instead, the MIC was chosen as a recommended and viable alternative. Moreover, the latent variables in the factor analyses, displayed by the percentages of the total variance, demonstrated that the included items could adequately be regarded as belonging to the same concept or topic.

### **Missing values**

Missing value analyses were conducted by excluding the cases listwise, including only those with full data on all of the variables. The reason for selecting this method is that only 5% or less of the data points were missing in a random pattern from this large data set (n=382). According to Tabachnick and Fidell (2007, p. 63), deletion is a good alternative under such conditions. This method simply implies dropping any cases with missing values. Deletion is the default option in SPSS.

## Summary of results

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### *Paper I: Communicating risk to parents and those living in areas with a disaster history*

Rød, S. K., Botan C., Holen A., 2011. Communicating risk to parents and those living in areas with a disaster history. *Public Relations Review* 37 (4), 354-359

The study about communication channel preference, i.e., public meetings, written documentation and web site information, investigated the publics' perception of the usefulness of risk communication. It explored how publics who lived in communities with a disaster history and who were parents of children exposed in the potential tsunami risk zones would perceive the risk communication. A two-way MANOVA was conducted to determine the effects of living in such an area, and also of having children, in relation to the three dependent variables of risk communication channels: "*Useful public meetings*", "*Useful written and mediated information*," and "*Useful information combined*".

The MANOVA testing group differences, indicated that "*Having children*" ( $p=0.001$ ) and "*Disaster history*" ( $p=0.000$ ) both significantly affected the combined DV of perceived usefulness of the risk communication. Univariate ANOVA indicated that the variable that significantly made a difference for both these groups was "*Useful public meetings*:" However, while those who lived in areas with a disaster history found the public meetings less useful, the parents of children exposed in the tsunami risk zones found them useful, as they also did with regard to the two other communication channels. Data on how views on the usefulness of risk communication differs for publics living in communities with a disaster history, and parents of children exposed in the tsunami risk zones are presented in Table 1 in Paper I.

The findings also suggested that living in an area with a disaster history does not have a significant effect on the perceived usefulness of the other communication sources.

The findings supported the social amplification of risk framework (SARF); the perception of risk may intensify or attenuate, depending on each individual's interpretation of threats (Kasperson et al., 1988). Having children exposed to risk and living in areas with a disaster history affected the perception of risk communication.

According to verbal information provided by the representatives from the Åknes/Tafjord project, the participation of lay people at the public meetings was noticeably smaller in the two communities struck by the disaster in 1934. Participating in public meetings and discussing the risk of a future catastrophe may become emotionally overwhelming by activating latent images and stories transferred to them from the past. Even though some dialogic component was encouraged at the public meetings, the main mode of communication tended to be monologues by the government agencies. As such, the non-experts living in areas with a disaster history may have anticipated this kind of exchange and therefore, they may have felt disregarded.

Government agencies monitoring a potential natural hazard play a key role in sharing expertise. As this study has demonstrated, risk communicators should emphasize several points of view, and also they should communicate via multiple communication channels. A stronger commitment to community engagement with the emphasis on dialogue at the public meetings, at the planning committees and at the advisory boards might have fostered more "trust, satisfaction, sympathy" (Taylor & Kent, 2006, p. 354); (Kent & Taylor, 2002, p. 32).

## *Paper II: Risk communication and the willingness to follow evacuation instructions in a natural disaster*

Rød, S. K., Botan C., Holen A., (2012). Risk communication and the willingness to follow evacuation instructions in a natural disaster. *Health, Risk & Society* 14(1), 87-99

This part of the study explored to what extent socio-demographic variables, individual differences, and the relationships between experts and residents determined the reported willingness to follow the recommended evacuation instructions when disaster strikes. Socio-demographic variables having significant correlations with the willingness to adhere to the instructions were found for the ages 18–33, 34–49, 66 and older, as well as in the high school graduates, and those with university graduate degrees. Likewise, high correlations for those having children were found. As for the individual differences, the traditional, psychodynamic defense mechanisms were explored. Regression and compensation were found to be significant, but also the externality from the locus of control measure (Craig et al. 1984) as well as neuroticism (Eysenck et al. 1985).

For the relationships with the experts, both trust in the experts and seeing risk communication as useful correlated significantly with the reported willingness to adhere. All significant variables, except “Age 18–33” ( $p < .005$ ) had correlations of  $p < .001$ . The variables “Age 34–49” and “Junior college”, as a level of education, accounted for too little of the unique variance of the dependent variable and were therefore excluded from the model, as advised by Mertler and Vannatta (2005, p. 194).

Table 2 of Paper II showed that three thematic blocks of predictors accounted for 39.8% of the total variance of the reported “Willingness to adhere to evacuation instructions”,  $F(16, 316) = 52.773, p < .001$ . Within the explained variance, the block of socio-

demographic characteristics accounted for 13.7%,  $F(10, 295) = 4.675, p < .001$ . The block of individual differences accounted for an additional 4.2%,  $F(14, 291) = 4.519, p < .001$ , even though none of the components separately rose to the level of statistical significance. The block including trust in the experts and useful risk information, elevated the explained variance to 22%,  $F(16, 289) = 11.958, p < .001$ . The beta ( $\beta$ ) column presents the standardized regression coefficients for the 16 variables of the model. The beta coefficients indicate the relative effect of each variable as a predictor of change in the willingness to adhere, partialing out all other predictor variables. In the final model, only block one (socio-demographic characteristics) and three (relationship with experts) emerged as statistically significant.

This paper suggested that people who live in areas with a history of natural disasters are more inclined to take preventative action in an emergency situation; they report that they will follow the evacuation instructions. Loewenstein et al. (2001) argue that emotional reactions to risky situations may drive behaviour, and even dominate over rational analyses. Thus, the emotions related to the past disaster of 1934 may reinforce protective behaviour that has been implicitly and tacitly passed on for generations. Examples of such protective behaviours were such as building the new homes higher above sea level in the aftermath of the 1934 disaster. Such behaviours may also have rubbed off on those who lived in the same area.

The study suggested a model that contained two independent blocks of determinants of preventative behaviours in relation to a large-scale natural disaster. First and foremost, trusted relationships with the experts were essential, but also aspects of the socio-demographic status influenced the willingness of the target population to adhere to the evacuation instructions. Psychological individual differences, however, did not add much of significance in explaining preventative behaviours. Because risk is manifested socially, it may

prove more useful for government agencies to meet people's needs both at the rational and the emotional levels, rather than merely conveying facts and figures about the risks.

### *Paper III: Risk communication and worried publics in an imminent rockslide and tsunami situation*

Rød, S. K., Botan C., Holen A (2012). Risk communication and worried publics in an imminent rockslide and tsunami situation. *Journal of Risk Research*, 15(6), 645-654

The study sought insights into the determinants of worry in a time-indeterminate, natural disaster situation. Standard multiple regression determined the variables that predicted adequate worry about the rockslide. The results indicated that “*Dialogue with the experts makes me apprehensive*” (beta = .303, p = .001); “*More concern about other issues*” (beta = .296, p = .001); “*Distrust in the experts*” (beta = -.282, p = .001); “*Readiness to comply with the evacuation procedures*” (beta = .120, p = .014); “*Gender*” (beta = .107, p = .019); “*Having children*” (beta = .102, p = .026), and “*Community assets*” (beta = .095, p = .050) emerged as the significant predictors ( $R^2=.329$ ,  $R^2_{adj}=.311$ ,  $F=18.126$ ,  $p<0.000$ ). The model accounted for an adjusted 31.1 % of the variance of worry about the rockslide. The multiple regression analysis has been presented in Table 1 in Paper III and indicated that seven of the nine tested variables significantly and independently contributed to the model.

The study documented that publics who had dialogue with the experts and who trusted them were more likely to have adequate worries about the future calamity. Those who worried also reported that they would comply with the evacuation procedures. More often they were women and parents, and also, they came from a community with extraordinary assets.

As opposed to the findings of Stöber et al. (2000), worry in our study correlated *positively* with the concreteness of risk elaboration; the vivid images of the tsunami in 1934 probably lingered in the minds of many in the affected areas. Stöber and his colleagues studied student samples in relation to a broad range of everyday worries, and thereby used a milder threat and a concept closer to anxiety. Our study, however, addressed directly the specific worry related to the rockslide in a general population; the younger age groups who more frequently deny fear were underrepresented. Accordingly, both the concepts of worry and the populations in the two studies were quite different. Our study supports the view that people with an adequate worry are more inclined to take preventative action (Davey 1993; Davey et al. 1992; Miceli et al. 2008). Members of the public engaged in dialogue with the experts and who reported that they will comply with the evacuation procedures, showed that they acknowledged the risks.

The findings supported the conservation of resources (COR) stress model (Norris et al. 2006; Hobfoll, 1991; Hobfoll, 1989), implying that natural disasters produce psychological stress, such as worry, when resources are threatened by loss. The model may help explain why publics living in areas with extraordinary assets, in this case tourism, would worry more than those who had less to lose.

Risk communication should aim for enkindling adequate worry, i.e., an acceptance of danger in threatening situations. In this way, the behaviours are more likely to comply with the advice given by authorities during warnings or in emergency situations. Conversely, those who deny or displace their worry pose special challenges to the risk communicators.

As this study has demonstrated, the risk communicators should emphasize multiple points of view as well as the use multiple channels of communication. In the discussion of the study, a model of seven determinants have been suggested to explain adequate worry in relation to natural disasters; they may be considered when addressing large scale threats. In



trying to communicate with the publics under threat, providing only rational information about the risk potentials may not be sufficient. Since publics are likely to interpret risks differently, to address their needs also at the emotional level may be useful (Slovic et al., 2004).

# Discussion

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## Main findings

The main findings of the study will briefly be outlined below. Subsequently, the findings will be compared with those from other studies. Afterwards, the strengths and limitations will be discussed before concluding.

The study about channel preference in communicating risk showed that two sub-populations perceived the usefulness of the risk communication differently. One included those who lived in areas with a disaster history; they perceived the public meetings less useful. The other included the parents of children exposed in the potential tsunami zones; they found all three channels of risk communication useful, i. e., the public meetings, the written and mediated information, and the combination of the two. Thus, the findings imply that living in an area with a disaster history does not have a significant effect on the perceived usefulness of the non-dialogic channels of communication; face-to-face communication at the public meetings is seen as less useful among these publics.

The willingness to follow the evacuation instructions is demonstrated by people who live in areas with a history of natural disasters, those who trust the experts, those who find the risk communication useful, and those who have a university degree. Trust in the experts appeared as the strongest key determinant of this willingness. The various explanatory components are independent and significant contributors to the willingness to follow evacuation instructions. Neither gender nor individual differences made any significant contributions. What each individual eventually will do when disaster strikes is hard to know in advance, but the reported willingness to adhere to the instructions is taken as a relevant approximation even though research suggests that people tend to overestimate their actual behaviour (Lindell & Perry 2000).

Publics who have dialogues with the experts and who trust them are inclined to have an adequate worry about the future calamity. Accordingly, they report that they will comply with the evacuation instructions. In this group, there are more women, more parents, and they tend to come from the community with extraordinary assets. Risk communication will most likely reach those who have an adequate worry; their behaviours are likely to comply with the advice given by the authorities during the warnings or in the emergency situations. Worry could therefore be regarded as signs of greater hazard salience, i. e., willingness to take preventative action (van den Berg et al., 2009, Baron et al., 2000, and Weinstein, 1989). To have their recommendations acknowledged, the experts may need to take aspects such as worry into account when communicating with multiple publics.

Those from the areas under threat who report that they are more worried about other issues than the future disaster report less worry about the rockslide, which may involve more denial or displacement of their worry or anxiety. If this is correct, some of those with low levels of worry pose special challenges for the risk communication.

## Social influences

Risk responses may be shaped by psychological, social, institutional, and cultural processes (Hom et al. 2009, Pidgeon et al. 2003, Kasperson 1992, Renn et al. 1992, Renn 1991, Kasperson et al. 1988, Bakir 2005). The social amplification of risk framework (SARF) was constructed by Kasperson to bridge the gap between experts' technical interpretation of risk and the emotional responses that may shape the public perceptions of risk. This study indicates that individual differences such as psychological defence mechanisms, neuroticism and externality were overridden by trusted relationships with experts and socio-demographic variables. Both having children exposed to risk and living in areas with a disaster history affected the perception of the risk communication. Glik (2007) suggests that situational

factors, individual and group characteristics, but also aspects of the warning messages determine whether the warnings are heeded. As suggested by social identity theory (Dawnay & Shah, 2005), lay people are more likely to be influenced by someone they identify with rather than by the authorities (Halpern et al. 2004). People show a strong bias in favor of in-group members (Dawnay and Shah). In other words, if a person identifies with a specific group of people, he is more likely to undertake the same values, attitudes and behaviours embedded in that group. The theory may imply that the two sub-populations; those who were not parents of children exposed to risk, and those who lived in communities with a disaster history processed communication about the risks differently than the others: Non-parents perceived the general risk communication as less useful, and likewise, those who lived in the areas with a disaster history perceived the public meetings less useful.

Those with higher levels of education are more likely to have an accurate perception of risks (Anderson-Berry 2003, Mileti & Fitzpatrick 1993, Drabek 1986, Faupel et al. 1992). In addition, the educated are more likely skilled in acquiring and evaluating communication about hazards (Heller et al. 2005, Anderson-Berry 2003, Pilisak & Acreddo 1988).

“Threats to a traditional lifestyle and connection to the land (‘place-identity’) are strongly associated with risk perspectives” (Jardine et al., 2009, p. 218). According to Jardine and colleagues, external risks, which may also be exemplified by a threatening tsunami, can disrupt the positive aspects of ‘place identity’, and result in heightened worry. The affects toward their home locations were evident in the aftermath of the 1934-disaster; many survivors re-built their homes in the same communities. The notion of their homes as a precious ‘place’ is likely to have an emotional impact on their behaviour. ‘Place identity’ may be even stronger in communities with a disaster history.

People who are more willing to take precautionary action, i. e., to follow the evacuation instructions, tend to live in areas with a history of natural disasters. Living in such

areas may enhance the willingness to adhere. Referring to Loewenstein et al. (2001) arguing that emotional reactions may dominate over rational analyses, the emotions related to the past “Tafjord disaster” may also have reinforced preventative behaviours. Such behaviours may have rubbed off on those who merely live in the same area. This tendency might also appear at the public meetings; the turnout was low in the communities that have had the disaster in the past. The conjured, yet vivid images, and also, the memories of the “Tafjord disaster” in 1934, together with the public meetings characterized by monologues by the experts may have left the inhabitants from these areas feeling disregarded.

## Worry and compliance

According to MacGregor (1991), worry is especially high when the future is uncertain and the expectations are not likely to be met. Van den Berg et al. (2009), Baron et al. (2000), and Weinstein (1989) found that increased worry should be treated as signs of greater hazard salience. The line of thinking is supported by this study. Participants who are more worried also reported more readiness to comply with the evacuation procedures.

Publics engaging in dialogue with the experts and who claim that they will comply with the evacuation procedures indicate not only that they acknowledge the risk, but also translate their emotions into adequate protective action. The affective or emotional dimension is reflected by higher degrees of worry in females, in line with findings from research on gender issues (Sjöberg 1998; Maccoby & Jacklin 1974). A limited amount of research has focused on gender differences related to risk. According to Loewenstein et al. (2001), studies show that women experience emotions, such as nervousness and fear more intensely than men (Loewenstein et al., 2001; Brody, 1993; Fujita et al., 1991; Brody et al., 1990; Stapley & Haviland, 1989). However, parental care also triggers the *experiential* system of Slovic et al.

(2004), irrespective of gender. The affects embedded in caring for children at risk are strong and seem to make parents worry far more than non-parents.

One theory that aims to explain the behaviours related to assets such as tourism, is the conservation of resources (COR) stress model (Hobfoll 1991, 1989). Studies have shown that resource loss in comparison with gain is a stronger predictor of negative psychological distress creating anxiety and worry (Hobfoll 1991; Freedy et al., 1992; Norris et al. 2006; Wells et al. 1999). Tourism has been Geiranger's lifeblood and pride for four generations. Accordingly, it is reasonable to ascribe extraordinary assets to this community and to predict that its residents would be even more worried about resource loss than those from the three other threatened communities. The findings support the research by Freedy et al. (1992, p. 441) "resource loss was relatively more important in predicting psychological distress than personal characteristics and coping behavior."

Trust emerges as a key element when people decide whether to accept or reject recommendations (Slovic, 1999). This study has documented that the combination of trust in experts and the perception of useful risk communication are important in making people follow the evacuation instructions. The knowledge gained through such collaboration may be more important than merely adhering to the evacuation instructions (Dow & Cutter 2000, Trettin & Musham 2000). Even a dreaded "false alarm" may enhance trust between the experts and the lay people if the communication is open and honest. "People accept that even experts make mistakes sometimes" (White & Eiser 2006, p. 1200).

## Strengths and limitations

This is a census study providing a snapshot of a population's responses at the time of the study; it does not show developmental trends or how people would actually behave in a

real disaster situation. Nevertheless, the conclusions leave a fair estimate of behaviours that may guide risk communication.

There are some limitations on the use of questionnaires; misunderstandings cannot be dealt with on the spot, and certain nuances may go unnoticed. It should also be noted that the self-generated items and composite variables used in this study were not standardized. Consequently, they were not tested beforehand to gain knowledge about how effectively they captured the reality they were intended for. On the other hand, standardized questionnaires alone would be insufficient since each disaster has unique characteristics that need to be discovered and explored. Variables composed of several items with good inter-correlations point towards the existence of a convergent validity; this applies to the topic related items generated in this study.

Even though the response rate (43.6%) seems adequate for this kind of survey with many of higher age in the target population, there are still some noticeable issues related to the age distribution. The response rates differed between the youngest and the older respondents. Some young adults pursue higher education after high school, yet maintain their home addresses in the area. Several of them did probably not receive the survey questionnaire booklets; they were out of their rural homes during the active parts of the academic year. The booklets were distributed in the middle of a semester to their registered home addresses; their temporary student addresses were not available.

Another possible factor in explaining the low response rate of the young may be related to media channel preferences. Government agencies prioritized traditional written documentation and public meetings which the older age groups are accustomed to, while the younger generation may prefer modern communication platforms, such as social media sites (Agichtein et al. 2008, Boyd & Ellison 2008, Svoen 2007) like facebook and twitter. Finally, the discrepancy in response rate between Fjørå and Geiranger (51.5 % versus 39.8%) may

reflect different attitudes towards this kind of research, based on disaster history background; Fjørå was most severely devastated by the tsunami in 1934, whereas Geiranger has no such history.

## Conclusions

One avenue for future research may be to explore further the effects of risk communication in relation to emotions, but also in relation to social, psychological, and cultural dimensions. Authorities monitoring potential natural hazards play a key role in sharing their expertise. One sub-population that represents a special challenge for risk communicators consists of the people who live in areas with a disaster history. On the one hand, they found the public meetings less useful, but on the other hand, they were inclined to adhere to evacuation instructions. As this dissertation has demonstrated, acknowledging that individuals interpret and respond differently to risk seems important to keep in mind. When government agencies communicate risks with high uncertainty and high probability to the publics, it may be useful to foster dialogues and attempt to meet a broad range of their needs and also, address issues involving emotions. Combining rational, emotional, and socio-cultural aspects in the risk communication may not only improve the dialogue between the authorities and publics, but also increase the motivation towards more hazard salience in imminent natural disaster situations.



## References

- Agichtein, E., Castillo, C., Donato, D., Gionis, A., & Mishne, G. (2008). Finding high-quality content in social media. In *Proceedings of the International Conference on Web Search and Web Data Mining*, 183–194, Stanford, CA.
- Ali, S. (1997) Trust, Risk, and the Public: The Case of the Guelph Landfill Site. *Canadian Journal of Sociology*, 22(4), 481–504.
- Anderson-Berry, L. J. (2003). Community vulnerability to tropical cyclones: Cairns, 1996–2000, *Natural Hazards*, (30)2, 209–232.
- Bakir, V. (2005). Greenpeace v. Shell: Media exploitation and the Social Amplification of Risk Framework (SARF), *Journal of Risk Research* 8(7–8), 678–91.
- Baron, J., Hershey, J. C., & Kunreuther, H. (2000). Determinants of priority for risk reduction: The role of worry. *Risk Analysis*, 20 (4), 413–428.
- Baxter, J., & Eyles J. (1997). Evaluating qualitative research in social geography: Establishing ‘rigour’ in interview analysis. *Transactions of the Institute of British Geographers* 22(4), 505–25.
- Baxter, J. W., Eyles, J. D., & Elliott, S. (1999). “Something happened”; The relevance of the risk society for describing the siting process for a municipal landfill. *Geografiska Annaler*, 81B(2), 91–109.
- Birley A.J., Gillespie N.A., Heath A.C., Sullivan P.F., Boomsma D.I., Martin N.G. (2006). Heritability and nineteen-year stability of long and short EPQ-R neuroticism scales. *Personality and Individual Differences* 40:737–747.

- Boyd, D. M., & Ellison, N. B. (2008). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13(1), 210–230.
- Briggs, S. R., & Cheek, J. M. (1986). The role of factor analysis in the development and evaluation of personality scales. *Journal of Personality*, 54(1), 106-148.
- Brody, L. R., Hay, D. H., & Vandewater, E. (1990). Gender, gender role identity and children's reported feelings toward the same and opposite sex. *Sex Roles*, 23, 363–387.
- Brody, L. R. (1993). On understanding gender differences in the expression of emotion. In S. L. Ablon, D. Brown, E. J. Khantzian, & J. E. Mack (Eds.), *Human feelings: Explorations in affect development and meaning (87–121)*. Hillsdale, NJ: Analytic Press.
- Burton, P. W., Silver, B. D. (2006). *The credibility of disaster evacuation warnings: The effects of issue framing and trust in government*. Available at [http://35.8.71.4/Documents/SOSSRelated/Burton\\_Silver\\_APSA2006\\_Final\\_Paper.pdf](http://35.8.71.4/Documents/SOSSRelated/Burton_Silver_APSA2006_Final_Paper.pdf). Downloaded, Dec. 15, 2011.
- Craig, A. R., Franklin, J. A., & Andrews, G. (1984). A scale to measure locus of control of behaviour. *British Journal of Medical Psychology*, 57, 173–180.
- Davey, G.C.L., J. Hampton, J. Farrell, and S. Davidson. 1992. Some characteristics of worrying: Evidence for worrying and anxiety as separate constructs. *Personality and Individual Differences* 13: 133–47.
- Davey, G.C.L. 1993. A comparison of three worry questionnaires. *Behaviour Research and Therapy* 31: 51–6.
- Davey, G.C.L. 1994. Worrying, social problem-solving abilities, and problem-solving confidence. *Behaviour Research and Therapy* 32: 327–30.
- Davis, M. S., Ricci, T., & Mitchell, L. M. (2005). Perceptions of risk for volcanic hazards at vesuvio and etna, italy. *Australasian Journal of Disaster and Trauma Studies*, 2005(1)

- Dawnay, E., & Shah, H. (2005). *Behavioural economics: Seven principles for policy makers*. London: New Economics Foundation.
- DeVellis, R. F. (2003). *Scale development: Theory and applications*, Sage Publications, Inc., Thousand Oaks, CA.
- Desvousges, W. H., & Kerry Smith, V. (1988). Focus groups and risk communication: The “science” of listening to data. *Risk Analysis*, 8(4), 479-484.
- Dieserud, G., E. Røysamb, Ø. Ekeberg, and P. Kraft. 2001. Toward an integrative model of suicide attempt: A cognitive psychological approach. *Suicide and Life-Threatening Behavior* 31, no.2: 153–168.
- Dow, K., & Cutter, S. L. (2000). Public orders and personal opinions: Household strategies for hurricane risk assessment. *Environmental Hazards*, 2(4), 143–155.
- Drabek, T. E., & Boggs, K. (1968). Families in disaster: Reactions and relatives. *Journal of Marriage and the Family*, 30, 443–451.
- Drabek, T. (1986). *Human System Responses to Disasters: An Inventory of Sociological Findings*. New York: Springer-Verlag.
- Endresen, I. M., Værnes, R., Ursin, H. & Tønder, O. (1987). Psychological stress-factors and concentration of immunoglobulins and complement components in Norwegian nurses. *Work and Stress*, 1, 365-375
- Endresen, I. M. (1991). A Norwegian translation of the Plutchik questionnaire for psychological defense. *Scandinavian Journal of Psychology*, 32(2), 105–113.
- Eysenck, S. B. G., Eysenck, H. J., & Barrett, P. (1985). A revised version of the psychoticism scale. *Personality and Individual Differences*, 6(1), 21–29.
- Faupel, C. E., Kelley, S. P., & Petee, T. (1992). The impact of disaster education on household preparedness for Hurricane Hugo. *International Journal of Mass Emergencies and Disasters* 10(1), 5–24.

- Finucane, M. L., & Holup, J. L. (2006). Risk as value: Combining affect and analysis in risk judgments. *Journal of Risk Research*, 9(2), 141-164
- Fischhoff, B. (2000). What forecasts (seem to) mean. In T. Connolly, R. H. Arkes, & K. R. Hammond (Eds.), *Judgment and decision making: An inter-disciplinary reader (2nd ed.)* (353–377). New York: Cambridge University Press.
- Freedly, J. R., Shaw, D. L., Jarrell, M. P., & Masters, C. R. (1992). Towards an understanding of the psychological impact of natural disasters: An application of the Conservation of Resources stress model. *Journal of Traumatic Stress*, 5(3), 441–454.
- Frey, L. R., Botan, C. H., & Kreps, G. L. (2000). Investigating communication. Allyn & Bacon, New York.
- Fujita, F., Diener, E., & Sandvik, E. (1991). Gender differences in negative affect and wellbeing: The case for emotional intensity. *Journal of Personality and Social Psychology*, 61, 427–434.
- Giddens, A. (1990). *The Consequence of Modernity*. Oxford: Oxford Polity Press.
- Glik, D. C. (2007). Risk communication for public health emergencies. *Annual Review of Public Health*, 28, 33-54.
- Granatt, M. (2004). On trust: Using public information and warning partnerships to support the community response to an emergency. *Journal of Communication Management*, 8(4), 354–365.
- Grothmann, T., & Reusswig, F. (2006). People at risk of flooding: Why some residents take precautionary action while others do not. *Natural Hazards*, 38(1), 101–120.
- Grunig, J. E., & Grunig, L. A. (1992). Models of public relations and communication. In J. E. Grunig (Ed.), *Excellence in public relations and communication management* (285–326). Hillsdale, NJ: Lawrence Erlbaum.

- Halpern, D., Bates, C., Beales, G., & Heathfield, A. (2004). *Personal responsibility and changing behaviour: The state of knowledge and its implications for public policy*. London: Cabinet Office.
- Heller, K., Alexander, D. B., Gatz, M., Knight, B. G., & Rose, T. (2005). Social and personal factors as predictors of earthquake preparation: The role of support provision, network discussion, negative affect, age, and education. *Journal of Applied Social Psychology*, 35(2), 399–422.
- Hobfoll, S. E. (1989). Conservation of resources. *American Psychologist*, 44 (3), 513–524.
- Hobfoll, S. E. (1991). Traumatic stress: A theory based on rapid loss of resources. *Anxiety, Stress & Coping*, 4(3), 187–197.
- Hom, A. G., Plaza, R., M. & Palmén, R. (2009). The framing of risk and implications for policy and governance: The case of EMF. *Public Understanding of Science*. Sage Publications 1: 1–15.
- Jardine, C. G., Boyd, A. D., & Furgal, C. M. (2009). Gender and place influences on health risk perspectives in northern Canadian Aboriginal communities. *Gender, Place and Culture*. 16(2), 201–223.
- Kaplan, S., & Garrick, B. J. (1981). On the quantitative definition of risk. *Risk Analysis*, 1(1), 11-27
- Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., Kasperson, J. X., and Ratick, S. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis*, 8(2), 177–187.
- Kasperson, R. E. (1992). The social amplification of risk: Progress in developing an integrative framework of risk. In S. Krimsky & D. Golding (Eds.), *Social theories of risk* (153–78). New York: Praeger

- Kent, M. L., & Taylor, M. (2002). Toward a dialogic theory of public relations. *Public Relations Review*, 28(1), 21–37
- Kraus, N. N., & Slovic, P. (1988). Taxonomic analysis of perceived risk: modeling individual and group perceptions. *Risk Analysis*, 8, 435–455.
- Ladouceur, R., F. Blais, M.H. Freeston, and M.J. Dugas. 1998. Problem solving and problem orientation in generalized anxiety disorder. *Journal of Anxiety Disorders* 12: 139–52.
- Leganger A., Kraft, P., & Røysamb E., (2000). Perceived self-efficacy in health behavior research: Conceptualisation, measurement and correlates. *Psychology and Health*, 15, 51-69.
- Lemyre, L., Gibson, S., Zlepnic, J., Meyer-Macleod, R., & Boutette, P. (2009). Emergency preparedness for higher risk populations: Psychosocial considerations. *Radiation Protection Dosimetry*, 134(3–4), 207–214.
- Lindell, M. K. & Perry, R. W. (2000) Household adjustment to earthquake hazard. A review of research. *Environment and Behavior*, 32(4), 461–501.
- Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, 127(2), 267–286.
- Luginaah, I., Taylor, S., Elliott, S., & Eyles, J. (2002). Community Responses and Coping Strategies in the Vicinity of a Petroleum Refinery in Oakville, Ontario. *Health & Place*, 8, 177–190.
- Luhmann, N. (1979). *Trust and power*. Chichester, UK: John Wiley & Sons.
- Luhmann, N. (1988). Familiarity, confidence, trust: Problems and alternatives. In D. Gambetta (Ed.), *Trust: Making and breaking cooperative relations*. (94–108). Oxford: Basil Blackwell.
- Lundgren, R. E., & McMakin, A. H. (2009). *Risk communication: A handbook for communicating environmental, safety, and health risks* Wiley-IEEE Press.

- Maccoby, E. E. & Jacklin C. N. (1974). *The Psychology of Sex Differences. Volume II.*  
Stanford, CA: Stanford University Press.
- MacGregor, D. (1991). Worry over technological activities and life concerns. *Risk Analysis*,  
*11*(2), 315–324.
- Malterud, K. (2012). *Fokusgrupper som forskningsmetode for medisin og helsefag.*  
Universitetsforlaget, Oslo.
- Masuda, J. R., & Garvin, T. (2006). Place, culture, and the social amplification of risk. *Risk  
Analysis*, *26*(2), 437–454.
- McComas, K. A. (2003). Citizen satisfaction with public meetings used for risk  
communication. *Journal of Applied Communication Research*, *31*(2), 164–184.
- Mertler, C. A. & Vannatta, R. A. (2005). *Advanced and Multivariate Statistical Methods:  
Practical Application and Interpretation (3<sup>rd</sup> ed.)*. Glendale, CA: Pyrczak Publishing.
- Miceli, R., I. Sotgiu, and M. Settanni (2008). Disaster preparedness and perception of flood  
risk: A study in an alpine valley in Italy. *Journal of Environmental Psychology* *28*: 164–  
73.
- Mileti, D. S. & Fitzpatrick, C. (1993). *The great earthquake experiment: Risk communication  
and public action*. San Francisco: Westview Press.
- Morgan, D. L. (1993). *Successful focus groups: Advancing the state of the art*, Sage  
Publications, Inc., Newbury Park, CA.
- Norris, F, Galea, S., Friedman, M., & Watson, P. (Eds.) (in press) (2006). *Methods for  
disaster mental health research*. New York: Guilford Press.
- O'Brien, K. (1993). Improving survey questionnaires through focus groups. An Earlier  
Version of these Findings was Presented at the Conference on Focus Groups and Group  
Interviews: Advancing the State of the Art, Portland, Oregon, Oct 4–6, 1990.

- Olson, D., Leitheiser, A., Atchison, C., Larson, S., & Homzik, C. (2005). Public health and terrorism preparedness: Cross-border issues. *Public Health Reports*, 120(Suppl 1), 76.
- Pallant, J. (2007). *SPSS survival manual: A step by step guide to data analysis using SPSS* (3rd ed.). Philadelphia: Open University Press.
- Perry, R. W., & Lindell, M. K. (1990). *Living with Mount St. Helens: Human adjustment to volcano hazards*. Washington State University Press, Pullman, WA
- Pidgeon, N., Kasperson, R. E. & Slovic, P. (Eds.) (2003). *The social amplification of risk*. Cambridge: Cambridge University Press.
- Pilisak, M. & Acreddo, C. (1988). Fear of technological hazards: One concern or many? *Social Behavior* 13(17), 110–127.
- Renn, O. (1991). Risk communication and the social amplification of risk. In R. E. Kasperson and P. J. Stallen (Eds.), *Communicating risks to the public: International perspectives*. (287–324). Amsterdam and New York: Kluwer Academic.
- Renn, O., Burns, W. J., Kasperson, J. X., Kasperson, R. E. & Slovic, P. (1992). The social amplification of risk: theoretical foundations and empirical applications. *Journal of Social Issues* 48(4), 137–160.
- Reyna, V.F., & C.J. Brainerd (1995). Fuzzy-trace theory: An interim synthesis. *Learning and Individual Differences* 7,1–75.
- Reyna, V. F., F. J. Lloyd, & C. J. Brainerd (2003). Memory, development, and rationality: An integrative theory of judgment and decision-making. In S. Schneider and J. Shanteau (Eds.), *Emerging perspectives on decision research*: 201-245. New York, NY: Cambridge University Press.
- Reyna, V.F. (2004). How people make decisions that involve risk. *Current Directions in Psychological Science* 13(2), 60–6.



- Rohrman, B. (1994). Risk perception of different societal groups: Australian findings and cross-national comparisons. *Australian Journal of Psychology*, 46, 150-163.
- Rohrman, B. (2000). A socio-psychological model for analyzing risk communication processes. *Australasian Journal of Disaster and Trauma Studies*, 4(2). Available at: <http://www.massey.ac.nz/%7Etrauma/issues/2000-2/rohrmann.htm>. Downloaded, Dec. 15, 2011
- Sandman, P. M. (1993). *Responding to community outrage: Strategies for effective risk communication*. Fairfax, VA: American Industrial Hygiene Association.
- Sattler, D. N., Kaiser, C. F., & Hittner, J. B. (2000). Disaster preparedness: Relationships among prior experience, personal characteristics, and distress. *Journal of Applied Social Psychology*, 30(7), 1396–1420.
- Schwarzer, R., 1993. Measurement of perceived self-efficacy: Psychometric scales for cross-cultural research. Berlin, Germany: Freie Universität Berlin.
- Schwarzer, R., Bäßler J., Kwiatec, P., Schröder K., & Zhang, J. K. (1997). The assessment of optimistic self-beliefs: Comparison of the German, Spanish, and Chinese versions of the General Self-Efficacy Scale. *Applied Psychology: An International Review*, 46, 69-88.
- Schwarzer, R (1998). General perceived self-efficacy in 14 cultures. Berlin, Germany: Freie Universität Berlin.
- Sellnow, T.L., Ulmer, R.R., Seeger, M.W., & Littlefield, R.S. (2009). *Effective risk communication: A message-centered approach*. New York: Springer Science.
- Sjöberg, L. (1998). Worry and risk perception. *Risk Analysis*, 18(1), 85–93.
- Sjöberg, L. (2004). Explaining individual risk perception: The case of nuclear waste. *Risk Management: An International Journal*. 6(1), 51–64.
- Slovic, P. (1999). Trust, emotion, sex, politics, and science: Surveying the risk-assessment battlefield. *Risk Analysis*, 19(4), 689–701.

- Slovic, P. (2000). Perceived risk, trust, and democracy. In T. Connolly, R. H. Arkes, & K. R. Hammond (Eds.), *Judgment and decision making: An inter-disciplinary reader (2nd ed.)*. (500–513). New York: Cambridge University Press.
- Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis*, *24*(2), 311–322.
- Slovic, P., Peters, E., Finucane, M., & MacGregor, D. (2005). Affect, risk, and decision making. *Health Psychology*, *24*, 35–40.
- Stapley, J. C., & Haviland, J. M. (1989). Beyond depression: Gender differences in normal adolescents' emotional experiences. *Sex Roles*, *20*, 295–308.
- Stöber, J., S. Tepperwien, and M. Staak. 2000. Worrying leads to reduced concreteness of problem elaborations: Evidence for the avoidance theory of worry. *Anxiety Stress and Coping* *13*: 217–27.
- Svoen, B. (2007). Consumers, participants, and creators: Young people's diverse use of television and new media. *ACM Computers in Entertainment*, *5*(2), 1-16.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*. Boston: Pearson/Allyn & Bacon.
- Taylor, M. & Kent M. L. (2006). Public Relations Theory and Practice in Nation Building. In C. H. Botan & V. Hazleton (Eds.), *Public Relations Theory II*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.
- Thalmann, A. T., & Wiedemann, P. M. (2006). Beliefs and emotionality in risk appraisals. *Journal of Risk Research*, *9*(5), 453-466.
- Trettin, L., & Musham, C. (2000). Is trust a realistic goal of environmental risk communication? *Environment and Behavior* *32*(3), 410–426.

- Van den Berg, M., Fort, R., & Burger, K. (2009). *Natural hazards and risk aversion: Experimental evidence from Latin America*. Available at: <http://ageconsearch.umn.edu/handle/51394>. Downloaded, Dec. 15, 2011.
- Værnes, R. J. Knardahl, S., Rømsing, J., Aakvaag, A., Tønder, O., Walther, B., & Ursin, H., (1988). Relations between environmental problems, psychology and health among shift-workers in the Norwegian process industry. *Work and Stress*, 2, 7-15.
- Wakefield, S., Elliott, S., Cole, D., & Eyles, J. (2001) Environmental Risk and (Re)action: Air Quality, Health and Civic Involvement in an Urban Industrial Neighbourhood. *Health and Place*, 7, 163–177.
- Weinstein, N. D. (1989). Effects of personal experience on self-protective behavior. *Psychological Bulletin*, 105(1), 31–50.
- Weinstein, N. D., & Nicolich, M. (1993). Correct and incorrect interpretations of correlations between risk perceptions and risk behaviors. *Health Psychology*, 14, 132-140.
- Wells, J. D., Hobfoll, S. E., & Lavin, J. (1999). When it rains, it pours: The greater impact of resource loss compared to gain on psychological distress. *Personality and Social Psychology Bulletin*, 25(9), 1172.
- West, D. (2001). *The rise and fall of the media establishment*. Boston: Bedford/St. Martin's Press.
- West, D. M., & Orr, M. (2007). Race, gender, and communications in natural disasters. *Policy Studies Journal*, 35(4), 569–586.
- Wester-Herber, M. (2004) Underlying Concerns in Land-Use Conflicts - The Role of Place-Identity in Risk Perception. *Environmental Science & Policy*, 7, 109–116.
- White, M. P., & Eiser, J. R. (2006). Marginal trust in risk managers: Building and losing trust following decisions under uncertainty. *Risk Analysis*, 26(5), 1187–1203

- Wolff B., Knodel J. & Sittitai W. (1993) Focus groups and surveys as complementary research methods. In *Successful Focus Groups: Advancing the State of the Art* (Morgan D., ed.), Sage, London, pp. 118–136.
- Zaalberg, R., Midden, C., Meijnders, A., & McCalley, T. (2009). Prevention, adaptation, and threat denial: Flooding experiences in the Netherlands. *Risk Analysis*, 29(12), 1759–1778.
- Zimmerman, R., Restrepo, C. E., Culpén, A., Remington, W. E., Kling, A., Portelli, I., & Foltin, G. L. (2010). Risk communication for catastrophic events: Results from focus groups. *Journal of Risk Research*, 13(7), 913-935.

# Paper I





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## Public Relations Review



# Communicating risk to parents and those living in areas with a disaster history

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### ABSTRACT

This study explored how publics respond to risk communication in high probability but time-indeterminate natural disaster situations when parts of the area have been involved in a similar disaster before. An impending rockslide is expected to produce a tsunami in the fjord around Åknes in Norway. Waves may run up above sea level as high as 82 m or 269 ft. All residents (18 and older) of the four most threatened communities received a questionnaire to determine what they perceived to be useful risk information. Three hundred and eighty-two (43.6% of 875) responded. Results indicated that parents of children living within the tsunami risk zones perceived the risk information to be the most useful. Those who lived in communities that experienced a similar disaster in 1934 reported public meetings less useful than written or mediated information. Publics who lived in communities with such disaster history and those who were not parents posed special challenges in risk communication because they perceived information from the government agencies as lacking in usefulness. Therefore, committing the resources necessary to foster dialogues with a diversity of publics exposed to risk would be well served to fully understand the nature of risk communication responses, and to be able to save human lives.

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### 1. Introduction

Approximately 3,000 people are living in a tsunami danger zone on the west coast of Norway around Åknes; this is one of the rockslide sites with the highest severity potential in Western Europe. Lasers, radar, remote video and human staff keep 24 h continuous watch over the site where 18–54 million cubic m (635 million–1.9 billion cubic ft) of rock is likely to fall into the fjord. In the worst-case scenario, the resulting tsunami may run as high as 82 m (269 ft) above the shoreline in the town Hellesylt 5 min after the rockslide. Most of the town, a local school and an institution for the elderly will be inundated. About 10 min later the tsunami would strike Geiranger with a wave run-up of about 63 m (206 ft), and destroy homes, at least one school, day care centers, hotels, kiosks, restaurants, and shops. The number of people at risk is greatest during the summer when this UNESCO-designated tourist community has many visitors. The wave run-up height estimated to reach two other towns is 13 m (42 ft) for Tafjord and 4 m (13 ft) for Fjørå. The distance from where the rockslide is likely to hit the water, measured along the fjord, is approximately 13 km (8 miles) to Hellesylt; 21 km (13 miles) to Geiranger; 28 km (17 miles) to Fjørå; 35 km (22 miles) to Tafjord.

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### 1.1. Disaster history background

The Åknes site serves as a constant reminder of 1934, when a similar calamity struck the communities of Tafjord and Fjørå: 40 people died. Back then, survivors thought the best cure was to let time heal the wounds by not sharing their traumatic stories. Not until 1985 was the incident widely discussed, when a local researcher published a first book about the event (Furseth, 1985). Nevertheless, awareness of what has come to be called the Tafjord disaster must have been prevalent.

In the parts of Norway studied here people still tend to stay for generations in the same area where they were born. Therefore it is relevant to explore whether residents of the two communities that were involved in the disaster of 1934 perceive risk information differently from those of similar communities that do not share their history. This knowledge will allow more informed campaign planning by risk communication specialists with respect to whether the same campaign can be used for all communities or if different disaster histories make different campaigns necessary.

### 1.2. Parenting

Half of the respondents in this study (180) are parents of children living in the tsunami risk zone. Thus, it is important to know if parents of children understand and respond to risk communication campaigns the same way as others in order, again, to decide if a single campaign is sufficient or if two separate campaigns are needed—one for parents and one for non-parents.

Effects of personal or familial experience of hazards have been explored over the past three decades (Grothmann & Reusswig, 2006; Van den Berg et al., 2009; Weinstein, 1989; Zaalberg, Midden, Meijnders, & McCalley, 2009). However, little or no research explores whether publics living in communities with a disaster history and parents of children regularly exposed to natural disaster risk tend to perceive risk communication differently than those without such a common background or who are not parents. The overall aim of this paper was to fill this gap.

### 1.3. Social influences and affect

Parts of our social identity come from groups we feel most associated with (Dawnay & Shah, 2005). The social amplification of risk framework (SARF) is founded on the individual's social, psychological, and cultural network. Masuda and Garvin (2006) have identified that risk perceptions are shaped by “place” attachments and that place is an important component in the social amplification or attenuation of risks.

According to Slovic, Finucane, Peters, and MacGregor (2004), there are two fundamental systems by which humans understand risk. The *analytic* system uses probability calculus, formal logic, and risk assessment. While the *experiential* system is based on intuition and is fast, mostly automatic, and to a limited degree is characterized by conscious awareness. “The *experiential* system encodes reality in images, metaphors, and narratives to which affective feelings have become attached” (P. Slovic et al., p. 316). The issues explored in this study involve the two systems. Face-to-face communication at public meetings may activate experiential processing, evoking images connected with affect (Marx et al., 2007). Written and mediated information may appeal more to the analytic processing since it lacks the spontaneity and the face-to-face confrontations.

### 1.4. Risk communication

The principal rationale for risk communication is to protect the publics from dangers and loss. Palenchar (2005) states that a “transactional communication process among individuals and organizations” is a key constituent in risk communication (p. 752).

In the Åknes case, there are two means for providing risk information: public meetings with some dialogic component, and mediated or written communication that is more impersonal and one-way. Public meetings are one of the most common and traditional ways of disseminating information about controversial issues. Officials from the local government usually chair the meetings with the support of experts. Written documentation including reading, seeing or hearing the information in print, audio-visually or digitally, is also common. The two approaches (Grunig & Grunig, 1992) may be assessed separately or together with regard to their “information usefulness,” a key concept in this paper.

Endangered publics make their individual choices on how to prepare for natural disasters. According to the uses and gratifications theory (Blumler & Katz, 1974), individuals seek out information they find useful. Therefore, it is important to study first which publics see current available information as useful, and how useful it is to them. When knowing whether parents of children regularly exposed to risk and individuals living in communities with a disaster history find public meetings more useful than printed or electronic information, risk communicators can more effectively determine to continue current presentation formats, or change them.

### 1.5. Research questions

Based on the reviewed research, the following two questions guided this study:



**RQ1.** Do publics from communities with a disaster history perceive the usefulness of risk communication differently than publics in communities without such a history?

**RQ2.** Do parents of children exposed to risk perceive the usefulness of risk communication differently than do non-parents?

## 2. Methodology

### 2.1. Participants

Of the 875 total residents over 18 in the four communities studied, a total of 382 (43.6%) responded to our questionnaire. Juveniles, defined as those under the age 18, were not included under the guidelines of the Norwegian Social Science Data Services. Respondents were 53.3% females ( $n = 200$ ) and 46.7% males ( $n = 175$ ), very reflective of the known 51% female 49% male gender distribution of the communities surveyed. To maintain anonymity in such small populations the participants were aggregated into four age groups; 18–33, 34–49, 50–65, 66 and above. The number of received questionnaires was 173 from Geiranger; 475 from Hellesylt; 128 from Fjørå; 99 from Tafjord. In relation to the total number of respondents, 18.4% were from Geiranger, 53.3% from Hellesylt, 10.7% from Tafjord, and 17.6% from Fjørå. The response rate of the age group 18–33 was 18.9%; age group 34–49 was 28.5%; age group 50–65 was 24.8%; age group 66 years and above was 27.7%.

### 2.2. Procedure

In February 2008, 875 booklets with questionnaires were distributed via regular mail. Each booklet contained 136 items; 46 items were generated specifically for this study by focus groups run in the communities involved by the first author. The remaining 90 items were from established standardized questionnaires. Two reminders were circulated with an interval of 1 month.

The front page of the booklet contained background information about the study. The questionnaires were treated anonymously, in accordance with the policy of the Norwegian Social Science Data Services (NSD).

### 2.3. Measures

Generated items for this study were scored on a five-point Likert-type scale ranging from 1—suits me very poorly to 5—suits me very well. The items and response options in this article are translated from the original Norwegian version into English. The original Norwegian term “*passar*”, for example, has been translated into “suits me” as the nearest English equivalent. Although “suits me” may not be an appropriate response option for a general audience in, for example, in the United States, it is appropriate in the original Norwegian. Some variables consist of single items, others of unweighted mean scores.

### 2.4. Information variables

The variable regarding useful public meetings ( $M 3.78$ ,  $SD 0.99$ ) consisted of one item: “The public meetings about the rockslide risk give me useful information.” The variable useful written and mediated information ( $M 3.48$ ,  $SD 0.82$ ), consisting of the two items: “the written documentation about the rockslide risk is useful to me,” and “the Åknes/Tafjord web site gives me useful information.” The correlation between the two variables was 0.49 which justified merging them into one variable called “the useful information combined” ( $M 3.5$ ,  $SD 0.78$ ). This combined variable covered how the publics perceived the usefulness of the risk communication generally, both face-to-face and the written and mediated information. In this way, the analyses could distinguish between face-to-face (public meetings), non-face-to-face (written and mediated) risk information, and also a combination of the two. The local governments and the experts (geologists) at the Åknes/Tafjord project were in charge of both sources of information.

### 2.5. Disaster of the past

The dichotomous disaster history variable assessed whether the respondents were living in communities with a disaster history. Residents of two geographically, culturally and economically similar communities closer to the rockslide site were grouped in two: whether their home had such a history (1) or did not (0).

The variable of having children was also coded dichotomously into respondents who were parents of children who either attended a school located in the tsunami risk zone, or whose school road or playing field was in that zone. If coded 1, the respondent was such a parent, else the variable was coded 0.

### 2.6. Data analyses

This study involved multiple dependent variables: useful information combined, useful public meetings, and useful written and mediated information. Because the dependent measures were highly correlated (useful information combined

**Table 1**  
Means and standard deviations for predictors of risk information usefulness.

Predictors	Useful info. combined	Useful public meetings	Useful written and mediated info.
Disaster history (Mean/SD)			
Yes	3.46 (.73)	3.42 (.90)	3.49 (.79)
No	3.62 (.79)	3.93 (.98)*	3.48 (.83)
Having children (Mean/SD)			
Yes	3.74 (.73)*	3.92 (.98)*	3.65 (.79)*
No	3.42 (.80)	3.65 (.97)	3.32 (.83)

\* The predictors that achieved significance ( $p < 0.001$ ) are marked.

with useful written and mediated information = .92; useful information combined with useful public meetings = .79), the effects of the dichotomous, independent variables of disaster history and having children were analyzed through the use of multivariate analysis of variance (MANOVA).

### 3. Results

Data on how risk communication usefulness differs for publics living in communities with a disaster history, and parents of children exposed to tsunami risk are presented in Table 1.

A two-way MANOVA was conducted to determine the effect of disaster history and having children on the three dependent variables of risk communication (see Table 1). As recommended by Tabachnick and Fidell (2007), Pillai's criterion was used to evaluate multivariate significance since sample sizes were unequal and Box's Test of Equality of Covariance Matrices was significant at  $p < .001$ . MANOVA indicates that having children (Pillai's Trace = .043,  $F(3, 355) = 5.34$ ,  $p = 0.001$ ,  $\eta^2 = 0.043$ ) and disaster history (Pillai's Trace = .068,  $F(3, 355) = 8.65$ ,  $p = 0.000$ ,  $\eta^2 = 0.068$ ) significantly affected the combined DV of risk information usefulness. Univariate ANOVA indicates that useful public meetings significantly differs for both having children ( $F(1, 355) = 6.6$ ,  $p < .010$ ,  $\eta^2 = 0.018$ ) and disaster history ( $F(1, 355) = 15.4$ ,  $p < .001$ ,  $\eta^2 = 0.042$ ). Useful written and mediated information significantly differs for having children ( $F(1, 355) = 15.5$ ,  $p < .001$ ,  $\eta^2 = 0.042$ ); likewise does useful information combined differ for having children ( $F(1, 355) = 15.2$ ,  $p < .001$ ,  $\eta^2 = 0.041$ ).

### 4. Discussion

This study investigated what could shape the publics' perception of the usefulness of risk information. Those having children living in the potential tsunami zones found all risk information useful. The publics who lived in communities with a disaster history perceived the public meetings as being less useful. Findings also suggest that living in an area with disaster history does not have a significant effect on the perceived usefulness of the other information sources (i.e., not involving face-to-face communication).

Parents having children at risk and those who live in areas with a disaster history appear more sensitive to how they perceive the usefulness of the risk information. This may be explained by vivid images and anecdotes tagged with affect, embedded in these publics. "*For whatever reasons, images often strike us more powerfully, more deeply than numbers. We seem unable to hold the emotions aroused by numbers nearly as long as those of images. We grow quickly numb to the facts and the math*" (Bass, 1996, p. 87). Interpreting Slovic et al. (2004), parental care and living in areas with a disaster history may trigger the *experiential* system. Research by Loewenstein, Weber, Hsee, and Welch (2001) argues that emotional reactions to risky situations may drive behavior. Thus, the affect embedded in caring for the children at risk, and individual needs for information, may be so overwhelming that all available risk information is perceived as useful (Infante, Rancer, & Womack, 1993). On the other hand, latent emotions from the 1934 disaster may drive the perception of risk information by those who live in areas with a disaster history in the other direction, as they found the public meetings less useful.

#### 4.1. Influence from society and culture

The findings of this study support the SARF; the perception of risk may intensify or attenuate, depending on each individual's interpretation of threats (Kasperson et al., 1988). Having children exposed to risk and living in areas with a disaster history affected the perception of risk information. The SARF was constructed by Kasperson to bridge the gap between experts' technical interpretation of risk and the socio-cultural and emotional responses that create public perceptions of risk.

Studies demonstrate that participants' "place identity" (i.e., attachment to home, embeddedness in tradition, family, and a rural lifestyle), has a significant effect in the understanding of risk (Ali, 1997; Baxter & Eyles, 1997; Jardine, Boyd, & Furgal, 2009; Luginaah, Taylor, Elliott, & Eyles, 2002; Wakefield, Elliott, Cole, & Eyles, 2001). "Threats to a traditional lifestyle and connection to the land ("place-identity") are strongly associated with risk perspectives" (Jardine et al., 2009, p. 218). External risks, such as a threatening tsunami, may disrupt these aspects of "place identity," and result in heightened worry. The affective feelings were evident in the aftermath of the 1934 disaster when the survivors re-built their homes in the same communities. The concrete and vivid images of a tsunami destroying a precious "place" is likely to have an emotional impact

on how risk communication is perceived. Thus, “place identity” may be stronger in the communities with such a disaster history.

According to the Åknes/Tafjord project, the participation of lay people at the public meetings was noticeably smaller in the two communities struck by the disaster in 1934. Participating at public meetings and discussing the risk of a future catastrophe may become emotionally overwhelming by activation of the latent images and stories transferred to them in the past. Even though some dialogic component is encouraged at the public meetings, there is a tendency toward monologs by the government agencies. As such, the non-experts living in areas with a disaster history may feel disregarded.

As suggested by the social identity theory (Dawnay & Shah, 2005), lay people are more likely to be influenced by someone they identify with rather than by the authorities (Halpern, Bates, Beales, & Heathfield, 2004), and people show a strong bias in favor of in-group members (Dawnay and Shah). The theory may imply that the two sub-populations – those who were not parents of children regularly exposed to risk and those who live in communities with a disaster history – processed the information about the risk differently, but equally among the group members. In this way, their perceived usefulness of the risk information from the government agencies may have suffered.

#### 4.2. Implications for communication

Government agencies monitoring a potential natural hazard play a key role in sharing expertise. As this study has demonstrated, risk communicators should emphasize many points of view as well as multiple sources of information. Bringing the publics together in partnerships may “favor collaborative dialogue that sees value in ambiguous, partial, and incomplete knowledge” (Gilpin & Murphy, 2008, p. 678), as suggested by the dialogic theory (Taylor & Kent, 2006). A stronger commitment to community engagement with emphasis on dialogue at public meetings, planning committees and advisory boards might be an alternative to foster “trust, satisfaction, sympathy” (Kent & Taylor, 2002, p. 32; Taylor & Kent, 2006, p. 354) among the community members and government agencies.

As demonstrated by this study, disaster history and having children affect risk communication and warrants further studies on risk communication with diverse publics.

#### 4.3. Limitations

The response rate of this census study is moderate at 43.6%. Even though it seems adequate for this kind of a survey with many in the aging sector of the population, there are some noticeable issues. Firstly, differences in the response rates were evident between the youngest age group (18.6%) and the others (28.0, 24.3, and 27.2%). A possible explanation may be differences in media channel preferences. The government agencies prioritize written documentation and public meetings which the older age groups may be more accustomed to, while the younger tend to prefer modern communication platforms, such as social media sites (Agichtein, Castillo, Donato, Gionis, & Mishne, 2008; Boyd & Ellison, 2008; Svoen, 2007). Alternatively, many young adults wanting to pursue further education after high school graduation need to leave their home communities for their higher education. Therefore, they might not have received the questionnaire booklets. Secondly, the discrepancy in response rate between Fjørå and Geiranger (51.5% vs. 39.8%) may reflect different attitudes toward such research, based on disaster history background; Fjørå was most severely devastated by the tsunami in 1934, whereas Geiranger does not have such a disaster history.

#### 4.4. Future research

The issues to be explored in future projects may relate to the psycho-social differences among the publics. Exploring why publics living in areas with a disaster history and those having children at risk perceive the risk communication differently, would undoubtedly be relevant to risk communicators.

This study has demonstrated that publics who live in areas with a disaster history and in particular, parents who have children at risk perceive differently the usefulness of risk information. When government agencies communicate risk with high uncertainty and probability, committing the resources necessary to foster dialogues with such diverse publics may be well served.

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### References

- Agichtein, E., Castillo, C., Donato, D., Gionis, A., & Mishne, G. (2008). Finding high-quality content in social media. In *Proceedings of the International Conference on Web Search and Web Data Mining* (pp. 183–194).
- Ali, S. H. (1997). Trust, risk, and the public: The case of the Guelph Landfill site. *Canadian Journal of Sociology*, 22(4), 481–504.
- Bass, R. (1996). *The book of Yaak*. New York: Houghton Mifflin.

- Baxter, J., & Eyles, J. (1997). Evaluating qualitative research in social geography: Establishing 'rigour' in interview analysis. *Transactions of the Institute of British Geographers*, 22(4), 505–525.
- Blumler, J. G., & Katz, E. (1974). *The uses of mass communication*. Newbury Park, CA: Sage.
- Boyd, D. M., & Ellison, N. B. (2008). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13(1), 210–230.
- Dawdney, E., & Shah, H. (2005). *Behavioural economics: Seven principles for policy makers*. London: New Economics Foundation.
- Furseth, A. (Ed.). (1985). *Dommedagsfjellet, Tafford 1934 (2. Utg. A.F. 1994 ed.)*. Oslo, Norway: Gyldendal.
- Gilpin, D. R., & Murphy, P. J. (2008). *Crisis management in a complex world*. New York: Oxford University Press.
- Grothmann, T., & Reusswig, F. (2006). People at risk of flooding: Why some residents take precautionary action while others do not. *Natural Hazards*, 38(1), 101–120.
- Grunig, J. E., & Grunig, L. A. (1992). Models of public relations and communication. In J. Grunig (Ed.), *Excellence in public relations and communication management* (pp. 285–326). Hillsdale, NJ: Lawrence Erlbaum.
- Halpern, D., Bates, C., Beales, G., & Heathfield, A. (2004). *Personal responsibility and changing behaviour: The state of knowledge and its implications for public policy*. London: Cabinet Office.
- Infante, D. A., Rancer, A. S., & Womack, D. F. (1993). *Building communication theory*. Prospect Heights, IL: Waveland Press.
- Jardine, C. G., Boyd, A. D., & Furgal, C. M. (2009). Gender and place influences on health risk perspectives in northern Canadian Aboriginal communities. *Gender, Place and Culture*, 16(2), 201–223.
- Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., et al. (1988). The social amplification of risk: A conceptual framework. *Risk Analysis*, 8(2), 177–187.
- Kent, M. L., & Taylor, M. (2002). Toward a dialogic theory of public relations. *Public Relations Review*, 28(1), 21–37.
- Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, 127(2), 267–286.
- Luginaah, I. N., Taylor, S. M., Elliott, S. J., & Eyles, J. D. (2002). Community responses and coping strategies in the vicinity of a Petroleum Refinery, Oakville, Ontario. *Health and Place*, 8, 177–190.
- Marx, S. M., Weber, E. U., Orlove, B. S., Leiserowitz, A., Krantz, D. H., & Roncoli, C. (2007). Communication and mental processes: Experiential and analytic processing of uncertain climate information. *Global Environmental Change*, 17(1), 47–58.
- Masuda, J. R., & Garvin, T. (2006). Place, culture, and the social amplification of risk. *Risk Analysis*, 26(2), 437–454.
- Palenchar, M. J. (2005). Risk communication. In R. L. Heath (Ed.), *Encyclopedia of public relations* (pp. 752–755). Thousand Oaks, CA: Sage.
- Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis*, 24(2), 311–322.
- Svoen, B. (2007). Consumers, participants, and creators: Young people's diverse use of television and new media. *Computers in Entertainment (CIE)*, 5(2), 5.
- Taylor, M., & Kent, M. L. (2006). Public relations theory and practice in nation building. In C. H. Botan, & V. Hazleton (Eds.), *Public relations theory. II*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston: Pearson/Allyn & Bacon.
- Van den Berg, M., Fort, R., & Burger, K. (2009). Natural hazards and risk aversion: Experimental evidence from Latin America. In *Contributed Paper prepared for presentation at the International Association of Agricultural Economists Conference, Beijing, China, August 16–22, 2009*.
- Wakefield, S., Elliott, S., Cole, D., & Eyles, J. (2001). Environmental risk and (re)action: Air quality, health and civic involvement in an urban industrial neighbourhood. *Health and Place*, 7, 163–177.
- Weinstein, N. D. (1989). Effects of personal experience on self-protective behavior. *Psychological Bulletin*, 105(1), 31–50.
- Zaalberg, R., Midden, C., Meijnders, A., & McCalley, T. (2009). Prevention, adaptation, and threat denial: Flooding experiences in the Netherlands. *Risk Analysis*, 29(12), 1759–1778.

# Paper II

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# Paper III



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