

**THE TIME OF  
TELLING TALES**

**THE DETERMINANTS OF EFFECTIVE RISK COMMUNICATION**

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UNIVERSITY OF TWENTE



# **THE TIME OF TELLING TALES**

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# THE TIME OF TELLING TALES

**THE DETERMINANTS OF EFFECTIVE RISK COMMUNICATION**

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# CHAPTER 1

## INTRODUCTION





With the increase of safety risks in modern day society, the necessity of preparing citizens for risks and crises in their environment becomes more evident (Rickard et al., 2014). Risk communication is seen as an effective tool to achieve risk management goals and increase the self-protectiveness of citizens (Gutteling, 2015). However, ineffective communication prior to and during crises and disasters is potentially harmful - as for instance illustrated during the fatal freight train crash in the Belgian municipality Wetteren in 2013 where a distorted, inaccurate and alarmist depiction of the disaster led to uncertainty and fear with citizens behaving inadequately (NOS, 2013; Andrews et al., 2016) - stressing the need to develop evidence-based effective risk communication. Changing views on risk communication have recently triggered a new array of risk communication approaches that go further than simply creating awareness about potential threats in the environment (Trettin & Musham, 2000; ter Huurne, 2008). In addition to being a top-down tool for informing citizens in acute crisis situations (e.g., NL-Alert), an interactive bottom-up approach is increasingly seen as necessary. In this approach the public's beliefs, opinions and feelings towards potential hazards are addressed, in order to create active, resilient citizens who are able to protect themselves and significant others against risks and threats (Wade et al., 1992; Gutteling, 2015). At least three developments are assumed to have contributed to these changing views on risk communication over the last years. First of all, recent events have emphasized the need to better prepare citizens for possible risks and crises in their environment. For instance, in 2000, disaster struck Enschede in the Netherlands when explosions at a fireworks facility killed 23 people, wounded 950 others and destroyed over 200 houses (Commissie Onderzoek Vuurwerkramp, 2001). Also, in 2011, a fire at Chemie-Pack - a packaging company for chemicals in Moerdijk in the Netherlands - had significant consequences for a big part of the West of the Netherlands (IOOV, 2011). In both cases, as well as during other smaller local incidents (Messemaker et al., 2013), ineffective communication efforts used were seen as part of the reason for the extent of the (societal) impact of the crisis (Helsloot & Groenendaal, 2013). Secondly, changing views in governance ask for more pro-active and better informed citizens taking more responsibility in many aspects of their lives, including disaster preparation. For instance, with regard to flood risks, the Dutch government has been moving towards a multilayer approach in risk management focusing on flood infrastructure, land-use planning and crisis management instead of exclusively relying on dikes and risk-assessment (Jongejan et al. 2012; Rijksoverheid, 2011). This asks for more societal resilience and better prepared citizens, and subsequently stresses the need for risk communication that will help to reach these goals (van Buuren, Ellen & Warner, 2016). Thirdly, developments in information technology (IT) - such as the emergence of social media - have provided citizens with the opportunity to constantly collect as well as spread information. Nowadays, social media are increasingly being used as an information source, including information related to risks and crises (Westerman, Spence & van der Heide, 2013). Citizens have become more active in seeking relevant risk information online (Ter Huurne, 2008). The developments in IT in the last decade have enormously increased the individual risk-information seeking potential, since risk information from various sources is available 24/7 and citizens might be more aware of risks and threats (Gutteling, 2015). These

developments increase the need for governmental organizations and care takers to be a visible and an effective part of this collectively available risk and resilience information.

The question that arises is: What do citizens do with available information on risks and threats in their environment? Is this implemented in their behavioral repertoire increasing their resilience? Or not? Unfortunately, we still have too little systematic knowledge on whether, when, why and how citizens use risk information in order to prepare themselves for possible threats in their environment. This knowledge is however needed in order to be able to develop evidence-based risk communication efforts.

The aim of this thesis is to gain an in-depth understanding of self-protective behavior of citizens regarding real-life safety risks, and it contributes to our understanding how risk communication can be used as an effective tool to enhance the self-protective behavior of at-risk populations. The main research question of this thesis is: *Which variables predict the self-protectiveness of citizens with regard to real-life safety risks and under which conditions is risk communication most effective in enhancing self-protective behavior?* The answer to this question is of particular importance for governmental institutions communicating risk aiming to help citizens to become aware, to become active, and to be resilient - able to prepare and protect themselves for threats in their environment.

## The focus of this thesis

Self-protectiveness regarding safety risks has emerged as a key topic within the risk communication literature (Ter Huurne & Gutteling, 2008; Terpstra, 2010; Rickard et al., 2014). Research has been particularly aimed at understanding why and when individuals take risk mitigating measures in order to protect themselves and significant others against risks, crises and disasters (Ter Huurne & Gutteling, 2008; Terpstra, 2010; Lindell & Perry, 2012; Yang et al. 2014). The emphasis of these studies often lies on developing generic theoretical models for predicting self-protective behavior (Witte, 1992; Lindell & Perry, 2012). Several studies have been conducted within the safety domain looking at the determinants of persuasion of the at-risk audiences, stimulating the adoption of self-protective behavior. These studies for instance show that perceived feasibility (self-efficacy) and usefulness (response-efficacy) of self-protective behaviors are, besides risk perception, important predictors of self-protectiveness (Witte, 1992; Lindell & Perry, 2012; Sheeran, Harris & Epton, 2013; Yang et al. 2014). However, some pieces of the puzzle are still missing. Although research shows that factors such as risk perception, self-efficacy and response-efficacy are predictors of self-protectiveness, we still do not know which additional factors might influence self-protectiveness. The social psychological elements underlying citizens' decisions on whether to take self-protective behavior regarding safety risks is a fairly unexplored area within the risk psychology domain and will therefore be one of the foci of the current thesis. Furthermore, the scope of these studies often does not go beyond studying one health- or risk-topic within a laboratory setting (Witte, 1992; Ter Huurne & Gutteling, 2008; Terpstra, 2010; Lindell & Perry, 2012; Yang et al. 2014) and often focus on the intention to be self-protective, not on

actual behavior. We still do not know to what extent these results are generalizable to other risk types and populations and we have insufficient insight in how risk communication can most optimally serve as a means to increase self-protectiveness.

This thesis goes beyond previous studies in five ways, that will be discussed in further detail below. One, I test the basic assumptions of the Extended Parallel Process Model (EPPM) (Witte, 1992) – the most prominent model used in this thesis – in a controlled laboratory setting as well as in field studies with regard to safety risks. I focus on the impact of risk perception, self-efficacy and response-efficacy on self-protectiveness. These studies should contribute to our understanding when and why citizens will engage in self-protective behaviors. The studies conducted in a controlled laboratory setting allow us to draw conclusions on relationships between variables and the field studies provide a further insight in the generalizability of these results to a real-life safety setting. Two, I add variables to the basic assumptions of the EPPM derived from social psychological theoretical models (Theory of Planned Behavior (Ajzen, 1991); the Protective Action Decision Model (Lindell & Perry, 2012); the Framework for Risk Information Seeking (FRIS) (Ter Huurne, 2008)). I specifically focus on the effect of social norm on self-protective behavior, since recent research suggests that this factor might be particularly important for enacting self-protective behavior (e.g. Lindell & Perry, 2012; Verroen, Gutteling & de Vries, 2013). I furthermore focus on involvement and personal responsibility as additional predictors of self-protectiveness. This will provide insight in a wider range of predictors of actual self-protective behavior and will contribute to our knowledge of the factors predicting adequate risk behaviors in preparation for and during crisis situations. Three, I study the effect of different risk communication efforts on self-protectiveness. I argue that the effect of the delivery mode of risk information (instructional method (active vs. passive); the effect of risk message repetition) on self-protectiveness should be tested in both the short- and long-term in order to gain insight in the most optimal way to communicate with citizens about risks. After all, protective behaviors of citizens require consistency over time in order to behave adequately in times of crisis or disaster. Since research in different safety domains shows that both active forms of risk communication by means of a behavioral training and risk message repetition might positively influence citizens' attitude regarding safe behavior (Burke et al., 2011; Shi & Smith 2016), I will focus on the effect of these different delivery modes of risk information on self-protectiveness. These studies will help unravel which risk communication efforts are most effective in enhancing self-protective behavior of individuals. Four, I study actual behavior instead of intentions only. Until now, most studies on self-protective behaviors of at-risk populations focused on intentions instead of actual behavior, whereas research shows that the intention of someone to behave in a certain manner does not necessarily correspond with one's actual behavior (Ajzen & Cote, 2008). Studying intentions as well as actual behavior will provide more insight in citizens' behavior during real-life events. Five, I focus on various risk topics and populations, namely primary school children (age: 9 – 13) and adults. These variations allow us to study human behavior regarding safety risks in general and to generalize our results to a broad population.

## Risk topics and research population

The research collection presented in this thesis is outlined along the topic of safety risks in general. I focus on predicting human behavior regarding different safety risks. Therefore, the risk topics addressed in this thesis are risk topics that provide clear risk mitigating options citizens can undertake in order to increase their safety. I chose to study six different real-life risks that are applicable and relevant to citizens' real-life situations (table 1.1.). The criteria for the general risk topics in this thesis were twofold. First, risk perception research regarding the psychometric paradigm (e.g. Fischhoff, 1995; Slovic, 2000) assumes that risk perception includes both cognition as well as affect factors. Although up to 18 factors are identified that might influence the perception of risks (Fischhoff, 1995), the factors that are assumed to most strongly predict risk perception are the perceived novelty of a risk (new vs. old), the number of people exposed, the dreadfulness of risks and whether risks are man-made or natural (Slovic, 2000; Sjoberg, 2002). Based on these factors, I chose different risks as the topics of the research included in this thesis. I incorporated risks differing in newness, the number of people exposed to the risk, the dreadfulness of certain hazards and I incorporated both man-made risks as well as natural hazards, to be able to study behavior regarding a wide variety of risk types. Second, I based the risk-topic choice on relevant developments in the regions where I conducted the studies. In these studies, I focused on an at-risk audience with risks being crucial and vital to both governmental organizations, policy makers and laypeople. Based on these factors, I chose to study flood risks, fire safety, terrorism, external safety (transportation of dangerous chemical substances by train), emergency situations in general (such as extreme weather, the release of chemical substances, a nuclear accident or a power outage) and internet safety (focusing on the risks of sharing personal information online). Table 1.1 provides an overview of the risk types incorporated in this thesis.

**Table 1.1 Risk types incorporated in this thesis**

	Well-known	New	Man-made	Natural	Dreadful	Many people involved	Relevant
Flood risks	X			X	X	X	X
Fire safety	X		X	X	X	x	X
Terrorism		X	X		X	X	X
External safety risks		X	X		X	X	X
Emergency situations	X	X	X	X	X	x	x
Internet safety		X	X				X

X indicates that the factor applies to the risk type

x indicates that the factor might apply to the risk type

Most research on risk behaviors of citizens uses an adult population as respondents (Witte, 1992; Grothmann & Reusswig, 2006; de Wit et al., 2008; Ter Huurne & Gutteling, 2008; Terpstra, 2010; Lindell & Perry, 2012; Yang et al. 2014), raising generalizability questions for other populations in our society. In order to gain knowledge on self-protectiveness among a broader variety of individuals in our society, we deliberately chose adult populations as well as populations of primary school children (age: 9 – 13). Only few studies have included this specific population of children, while children are increasingly vulnerable to modern day risks (Schwebel & McClure 2010). Our choice to focus on a population of primary school children as an addition to an adult population is threefold. First, children are a vulnerable group in our society and an increasingly greater role for children is conferred as a social group to influence norms, values, policies and practice in society (Hill & Tisdall, 2014). This stresses the importance to communicate risks particularly with this group. Second, research shows that especially among children, knowledge and skills can be learned easily and transformed into action (Broström, Johansson, Sandberg, & Frøkjær, 2014). This gives support for the idea that communicating about risks and teaching individuals how to deal with unsafe situations is especially effective during childhood. Third, since the number of risks in our society rises and children become increasingly vulnerable to these modern day risks, the necessity of learning children how to cope with risks and threats - as an addition to basic skills such as reading, writing and arithmetic - becomes more evident (Livingstone, Haddon, Görzig, & Ólafsson, 2010; Schwebel & McClure, 2010).

### Theories on self-protective behavior

The Extended Parallel Process Model (EPPM) (Witte, 1992) is a message design theory in the social science fear appeal literature that provides a framework for effective communication of health related information (Malony, Lapinsky & Witte, 2011). The EPPM derives from models such as the Protection Motivation Theory (PMT) (Rogers, 1975). The PMT was originally proposed to provide conceptual clarity to the understanding of fear appeals. A later revision of the PMT extended the theory to a more general theory of persuasive communication, with an emphasis on the cognitive processes mediating behavioral change. Both the PMT and the EPPM posit that the perceived risk is a key element in predicting adequate behavior. Threat is defined as “A danger or harm that exists in the environment whether we know it or not” (Witte, Cameron, McKeon & Berkowitz, 1996; p. 320). According to both models, perceived threat motivates people into action. Moderate to high levels of risk perception are seen as necessary conditions for individuals to take action (Larsman et al., 2012). Furthermore, according to the PMT and the EPPM, both self-efficacy and response-efficacy are significant predictors of self-protectiveness. Following Bandura (Bandura, 1986), - self-efficacy can be defined as “people’s beliefs about their capabilities to exercise control over their own level of functioning and over events that affect their lives” – or the level of perceived feasibility. Response efficacy is defined as the belief that a specific response will help effectively diminish a certain risk (Bandura, 2004) – or the perceived usefulness of risk mitigating behavior. Research shows that, when citizens do not know whether they are capable of executing actions that may reduce their

vulnerability to risks (low level of self-efficacy), and they are uncertain that advised actions may be effective in mitigating the threat (low level of response-efficacy), they will not engage in risk mitigating behavior (Rimal & Real, 2003; Gore & Bracken, 2005).

According to Witte (1992) the combination of elevated levels of risk perception, self- and response-efficacy would motivate people to adopt self-protective measures. The more individuals believe they are susceptible to a serious threat, the more motivated they are to evaluate the efficacy of the recommended response. If the threat is perceived as irrelevant, then there is no motivation to further process the message, and people will simply ignore the message. In contrast, when a threat is believed to be serious and relevant, individuals may become motivated to take some sort of action to reduce the induced level of fear (Witte & Allen, 2000).

Over the last decade, some studies have contributed to our understanding why citizens do, or do not, engage in self-protective actions with regard to safety risks (Terpstra & Gutteling, 2008; Lindell & Perry, 2012). Recently, studies within the safety domain show evidence that similar elements as the elements incorporated in the PMT and EPPM predict safety behavior. One model aiming at predicting public responses to risk is the Protective Action Decision Model (PADM). The PADM is a multistage model that is based on findings from research on people's responses to environmental hazards and disasters (Lindell & Perry, 2012). This model predicts that cues in an individuals' day-to-day life (social cues, environmental cues and warning) initiate a series of pre-decisional processes that, in turn, elicit core perceptions of the environmental threat, alternative protective actions and relevant stakeholders. These perceptions provide the basis for protective action decision making (Lindell & Perry, 2012). This model thus shows that threat perceptions as well as protective action perceptions are predictors of self-protective behavior. Higher levels of self-protectiveness were seen among citizens who perceived a certain risk as risky and felt that protective actions were useful and feasible (Lindell & Perry, 2012).

Although the three theories on self-protectiveness do not focus on the same type of behavior and have some different focus-points, the core is the same: the models assume that individuals are most likely to undertake self-protective measures when they perceive a risk as threatening and evaluate risk mitigating options are both feasible (elevated levels of self-efficacy) and useful (elevated levels of response-efficacy) (Rogers, 1975; Witte, 1992; Lindell & Perry, 2012). These insights are useful to examine how individuals deal with risks and threats in their environment regarding different safety risks among different population. Taken these insights, I use the factors risk perception, self-efficacy and response-efficacy as key predictors of self-protective behavior throughout the work presented in this thesis.

### **The behavior: self-protectiveness**

The focus of the studies in this thesis is on measuring actual self-protective behavior of citizens regarding real-life safety risks as a dependent variable. Although in some research papers the term resilience is used (Windle, 1999; Tugade, Fredrickson & Feldman Barret, 2004; Youssef & Luthans, 2007), we chose to use the term self-protective behavior since it better stresses the

fact that we measure behavior as a dependent variable. To date research on self-protective behavior regarding safety risks generally focusses on intentions instead of actual behavior (e.g. Gore & Bracken, 2005; Grothmann & Reusswig, 2006; Terpstra & Gutteling, 2008; Terpstra, 2010). However, research demonstrates that the intention of someone to behave in a certain manner does not necessarily lead to actual behavior (Ajzen & Cote, 2008), stressing the need to study both intentions as well as actual behavior. This will provide more insight in the possible similarities and differences between people's intentions and their actual behavior and will increase our understanding of citizens' behavior during real-life situations. The emphasis of this thesis will be on studying the psychological elements that predict actual human behavior concerning various safety risks. In order to do so, our dependent variable self-protectiveness is measured in three different ways. Firstly, I study the intention of individuals to take risk mitigating options. Secondly, I measure actual risk mitigating behavior in real-life safety setting. Finally, I study risk information seeking as a specific form of self-protective behavior. Since active gathering by individuals of personally relevant risk information is increasingly considered important for adopting adequate risk related behavior (Griffin, Neuwirth & Dunwoody, 1999; Turner et al., 2006; Kahlor, 2007; Ter Huurne, 2008; Ter Huurne & Gutteling, 2009), I added this specific manifestation of self-protective behavior.

## This thesis

In seven empirical studies reported in five empirical chapters (chapter 2 – 6), I examine the predictors of (actual) self-protective behavior of adults and children regarding different real-life safety risks. Please see Table 1.2. for an overview of the focus, methodological approach, and outcome variables per chapter.

The first **empirical study (reported in chapter 2)** is conducted to provide insight in the effect of risk perception and efficacy beliefs on self-protectiveness regarding flood risks. The effect of risk messages – differing in level of risk perception and perceived efficacy – on the intention of citizens prone to the risks of flooding to take risk mitigating options will be examined. Moreover, their information seeking behavior concerning flood risks will be studied. This research extends the scope of current risk communication research since it is a field study and provides new insight in the effect of risk perception and efficacy beliefs on self-protectiveness in the safety domain.

In the study reported in chapter 2 (n = 726) a quasi-experimental field study will be conducted among adults prone to flood risks, manipulating levels of perceived risk and efficacy beliefs in different risk messages. My co-authors and I first measure the intentions of respondents to take risk mitigating options regarding the risk of flooding after reading one of the four risk messages communicated. Next, we measure their information seeking behavior regarding flood risks. This allows us to study the effect of risk perception and efficacy beliefs on self-protective behaviors. The study makes use of a representative sample of adults prone to the risk of flooding.

**Table 1.2 Overview of the empirical chapters**

Chapter	Risk Topic	Predictors	Outcome variable(s)	Method
2	Flooding	<ul style="list-style-type: none"> <li>- Risk perception</li> <li>- Efficacy beliefs</li> </ul>	<ul style="list-style-type: none"> <li>- The adoption of risk mitigating options</li> <li>- The intention to seek relevant risk information</li> </ul>	Quasi-experimental field study among adults prone to flooding (N = 726) manipulating risk perception and efficacy beliefs.
3	<ul style="list-style-type: none"> <li>- Fire safety</li> <li>- Terrorism</li> </ul>	<ul style="list-style-type: none"> <li>- Risk perception</li> <li>- Response efficacy</li> <li>- Involvement</li> </ul>	<ul style="list-style-type: none"> <li>- The adoption of risk mitigating options</li> <li>- The intention to seek relevant risk information</li> <li>- Actual information seeking behavior</li> </ul>	Two controlled lab studies among undergraduate students from University of Twente with the first study manipulating risk perception and involvement (N=92) and the second study manipulating risk perception, response efficacy and involvement (N=168)
4	External safety	<ul style="list-style-type: none"> <li>- Efficacy beliefs</li> <li>- Personal responsibility</li> <li>- Instructional method</li> </ul>	<ul style="list-style-type: none"> <li>- Intentions to take risk mitigating actions</li> <li>- Actual levels of self-protective behavior</li> </ul>	Two field studies among adults prone to the risks of chemical substance transportation by train with a first behavioral training effectiveness study (N=47) and a second questionnaire study (N=614)
5	<ul style="list-style-type: none"> <li>- Fire safety</li> <li>- Emergency situations</li> </ul>	<ul style="list-style-type: none"> <li>- Social norm</li> <li>- Efficacy beliefs</li> <li>- Instructional method</li> </ul>	The intention to take risk mitigating option	Field study (Risk Factory) among children (age: 9 - 13) (N=365) manipulating the delivery mode used.
6	<ul style="list-style-type: none"> <li>- Internet safety</li> <li>- Emergency situations</li> </ul>	<ul style="list-style-type: none"> <li>- Instructional method</li> <li>- Risk message repetition</li> </ul>	<ul style="list-style-type: none"> <li>- The intentions to take risk mitigating actions</li> <li>- Actual levels of self-protective behavior</li> </ul>	Longitudinal field study (Risk Factory) among children (age 9 - 13) consisting of a pilot study (N=365) and a main study (N=265) manipulating the delivery mode.



In the **second and third empirical study (reported in chapter 3)** I focus on the effect of risk information seeking on risk behavior. Although a growing body of risk communication research focuses on how people process risk information, one question often overlooked is how the seeking of information contributes to behavioral adaptation toward the risk issue (Ter Huurne, 2008). I focus on studying how behavioral responses to risks are affected by the search for risk information. In the first study of chapter 3, my co-authors and I set out to test, in a laboratory experiment (n = 92), several of the basic assumptions of the Framework for Risk Information Seeking (Ter Huurne, 2008). The objective of this study is to show that personal involvement and risk perception can be used in an experimental setting to increase the intention for risk information seeking. In the second study of chapter 3 (n = 168), in a controlled lab setting, my-co-authors and I tested the effect of risk perception, involvement and efficacy on self-protectiveness and more closely looked into the relationship between risk information seeking and the intention to take other preventive or risk-mitigating behaviors. I argue that studying the relationship between information seeking behavior and (predictors of) risk mitigating behavior is crucial in order to optimally stimulate self-protectiveness. With the Internet being one of the main sources of information regarding safety risks (Redmond & Griffith, 2006; Jacob, Mathiasen & Powell, 2010), the relationship between risk information seeking and (the predictors of) risk behavior becomes more evident. A student sample is used to study these relationships.

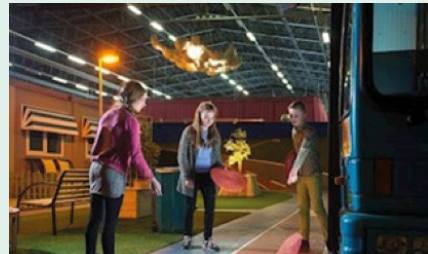
In the **fourth and fifth empirical study (reported in chapter 4)** I focus on the way in which risk communication efforts are most effective in enhancing self-protectiveness of individuals. I propose that the psychological elements underlying people's judgment whether to take self-protective behaviors can be influenced by the way in which risk communication is provided – the so called delivery mode. In most studies on self-protective behavior, the results are based on responses of respondents after receiving mere information only (e.g. Terpstra & Gutteling, 2008; Lindell & Perry, 2012). However, previous research in different safety domains shows that self-protective behavior can be more effectively trained through highly engaging measures such as behavioral trainings (Burke et al., 2011). Not only will the level of procedural knowledge – the “knowing how” – increase making the behavior a routine activity, a behavioral training might also increase levels of perceived feasibility and usefulness of risk mitigating behavior (Tulving, 1983; Sitzman, 2011). Therefore, I will focus on studying the effect of different delivery modes (active and passive risk communication) on (predictors of) self-protective behavior.

The first study of chapter 4 consists of a behavioral-training-effectiveness study (n = 47), exploring whether a behavioral training (an active form of risk communication) increases participants' efficacy beliefs and self-protectiveness. This study makes use of a convenience sample. In the second study of chapter 4, my co-authors and I test if the delivery mode used when communication about risks (behavioral training vs. information only vs. no information) is a predictor of efficacy beliefs and self-protectiveness. Furthermore, personal responsibility is added as a predictor of self-protective behavior. In the second study of chapter 4 a random sample of the population of Borne (n = 614) will be used. In both studies the transportation of dangerous chemical substance by train will be used as risk topic. Borne (a small town

in the Eastern part of the Netherlands with approximately 22.000 inhabitants [CBS, 2015]) will be used as an area for experimentation. Trains transporting highly dangerous chemical substances ride through the center of this village daily, making it a high risk area.

**The sixth empirical study (reported in chapter 5)** adds to current research on self-protectiveness by focusing on social norm as an additional predictor of self-protectiveness. Although the concept of social norm is a well-known predictor of behavior in social psychological theoretical models such as the Theory of Planned Behavior (Ajzen, 1991), it has not been studied intensively within the safety domain. I argue that, during a crisis or disaster, the social context is of the utmost importance. In times of crisis, citizens may have a variety of sources available to help them cope with the crisis (Verroen, Gutteling & de Vries, 2013). According to Verroen, Gutteling and de Vries (2013), people's behavior in preparing for a crisis as well as their behavior during a crisis is partly predicted by their perceived social norm regarding safe behavior. I propose that social norm, together with perceived feasibility (self-efficacy) and the expected usefulness (response-efficacy) of risk-mitigating options, might predict self-protectiveness. In the study of chapter five - and in line with Verroen, Gutteling and de Vries (2013) - I define social norm as people's judgment of the perception of significant others towards the risk at hand and possible risk mitigating options. My co-authors and I will study the influence of social norm, over and above the effect of self- and response-efficacy, on self-protectiveness. Furthermore, in the study reported in chapter 5, the perspective is taken that a behavioral training (active risk communication) in which peer interaction is stimulated, leads to a more positive social norm and subsequently higher levels of self-protective behavior than passive risk communication. This study will be conducted in the Risk Factory (see fig 1.) - a state-of-the-art education-center in which children (age: 9 - 13) experience real-life risks first hand and learn how to deal with dangerous situations. A sample of children from 14 primary schools (n = 365) randomly assigned to one of three conditions (behavioral training vs. passive information vs. no information) will be used.

## Fig 1. Information about the Risk Factory



The Risk Factory is a state-of-the-art education center in Twente (a region in the eastern part of the Netherlands). In the Risk Factory, children (age 9 - 13) experience real-life risks first hand and learn how to deal with dangerous situations by practicing adequate risk behaviors. This is done in small groups of peers in which peer interaction is actively stimulated (brandweer Twente, 2017).

In the **seventh empirical study (reported in chapter 6)** the effect of risk message repetition on self-protectiveness in the short- and long-term is examined more closely. I assume that risk message repetition increases the level of self-protective behavior to a larger extent than providing only one single risk message or than providing no risk message at all. I chose a behavioral training (active risk-communication) as the delivery mode since research indicates that this form is more effective in increasing self-protectiveness than standard-passive techniques of risk communication. The current paper adds to the literature on self-protectiveness by testing the added value of repetitive risk messages on (predictors of) actual self-protective behavior in both the short- and long-term. While a large amount of literature in advertising and persuasion try to explain the influence of message repetition on attitudes and behavior (Zajonc, 1968; Berlyne, 1970; Cacioppo & Petty 1989), within the risk communication literature the effect of message repetition on self-protectiveness has not been studied intensively (Witte 1992, 1994; Shi & Smith 2016). The study reported in chapter 6 provides crucial additional information on the effect of message repetition in a real-life safety setting, answering the question: does message repetition increase the actual self-protective behavior of individuals in both the short- and long-term?

My co-authors and I will – again – conduct our study in the Risk Factory. The added predictive value of repeating risk messages over and above the effect of a behavioral training (behavioral training repetition vs. behavioral training vs. no information) will be tested on self-protectiveness directly following and 3 months after the interventions. Intentions to take risk mitigating options as well as actual risk mitigating behavior of primary school children (n = 265) randomly assigned to one of three conditions (behavioral training repetition vs. behavioral training vs. no information) will be measured.

Together these findings provide insight in the variables that predict the self-protectiveness of citizens with regard to real-life safety risks and under which conditions risk communication is most effective in enhancing self-protective behavior.

## CHAPTER 2

### YES WE CAN:

**MOTIVATE DUTCH CITIZENS TO ENGAGE IN SELF-PROTECTIVE  
BEHAVIOR WITH REGARD TO FLOOD RISKS.**

*This chapter is based on: Kievik, M. & Gutteling, J.M. (2011). Yes we can: motivate Dutch citizens to engage in self-protective behavior with regard to flood risks. *Natural hazards*, 59, 1475 – 1490.*

Floods pose a common threat to many heavily populated coastal areas around the world (Maaskant et al., 2009). The Netherlands is situated in a delta area, partly below sea level, bordered by the North Sea, with several major rivers flowing through the country. In terms of the severity of the consequences, floods can be seen as the most serious natural hazard of the country. Although many high-quality precautionary measures are being taken against flooding, and flooding actually is a low-probability risk, no certainty exists about whether flooding may occur in the future when climatic conditions change (Ministry of Transport, Public Works and Water Management, 2006). Influenced by European rules and regulations and with the catastrophic events in New Orleans after the hurricane Katrina as a warning sign, the Dutch government is re-inventing its role in preventing and mitigating calamities, like disastrous flooding. In this process, the notions about the role and responsibilities of individual citizens in taking risk-preparation activities also change. The government is aware that it cannot give the Dutch citizen a 100% calamity protection guarantee. The protection of the public is best served by encouraging additional self-protective measures and resilience (de Wit et al., 2008). Citizens are expected to proactively prepare themselves for flood risks to increase their personal safety (Grothmann & Reusswig, 2006). These prevention actions undertaken by residents may also reduce economic damages of floods considerably (Fink et al., 1996).

To motivate citizens to adopt preventive behaviors, different governmental campaigns have been established in the Netherlands, like the 'denk vooruit' (think ahead) campaign ([www.crisis.nl](http://www.crisis.nl)). Information regarding those risks can be reached via municipal and provincial Web sites and can easily be linked to the own residence by entering a postal code. The question is whether this campaign sufficiently motivates people to prepare for the risk of flooding. Several studies have shown that relatively few people inform themselves by visiting the 'think ahead' Web site, only few people indicate to take self-protective measures with regard to flooding, and the risk perception with regard to flooding in the Netherlands is generally low (Terpstra, 2010; Gutteling et al., 2010). The lack of motivation to prepare for floods is not only observed in the Netherlands. But research in other European countries like Germany, Norway, Sweden, and the UK indicates that over 80% of all respondents had not undertaken activities to mitigate future losses or to prepare for flood emergencies (Krasovskaia, 2005). Additional research in different regions in the Netherlands by Terpstra and Gutteling (2008) has pointed out that very few citizens engage in self-protective behaviors with regard to flood risks. They do not take precautionary actions, nor do they show signs of adaptive behaviors with regard to flood risks. These results seem surprising as floods do pose a serious threat to the Dutch population, and the government does strive to promote self-protective actions through campaigns.




## Theory and hypothesis

The question in this study is how (flood risk) information can help to stimulate the adoption of self-protective behavior. In this paper, we take the position that the lack of adopting self-protective measures in the case of flood preparedness is due to at least two conditions. The first is that, as studies indicate, Dutch people do not seek flood risk information and without information seeking, there is no exposure. And without exposure, no effect is to be expected. So the determinants of risk information seeking with respect to flood risk are studied (Kahlor, 2007; Ter Huurne & Gutteling, 2008). This could fit well with the signaled policy change where individual citizens are asked to take more responsibility for flood risk preparation. This increased awareness of responsibility could become manifest in a more active risk information-seeking role of the citizen. This approach implies a focus on mass-mediated information. Given the urgency of the issue, and the size of the targeted Audience (10 million people), other risk communication approaches seem less obvious at the moment. The second condition is that existing flood risk information may not be effective in promoting self-protective behavior. There is no empirical evidence of the flood risk information's efficacy. And neither is the information based on risk communication theory or best practices. The research question here is how the determinants of individual risk information seeking can be applied to make the information more effective in stimulating the adoption of self-protective measures.

### Information seeking

The seeking of information has emerged as an important topic within risk communication over the past few years and can be described as a deliberate effort to acquire information in response to a need or gap in one's knowledge (Griffin et al., 1999; 2008; Case et al., 2005). Campaigns are often established under the assumption that all residents are susceptible to certain risks and threats faced by society and that they will more or less naturally seek for the provided information on the different risk topics (Sjoberg, 2002). However, residents' information seeking is not as straightforward as it might seem. Individuals do not always seek relevant risk information or may even avoid information (Miller, 1987). This calls for an understanding of the factors that may influence the ways in which people respond to risk information and determine whether to attend to it or not.

The Framework for Risk Information Seeking (FRIS) (Ter Huurne, 2008; Kievik et al., 2009) focuses explicitly on the determinants of individual information seeking with respect to risk and safety. It proposes that three awareness factors may account for the perceived need for additional information in a risk setting. These factors are the perceived level of risk ('is there a threat?'), personal involvement ('is the threat relevant to me?'), and self-efficacy ('am I able to deal with the threat?'). Perceived risk is seen here as the perception of the risk related to the event "flooding". Personal involvement, sometimes labeled as personal risk, relates to the probability that a flood will have severe personal consequences (death, injury, property damage, or social disruption) (see e.g., Lindell & Perry, 2000). Self-efficacy has been



defined in several ways, but here we follow Bandura's (1997) definition that states that it refers to one's belief that one is able to execute a specific task successfully. In this case, this might refer to successfully deal with the threat of a flood by seeking information that will help to take adequate self-protective measures. Furthermore, FRIS states that, when risk and efficacy beliefs are made salient, risk perception and efficacy beliefs jointly affect subsequent action. Thus, the level of perceived risk and efficacy may be crucial factors in facilitating the information-seeking process. As the level of both these factors seem to be low among citizens with regard to flood risks (e.g., Terpstra & Gutteling, 2008; Grothmann & Reusswig, 2006), FRIS would predict a low level of information seeking among citizens, creating unfavorable conditions for effective risk communication.

### **The intention to take risk mitigating or preventive actions**

Research contributed to our understanding why Dutch citizens do not engage in flood risk self-protective actions (e.g., Terpstra & Gutteling, 2008). Firstly, the level of risk perception that citizens experience with regard to flood risks is low. As moderate to high levels of risk perception are seen as necessary conditions for individuals to take action, this might be one explanation for the lack of motivation to take precautionary measures among residents (Miceli et al., 2007). Secondly, citizens of areas prone to flooding seem to have low levels of both self-efficacy ('am I able to deal with the threat?') and response efficacy ('is the advice that I get to deal with the threat useful in the sense that it will successfully help me to cope with the threat?'). That is, citizens do not know whether they are capable of executing actions that may reduce their vulnerability to flood risks (low level of self- efficacy), and they are uncertain that advised actions may be effective in mitigating the threat (low level of response efficacy) (Grothmann & Reusswig, 2006). Research indicates, however, that for an individual to take precautionary measures, certain levels of self- efficacy and response efficacy are required (Rimal & Real, 2003). The combination of elevated levels of risk perception, self-efficacy, and response efficacy would motivate people to adopt self-protective measures (Witte, 1992; Smith et al., 2007).

One way to increase risk perception would be the use of fear appeal messages (Witte & Allen, 2000; Kievik et al., 2009). The evaluation of a fear appeal initiates two appraisals of the message, which result in one of three outcomes (Witte, 1992). First, individuals appraise the threat of an issue from a message. The more individuals believe they are susceptible to a serious threat, the more motivated they are to evaluate the efficacy of the recommended response. If the threat is perceived as irrelevant or insignificant, then there is no motivation to further process the message, and people will simply ignore the fear appeal. In contrast, when a threat is believed to be serious and relevant, individuals may become motivated to take some sort of action to reduce the induced level of fear (Witte & Allen, 2000).

Perceived efficacy (composed of self-efficacy and response efficacy) determines whether people will become motivated to control the danger or control their fear about the threat. When people believe they are able to perform an effective recommended response against the threat (i.e., the advice is perceived as high with regard to self-efficacy [I can deal with

the threat'] and response efficacy ['the advice I get how to deal with the threat is useful'], they are motivated to control the danger and consciously think about ways to remove or lessen the threat. Under these conditions, people carefully think about the recommended responses advocated in the persuasive message and adopt those as a means to control the danger. Alternatively, when people are uncertain about the effectiveness of recommended actions (i.e., the advice is perceived as low on self-efficacy and/or response efficacy), they are motivated to control their fear through denial, defensive avoidance, or reactance (Witte & Allen, 2000).

Thus, the risk communication literature suggests that perceived threat contributes to the extent of a response to a fear appeal, whereas perceived efficacy (or lack thereof) contributes to the adaptive or maladaptive nature of the response. That is whether people will take adequate risk-mitigating actions or not. If no information with regard to the efficacy of the recommended response is provided, individuals will rely on past experiences and prior beliefs to determine perceived efficacy (Zaalberg et al., 2009). It thus seems that, for residents to engage in self-protective behaviors, two demands must be met. First of all, the level of aroused fear must be high. According to Witte and Allen's (2000) Extended Parallel Processing model, the stronger the fear appeal, the greater the fear aroused, the greater the severity of the threat perceived, and the greater the susceptibility (personal risk) to the threat perceived. In this study, we assume that the stronger levels of fear appeal will lead to higher levels of perceived risk and personal involvement. Secondly, the level of perceived efficacy should be high as well. Not only is the 'fear message' of importance but also the (self and response) efficacy message that is attached to the fear appeal. When both self and response efficacy are strong, that is, when people are convinced, they can perform the behavior and the behavior is seen as successful in the mitigation of the risk, engaging in self-protective behavior will probably be the result. Furthermore, when both levels of perceived risk and (self and response) efficacy are high, individuals will seek for relevant information and take precautionary measures to protect themselves against risks like flooding.

## Hypotheses

The aim of the current study is to determine the effect of levels of risk perception and efficacy beliefs on the actual information seeking and the risk information-seeking intention and the intention to take self-protective behaviors for flooding risk. With regard to the information seeking, the following hypotheses are formulated.

**H1a:** High levels of risk perception lead to higher levels of both the actual information seeking and the intention to seek information than low levels of risk perception.

**H1b:** High level of efficacy beliefs leads to higher levels of both the actual information seeking and the intention to seek information than low levels of efficacy beliefs.

With regard to the intention to take precautionary action, two hypotheses have also been established.

**H2a:** High levels of risk perception lead to higher levels of intention to take risk mitigating of preventive behaviors than low levels of risk perception.

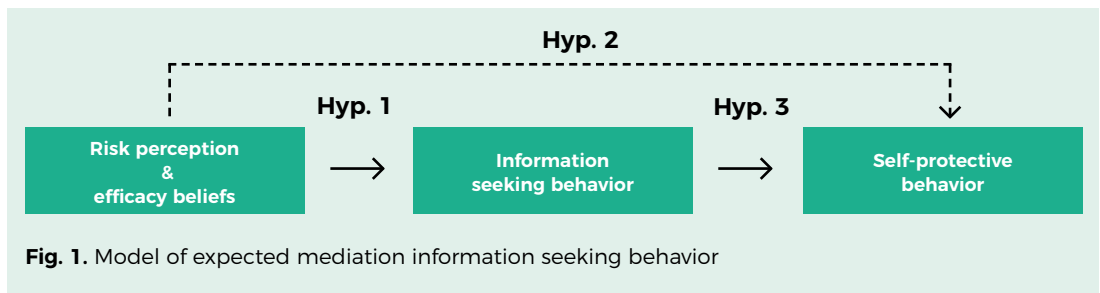


**H2b:** High levels of efficacy beliefs lead to higher levels of intention to take risk mitigating of preventive behaviors than low levels of efficacy beliefs.

Furthermore, we aimed to understand how the seeking of information contributes to the adoption of risk mitigating and preventive behaviors. Since the assumption is that the same factors that predict the information-seeking process derived from FRIS (risk perception and efficacy beliefs) underlie the intention of citizens to engage in protective actions, we predict that information seeking predicts the intention to adopt self-protective measures.

**H3:** A high level of both actual information seeking and the intention to seek information leads to higher levels of intention to take risk mitigating of preventive behaviors than low levels of information seeking.

Finally, we wanted to test whether actual information seeking is a mediator (see Baron and Kenny, 1986 p. 1176) between the independent variables risk perception and efficacy beliefs, and the dependent variable intention to take risk-mitigating or self-protective behavior (Fig. 1).



**Fig. 1.** Model of expected mediation information seeking behavior

Since the aim of governmental campaigns is to enhance the self-protectiveness among citizens (Grothmann & Reusswig, 2006), and the assumption is that the seeking of information is an essential link between the risk campaign and individual risk information processing (Griffin et al., 1999), information seeking is assumed to mediate the relationship between the provided stimuli and behavior. Testing will make clear whether seeking of risk information indeed adds upon providing stimuli alone or not. Therefore, the final hypothesis that has been established is as follows:

**H4:** Information seeking acts as a mediator between the independent variables risk perception and efficacy beliefs, and the intention of respondents to take risk-mitigating or self-protective actions.

## Method

### Design and procedure

The study was a 2 (flood risk: high vs low) x 2 (efficacy: high vs low) between subjects experiment. Table 1 presents the main characteristics of the four conditions in the experiment. In September and October 2009, randomly chosen inhabitants of various low-lying parts of the Netherlands were invited by letter to participate in the study. Participants were randomly assigned to one of the four groups by sending each respondent randomly

one of four established invitation letters corresponding to one of the four conditions. These letters contained a Web site link, giving respondents access to the corresponding online questionnaire. After entering the questionnaire, participants were told that they participated in a study exploring the thoughts and feelings of citizens with regard to flood risks.

**Table 1** The four conditions in the experiment with corresponding manipulations of risk perception and perceived efficacy

Perceived efficacy	Risk perception	
	High	Low
High	<b>Condition 1:</b> High 'personal risk' message Fear appeal (picture) High self-efficacy message High response-efficacy message	<b>Condition 2:</b> Low 'personal risk' message No fear appeal (picture) High self-efficacy message High response-efficacy message
Low	<b>Condition 3:</b> High 'personal risk' message Fear appeal (picture) Low self-efficacy message Low response-efficacy message	<b>Condition 4:</b> Low 'personal risk' message No fear appeal (picture) Low self-efficacy message Low response-efficacy message

**Manipulation of flood risk.** Two successive manipulations were used. At first, after respondents entered the correct webpage, they were asked to answer a few personal questions. They were told that these questions served to see in which amount respondents were vulnerable to flood risks. After answering these questions, respondents were told that the computer processed the information and that they had to wait for a few seconds. At this point, the computer froze for 10 s, while the picture of a turning hourglass showed on the screen. Hereafter, respondents received the information about their personal risk of flooding in the future, based on their given answer. We employed a procedure similar two Rimal (2001) to manipulate risk perception and also efficacy as will be discussed later. Without actually calculating a score, randomly half of the participants received feedback that their personal risk in case of a flood was high, whereas the other half of the respondents were told that their personal risk in case of a flood was low, regardless of their answers to the personal questions.

Respondents in the high-risk group were given the following message:

*Based on the information you provided, the chance that a future flood will have negative consequences for you—"is in the top 10% of the population living in an area prone to flooding." This means that you are vulnerable when a flood will occur. While this assessment is not 100% accurate, it is highly reliable. Possibly you're not worried about the possibility of a flood in the future, but did you know that the chance of flooding in the Netherlands is fairly high!*

Respondents in the low-risk group were given the following message:

*Based on the information you provided, the chance that a future flood will have negative consequences for you—"is in the bottom 10% of the population living in an area prone to flooding." This means that you are not vulnerable when a flood will occur. While this assessment is not 100% accurate, it is highly reliable. Possibly, you didn't worry about the possibility of a flood in the future, and this is legitimate. The chance of flooding in the Netherlands is fairly small!*

Secondly, after respondents read this message, a fear appeal was used. After respondents had received their 'personal risk message', they were asked to read a newspaper article about flood risks in the Netherlands and the way in which citizens can prepare themselves for a possible flood in the future (this will be discussed in further detail below). This article was accompanied by a picture. Half of the participants received the newspaper article accompanied by a fear appeal picture, whereas the other half received the same article to which a more neutral picture was added ("Appendix").

**Manipulation of efficacy.** After respondents received feedback about their personal flood risk, they were asked to read a newspaper article about flood risks in the Netherlands, as already discussed earlier. This article discussed in detail the precaution measures the government takes against flooding and the way in which citizens can prepare themselves for a possible flood in the future. Two different newspaper articles were established. Half of the respondents read the article that was established on the current campaign against flood risks (the 'denk vooruit' campaign) and was supposed to create lower levels of both self-efficacy and response efficacy. The other half read an article was in principle the same as the first article, but several sentences were added to increase the perceived levels of self-efficacy and response efficacy. Basically, these sentences were variations on 'you can easily perform this' (aimed at boosting self-efficacy beliefs), and 'this behavior is successful in mitigating the threat' (boosting response efficacy).

## Participants

A total of 726 respondents between 18 and 85 years of age participated in the study. Responses were collected in two different waves. The first wave accounted for 160 participants and functioned as a pilot test to find support for the different manipulations. The second wave accounted for the other participants and took place 1 month later. Since no significant differences in dependent variable were found between both waves, results will be based on the total group of participants. Distribution of respondents among conditions varied between 156 and 238. Slightly more men (59%) than women (41%) participated in the study ( $\chi^2(1) = 24.00, p < .01$ ).

## Measures

After respondents finished reading the stimulus material, they were asked to fill in a questionnaire measuring the following variables. The questionnaire was based on a previously validated questionnaire (Ter Huurne, 2008). This questionnaire, unless otherwise stated,

measured responses on five-point Likert-type scales, with extremes strongly disagree (1) to strongly agree (5).

**Actual information seeking.** To measure the actual information seeking, respondents were asked, after reading the newspaper article, to choose between one of four Web site links with an informative name. Two of these links were relevant to the topic of flood risks, scoring 1 (the URL's refer to the existing Dutch Web sites [www.thinkahead.nl/emergencykit](http://www.thinkahead.nl/emergencykit) and [www.netherlandsliveswithwater.nl/preparation](http://www.netherlandsliveswithwater.nl/preparation)). The other two Web site links were irrelevant to the topic, scoring 0 (the URL's refer to [www.traveldestinations.nl/Maledives](http://www.traveldestinations.nl/Maledives) and [www.carweek.nl/Porsche911turbo](http://www.carweek.nl/Porsche911turbo)). Respondents choosing the Web site links with the topic of flood risks showed adaptive actual information seeking, whereas respondents choosing one of the other Web site links did not (they showed maladaptive information seeking).

**Intention to seek information.** Furthermore, levels of intention to seek relevant risk information were measured using a 3-item scale. Respondents were asked to indicate how likely they were to seek information in the future and to keep track of relevant risk information. The Cronbach's alpha for the scale was .89, indicating that the inter-item correlations were consistently positive and high. This alpha  $>.70$  allowed us to aggregate the 3 items into one new variable 'intention to seek information'.

**Intention to take precautionary measures.** The motivation of respondents to take preventive actions was measured using an 8-item scale. Respondents were asked how likely they were to take preparation and precautionary measures and adhere to given instructions. This scale was very reliable (Cronbach's alpha = .94). Consequently, the 8 items were aggregated to a new variable 'Intention to take precautionary measures'.

**Risk perception.** Risk perception was measured using a 17-item scale. Respondents were asked to indicate how severe and dangerous flood risks are, how high the chance is that a flood will occur in the Netherlands in the future, and how much damage a flood risk will cause for citizens living in the affected area. Also, they had to indicate how risky they felt flood risks are for them personally and how likely they felt it would be that a future flood would cause problems for them personally. Also, this scale yielded very reliable results (Cronbach's alpha = .94), and items were aggregated to the variable 'risk perception'.

**Self-efficacy.** Level of self-efficacy was measured using a very reliable nine-item scale (Cronbach's alpha = .96). Respondents were asked to indicate to what extent they thought they could prepare themselves for the possibility of a flood risk in the future.

**Response-efficacy.** Response efficacy was measured using a very reliable ten-item scale (Cronbach's alpha = .95), measuring the extent to which respondents thought that different preparation and precautionary measures were effective in protecting oneself from negative consequences of a possible flood in the future.

**Efficacy scale.** The analysis with regard to efficacy beliefs will be conducted based on the combination of levels of self-efficacy and response efficacy. The combined nineteen-item scale of both variables also showed to be highly reliable (Cronbach's alpha = .97), and items were aggregated to a new variable 'efficacy beliefs'.

## Results

### Descriptive statistics

Analysis of variances indicated no differences between the four conditions in either gender ( $F(3,722) = 1.34, p = .26$ ) or age ( $F(3,722) = 0.53, p = .66$ ). The manipulation check revealed with a similar analysis significant main effects for risk perception, self-efficacy, and response efficacy, all in the predicted directions, that is, risk perception ( $F(1,722) = 97.69, p < .01, \eta^2 = .27$ ); self-efficacy ( $F(1,722) = 51.50, p < .01, \eta^2 = .17$ ); and response efficacy ( $F(1,722) = 45.08, p < .01, \eta^2 = .16$ ). This indicates that the conditions differed on these variables as intended. Furthermore, no strong correlations between level of risk perception and self-efficacy ( $r = .15$ ) or between risk perception and response efficacy ( $r = .15$ ) were found.

**Table 2** Correlations between independent and dependent variables with corresponding mean scores and standard deviations.

	1	2	3	4	5	6	7
1. Flood risk (manipulation)							
2. Efficacy beliefs (manipulation)	.09*						
3. Risk perception (measured)	.52*	.10*					
4. Efficacy beliefs (measured)	.08	.43**	.15**				
5. Actual information seeking	.25**	.22**	.18**	.11**			
6. Intended information seeking	.22**	.30**	.46**	.54**	.50**		
7. Intended precautionary measures	.21**	.38**	.44**	.71**	.11**	.78**	
Mean	.54	.57	3.14	3.56	.82	2.91	3.40
Standard deviation	.50	.50	.86	1.01	.38	1.03	.99

\* Correlation significant at the .05 level (2-tailed)

\*\* Correlation significant at the .01 level (2-tailed)

indicating that the manipulations were relatively independent and only enhanced the targeted variable, without increasing the levels of the other variables. Therefore, we can conclude that the manipulations were successful. A positive and highly significant correlation was found between self-efficacy and response efficacy ( $r = .84$ ). This supported our goal to measure the effect of level of combined efficacy, and consequently, we combined the two factors for further analyses.

Table 2 presents the correlations of the dependent and independent variables with corresponding mean scores and standard deviations. Table 3 presents the mean scores for the separate conditions for all dependent variables.

**Table 3** The four conditions in this experiment with corresponding mean scores for all dependent variables.

	Actual information seeking	Intended information seeking	Intention to take prec. measures
Condition 1 N = 238			
High-level risk perception	.96**	3.40**	3.86**
High-level efficacy			
Condition 2 N = 178			
Low-level risk perception	.78	2.90	3.51
High-level efficacy			
Condition 3 N = 158			
High-level risk perception	.86	2.74	3.20
Low-level efficacy			
Condition 4 N = 156			
Low-level risk perception	.62#	2.35#	2.78#
Low-level efficacy			

\*\* Score is significantly higher than other scores at the .01 level # Score is significantly lower than other scores at the .01 level (2-tailed) Scale information seeking: 1 = relevant, 0 = irrelevant. Other variables: 1 = strongly disagree to 5 = strongly agree

## Information seeking

Hypotheses 1a and 1b were tested using an ANOVA (analysis of variance). The effect of flood risk and efficacy beliefs manipulations on information seeking was measured. Significant main effects of flood risk ( $F(1,722) = 58.27, p < .01, \eta^2 = .08$ ) and efficacy beliefs ( $F(1,722) = 22.74, p < .01, \eta^2 = .04$ ) on actual information seeking were found. No interaction effect between the two variables existed ( $F(1,722) = 1.56, p = .22$ ). With regard to the intention to seek relevant risk information, again we found significant effects of flood risk ( $F(1,722) = 37.29, p < .01, \eta^2 = .06$ ) and efficacy beliefs ( $F(1,722) = 68.45, p < .01, \eta^2 = .11$ ). Again, no interaction effect was found ( $F(1,722) = .61, p = .43$ ).

Inspection of the mean scores in Table 3 learns that respondents in the high flood risk/high efficacy condition scored significantly higher on both actual information seeking ( $M = .96$  indicates that 96% of the subjects choose the adaptive Web site link) and intention to seek information ( $M = 3.40$ ) than the respondents in the other conditions. Furthermore, respondents in the low flood risk/low efficacy condition showed the least actual information seeking ( $M = .62$ , indicating that 62% of the subjects choose the adaptive Web site link, which is only slightly more than the 50% that would have been expected based on a random choice of the subjects) and intention to seek information ( $M = 2.35$ ). This is in accordance with our hypotheses.

Furthermore, we looked at the relationship between actual information seeking and the intention to seek information to make sure that the intention to seek relevant risk information indeed corresponds with the actual behavior of citizens. Correlations were significant ( $r = .50$ ) indicating that both concepts are related.

## Intention to take risk-mitigating or preventive actions

With regard to the intention to take risk-mitigating or preventive actions, hypotheses 2a and 2b were tested with an analysis of variance. Results indicated significant main effects of both flood risk ( $F(1,722) = 31.21, p < .01, \eta^2 = .05$ ) and efficacy beliefs ( $F(1,722) = 101.10, p < .01, \eta^2 = .13$ ) on the intention to take self-protective measures. No interaction effect was found ( $F(1,722) = .29, p = .59$ ). Inspection of the mean scores in Table 3 indicates that respondents in the high flood risk/high efficacy condition showed significantly the most intention to take preventive actions ( $M = 3.86$ ) compared with respondents in the other conditions, as expected. Respondents in the low flood risk/low efficacy condition showed a significantly lower intention to take preventive actions ( $M = 2.78$ ) than in the other conditions. These results support our second set of hypotheses.

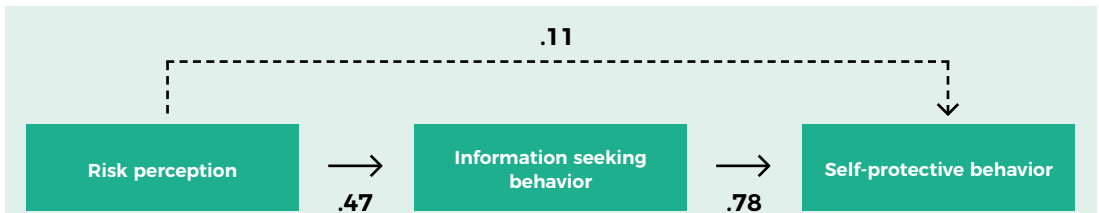
## Relationship information seeking and intention to take preventive actions

With regard to the relationship between information seeking and the intention to take risk mitigating and preventive behavior, hypothesis 3 was formulated. Results show that the level of intended information seeking and the intention to take risk-mitigating or preventive actions correlated strongly and positively ( $r = .78$ ). Furthermore, respondents showing actual information seeking by choosing the adaptive Web site link were significantly more willing

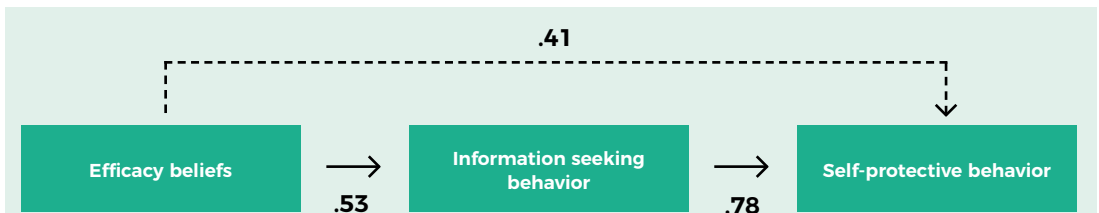
to engage in risk-mitigating or preventive behaviors than respondents showing no actual risk information seeking ( $F(1,722) = 68.87, p < .01, \eta^2 = .03$ ). These findings support the third hypothesis.

### Mediation effect information seeking

A mediation analysis tested the hypothesis that actual information seeking mediates the relationship between risk perception and efficacy beliefs on the one hand and the intention of respondents to engage in self-protective behavior on the other hand (cf. Baron & Kenny, 1986). The first regression analysis with the intention to take self protective behavior as dependent variable and risk perception as the predictor yielded a significant relation ( $b = .45, p < .01$ ). A second regression analysis, with the mediator (actual information seeking) as



**Fig. 2** Mediation model with independent variable risk perception showing beta's.



**Fig. 3** Mediation model with independent variable efficacy beliefs showing beta's.

the dependent variable and risk perception as the predictor, showed that risk perception influenced actual information seeking significantly ( $b = .47, p < .01$ ). Subsequently, following the procedure of Baron and Kenny (1986), a regression analysis with risk perception and actual information seeking as predictors and the intention to take self-protective behavior as the dependent revealed that the previously found relationship between risk perception and the intention to take self-protective behavior became less significant ( $b = .11, p < .05$ ), whereas the mediator showed a highly significant relation ( $b = .73, p < .01$ ), which indicated partial mediation of actual information seeking (Fig. 2). A Sobel test (Baron & Kenny, 1986) confirmed that actual information seeking mediates the relation between risk perception and the intention of respondents to engage in self-protection ( $Z = 11.25, p < .01$ ). For efficacy beliefs as independent variable, the same analyses were conducted. The first regression analysis, with the intention to take self-protective behavior as dependent variable and efficacy beliefs as the predictor, yielded a significant relation ( $b = .71, p < .01$ ). A second regression analysis,



with the mediator (actual information seeking) as the dependent variable and efficacy beliefs as the predictor, showed that efficacy beliefs influenced actual information seeking significantly ( $b = .53, p < .01$ ). The regression analysis with efficacy beliefs and actual information seeking as predictors and the intention to take self-protective behavior as the criterion revealed that the previously found relationship between efficacy beliefs and the intention to take self-protective behavior remained significant ( $b = .41, p < .01$ ), whereas the mediator showed a highly significant relation ( $b = .56, p < .01$ ), which indicated partial mediation of actual information seeking (Fig. 3). A Sobel test (Baron & Kenny, 1986) confirmed that actual information seeking mediates the relation between risk perception and the intention of respondents to engage in self-protection ( $Z = 16.09, p < .01$ ).

## Discussion

This study contributes to the small body of literature available on the effect of risk perception and efficacy beliefs in the domain of risk communication and more in particular flood risk communication. This area is getting attention only recently (see e.g., Grothmann & Reusswig, 2006; Zaalberg et al., 2009; Terpstra & Gutteling, 2008; Terpstra et al., 2009; Terpstra, 2010). In our perspective, this study has scientific as well as societal or practical importance. It recognizes the need to enhance levels of risk perception and efficacy beliefs as well as the stimulation of individual active information seeking to increase the intention of citizens to adopt self-protective behaviors. The experiment with participants that actually live in flood-prone areas in the Netherlands indicates that flood risk communication can be effective in stimulating both information seeking and self-protective behavioral intentions. Results show that higher levels of induced risk perception and efficacy beliefs result in significantly higher levels of both information seeking and the intention to engage in self-protective behavior than lower levels. This is novel because, as far as we know, this has not been reported with respect to (flood) risk communication. The societal importance is related to the scarcity of evidence that individual flood self-protective behavior can be stimulated with relatively simple risk communication tools, which is important in the context of future climate change and sea level rising.

We also observe that respondents engaging in the gathering of relevant risk information are more intended to take preventive measures than low seekers. Furthermore, the seeking of information turned out to be a partial mediator between the independent variables risk perception and efficacy, and the intention to engage in preventive actions, indicating that enhancing information seeking might have positive impacts on the intention to take preventive actions among citizens. This too is a novel result. The study thus supports research efforts in the domain of risk information seeking (e.g., Ter Huurne, 2008), with the stimulation of self-protective behaviors in the population as a secondary goal. Therefore, the focus of flood risk communication research should not only be improving risk message effectiveness but it should also focus on the determinants of public risk information seeking. To date, only few studies have been reported on this topic, and many risk communication efforts aimed at stimulating self-protective behavior do not involve information-seeking processes. Therefore, additional research is needed here.

Based on previous risk information-seeking studies (ter Huurne, 2008), one can assume that risk-awareness variables as risk perception ('is there a threat?'), personal involvement ('is the threat relevant to me?'), and self-efficacy ('am I able to deal with the threat?') are the triggers that can be used to stimulate the public's motivation to seek risk information. In this experiment, we looked at risk perception and efficacy, assuming that personal involvement would be high because all of our participants lived in flood-prone areas. However, additional research must provide a better understanding of the role of personal involvement in this type of risk communication. Of course, governmental and other organizations can stimulate seeking risk information by providing the information by a multitude of channels and, e.g., to have it available 24/7 as is possible on the Internet.

However, the results of this study must be viewed in light of some limitations that need to be addressed. First of all, actual information-seeking behavior was measured using only one item. This seems not ideal in that the results of only one item can result in drawing biased conclusions about the information-seeking behavior among respondents. Therefore, using more items to measure information-seeking behavior seems advisable. Also, since our measure allowed respondents to make a rather effortless or costless choice, immediately after being confronted with the possibility to choose, this raises the question whether this type of response is representative of information-seeking processes outside an experimental reality. Additional research is needed here. Finally, taking preventive actions was measured by asking respondents about their intention to adopt recommendations. As the intention a person has to adopt certain behaviors does not always correspond to their actual behavior, this may give a slightly biased view of the preventive actions taken among respondents.

## Conclusion

The results provide valuable implications for future risk communication efforts with respect to flood preparedness of the Dutch public and may have similar implications for other risk communication directed at preparative actions. First, to motivate the general public to engage in self-protective behavior, a certain level of risk awareness (or threat) is necessary in the communication effort to motivate receivers to actively engage in information seeking and to adopt self-protective recommendations. Furthermore, the results of this study suggest that risk messages aimed at promoting self-protective actions are effective under the conditions that the advised actions are perceived by the public as high on self-efficacy (Yes, you can do it) and high on response efficacy (Yes, it works). The preparation of such public service messages aimed at (flood) risk communication is thus of the utmost importance. The designers of these messages no longer can suffice to take their own perception of message effectiveness as the sole guideline. No, messages should be carefully crafted and designed along the lines of behavioral actions that are seen as efficacious by large numbers of people. Pretesting these message seems a must here, but most likely, the effort spend here will pay off at the end of the day.

# Appendix

## Pictures manipulation

**Fear appeal:**



**No fear appeal:**



# CHAPTER 3

## THE ACTION SUITED TO THE WORD?

USE OF THE FRAMEWORK OF RISK INFORMATION SEEKING TO  
UNDERSTAND RISK-RELATED BEHAVIORS.

*This chapter is based on: Kievik, M., ter Huurne, E.F.J. & Gutteling, J.M. (2012). The action suited to the word? Use of the framework of risk information seeking to understand risk-related behaviors. Journal of risk research, 15, 131 - 147.*

Information seeking has emerged as an important topic in risk communication over the past few years. The active gathering by individuals of personally relevant risk information is increasingly considered an important mediator between risk communication and subsequent risk-related knowledge and behavior (Griffin, Neuwirth & Dunwoody, 1999; Turner et al., 2006; Kahlor, 2007; Ter Huurne, 2008; Ter Huurne & Gutteling, 2009; Ter Huurne, Griffin & Gutteling, 2009; Kievik & Gutteling, in press). In this paper, we present two experimental studies that focus on the determinants of man-made risk communication, in the context of risk information seeking. The experiments aim to provide a better understanding of the role of risk perception, personal involvement, and response efficacy in risk communication.

Experimental research regarding man-made risk is scarce. However, the experimental research methodology is seen as important to increase our knowledge of the factors that influence risk communication effectiveness (see, e.g. Gutteling & Wiegman, 1996; Gurabardhi, Gutteling & Kuttuschreuter, 2004 advocating this issue). Recently, several experimental studies have been published that focus on health risk decision-making (e.g. Cuite et al., 2008; Timmermans, Ockhuysen-Vermeij & Henneman, 2008; Keller & Siegrist, 2009; Keller, Siegrist & Visschers, 2009). Medical or health risk communication has a long tradition in empirical and conceptual work (e.g. Rogers, 1983; Witte, 1992, 1998; Witte & Allen, 2000; Cho & Witte, 2005). This work tends to focus on the determinants of persuasion of the at-health risk audiences in laboratory setting experimental studies, stimulating the adoption of adaptive health behavior. Experimental designs in risk communication studies allow for the analysis of causal relations between predictors and behavior. In that sense experimental studies are essential in the furthering of our insight in the determinants of behavior from correlational analyses. The assumption in this study is that the theoretical concepts of health risk communication and its research methodology are applicable in preparing risk communication aimed at helping individuals to adopt self-protective behaviors with respect to man-made risks. However, to the growing body of experimental studies in (health) risk communication, there is no equivalent body of work aimed at behavioral change related to man-made risk.

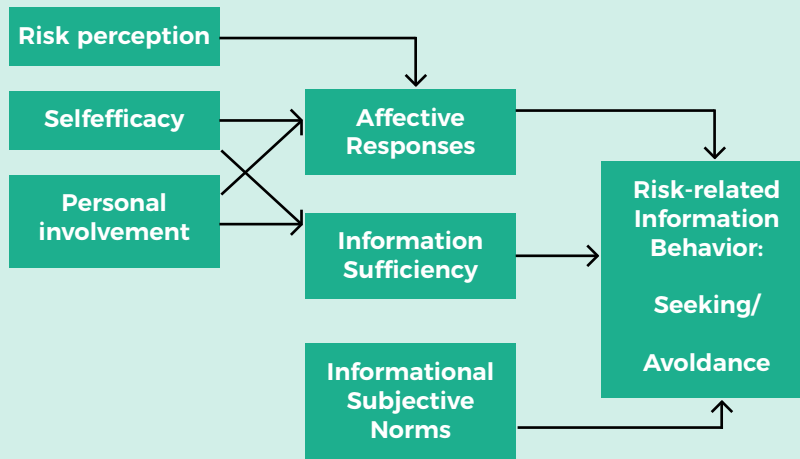
Risk communication on man-made risks shares another question with medical or health risk communication. Although risk messages may prove to be effective in the research laboratory, they tend to be less effective in the public domain. Here, (health or man-made) risk information has to compete with myriad other issues and messages that call for the individual's attention. When the content of the risk message or the issue it addresses is not perceived by the individual as personally relevant or risky, the message may not be processed and recommendations will not be adopted. In this respect, it is understandable that successful 'lab-tested' messages are not always equally successful in reaching and persuading the real-world target audiences. Ultimately, persuasiveness in the public domain is not as impressive as one would have expected from the lab tests, and the preventive behavior is not adopted by many people.

Theories on risk information seeking may be better at addressing this issue and may be considered as the missing link between theory and lab research on the one hand and risk communication practice on the other hand. Risk information seeking theories focus on the

risk information recipient's central position in the risk communication process. They call for an understanding of the factors that may influence the ways in which people respond to risk information and how these responses ultimately affect individuals' behavioral adaptations in the face of a specific risk. In this respect, risk information seeking is particularly noteworthy because information acquisition is an important risk coping strategy (Brashers, Goldsmith & Hsteh, 2002). Individuals may believe that if they are armed with sufficient information about a risk topic, they will be better able to make adequate decisions and implement required behavioral changes (Rimal, 2001; 2008). The general public's growing interest in participating more actively in self-care decisions regarding a variety of everyday risks, combined with the rapid growth of publicly available information and heightened public information demands, underlines the importance of theoretical and empirical focus on how individuals interact with information as they form and modify perceptions of risk (Turner et al., 2006; Kahlor, 2007; Griffin et al., 2008; Ter Huurne & Gutteling, 2008).

## The determinants of risk information seeking

A number of scholars have begun to explore determinants of the risk information seeking strategies people employ. Theoretically, the notion of risk information seeking is rather new. To get a better understanding of the social psychological determinants of risk information seeking processes, the Framework for Risk Information Seeking (FRIS) has been developed over the last few years (Ter Huurne, 2008; Ter Huurne & Gutteling, 2009). Through a stepwise procedure, the theoretical development of FRIS, the development and validation of measurement instruments, model testing, and interpretation based on survey data have been reported (Ter Huurne, 2008). FRIS focuses on the risk information recipient's central position in the risk communication process. Instead of just asking how messages may influence people, the current approach calls for a focus on understanding the information user's evaluative behaviors. Thus, FRIS identifies factors that may influence the ways in which people respond to risk information, and how these responses ultimately affect individuals' behavioral adaptations in the face of a specific risk. FRIS proposes that so-called risk awareness factors (risk perception, self-efficacy, and personal involvement) account for the perceived need for additional information in a risk setting (Ter Huurne 2008). These three factors play key roles in the process of risk information seeking, and given the assumption that risk information seeking precedes risk behavior adaptation or the adoption of risk preventive behaviors, they are also considered as essential for those behaviors. FRIS is theoretically founded on (social) psychological concepts; it is conceptually not confined to the boundaries of one specific risk domain (see Figure 1).



**Fig. 1** The Framework of Risk Information Seeking.

The three factors - risk perception, personal involvement, and self-efficacy - determine affective responses and information sufficiency. In combination with informational subjective norms, affective responses, and information sufficiency, they determine a person's seeking of additional risk information through various information channels or avoiding it altogether. FRIS suggests that, when risk and efficacy are made salient, risk perception and efficacy beliefs jointly affect subsequent action. Lack of perceived efficacy is frequently noted as a factor that increases risk perceptions. With high-risk perceptions, efficacy beliefs take on added importance because the heightened levels of risk not only act as motivational factors but also tend to generate anxiety (Witte, 1992). When individuals feel anxious or worried about their well-being as a result of increased risk perceptions, their perceived ability to exert personal control over the issue plays a critical role in how they behave (Witte, 1992). Self-efficacy has been found to be strongly associated with both affective responses and information sufficiency, which in turn, affect the risk information seeking strategies people employ. Given recent results (Ter Huurne & Gutteling, 2009), self-efficacy could be seen as a more important factor in how the audience construes risks, and successively, impacts public uptake of risk communication efforts. Since both affective responses and information sufficiency have been found to be key determinants of how people respond to information about risks (Griffin et al., 2008; Ter Huurne, Griffin & Gutteling, 2009), the influence of self-efficacy remains an important line of inquiry in this research area (McComas, 2006). In addition, the level of perceived issue involvement surfaced as an important factor associated with one's intended risk information seeking behavior. To date, the work on FRIS had been correlational and based on cross-sectional survey data (see Ter Huurne, 2008). So in this study, we set out to test, in a laboratory experiment, several of the basic assumptions of this model. We focused on the factors of risk perception and personal involvement.

The risk literature comprises many studies analyzing risk perception (see e.g. Slovic, 2000). Many of those studies focused on the cognitive and affective determinants of public coping with hazardous activities, situations, and technologies (see e.g. Gurabardhi, Gutteling &

Kuttschreuter, 2004; Pin & Gutteling, 2009 for overviews). The construct of involvement represented in FRIS refers to what Apsler and Sears (1968) termed personal or situational involvement and represents personal interest as a result of the idea that the risk issue or situation can have significant consequences to one's life (Andrews, Durvasula, & Akhter, 1990; Cho & Boster, 2005). In general, persons with high involvement analyze issues more often, prefer messages that contain more and better arguments (Petty & Cacioppo, 1986; Heath, Liao & Douglas, 1995), and attain greater knowledge levels (Chaffee & Roser, 1986; Engelberg, Flora & Nass, 1995). Involvement has been put forward as a key variable that will alter or affect the information utility one seeks to achieve by gathering additional information in a risk setting. When involvement is elicited by the perception that important future consequences are at stake, people are likely to pay attention to messages and to process them in-depth, as outcome-relevant involvement stimulates the motivation to process information and subsequent cognitive processing. Hence, outcome-relevant involvement is likely to be associated positively with information seeking, such as the motivation to stay informed about issues or products, the tendency to pay attention to mass media coverage of issues or products and the motivation to process this information. For example, research has demonstrated consistently that those who are highly involved seek information and engage in an extensive evaluation of information (e.g. Kapferer & Laurent, 1985; McQuarrie & Munson, 1992). They pay more attention to persuasive messages and engage in a greater level of elaboration (e.g. Celsi & Olson, 1988; Perse, 1990), and their information processing is more objective and less biased (e.g. Levin, Huneke & Jasper, 2000; Hubbell, Mitchell & Gee, 2001).

## Study 1

The objective of this study is to show that personal involvement and risk perception can be used in an experimental setting to increase the intention for risk information seeking, as assumed by FRIS. Because the supporting evidence for FRIS to date is based on cross-sectional survey data and extensive path-analysis/Structural Equation Modeling (SEM), this study was the first attempt to apply and test the framework in an experiment.

### Design

The study design was an online 2 (risk perception: high vs. low) x 2 (involvement: high vs. low) between-subjects experiment. Potential subjects were sent an email message containing a website link guiding them to an online questionnaire, which contained all of the experimental information and questions.

Participants (University of Twente students in the Netherlands) were randomly assigned to one of four groups. At the beginning of the experiment, subjects were asked to answer some questions about their demographic background. After this, the experiment started with the reading of a fictitious newspaper article about a fire. Half of the groups read articles detailing a fire in a faculty building at the University of Twente. These messages are assumed to create



a high level of involvement. An actual fire in a University of Twente building occurred in 2002. The article provided a photograph of this event to strengthen the realism of the message. The other two groups received an article describing a fire at a faculty building at Columbia University in New York, with which none of the participants had any connection. This article also contained a picture depicting the fire at Columbia. This was assumed to cause a low level of involvement.

Different amounts of arguments were used in this experiment to create different levels of risk perception (based on the work of Petty & Cacioppo, 1986). Half of the subjects received articles that provided many graphic descriptions of the fire, like the intensity of the fire and the possible consequences that the fire could have for citizens, intended to create high levels of risk perception. Examples are 'During the fire, an extreme amount of dangerous substances was released,' and 'Parts of the building contained asbestos, which was released during the fire. Asbestos may cause a serious threat to the health of people living in the neighborhood, like lung cancer.' The other subjects read articles that contained none of the above descriptions. These articles were supposed to create low levels of risk perception. In both articles, the source of the information was the head of the local fire department (presumed to be a reliable source). The assumption is that reading more health risk-related arguments will have more impact on risk perception than reading only a few arguments. Table 1 summarizes the manipulations.

**Table 1 Summary of manipulations in study 1.**

	Low involvement	High involvement
Low-risk perception	Colombia University	Twente University
	Few health arguments	Few health arguments
High-risk perception	Colombia University	Twente University
	Many health arguments	Many health arguments

### Participants

Ninety-two persons, aged 18–30 years, participated in the study. Significantly more females (63%) than males (37%) participated in the study ( $\chi^2(1) = 6.26, p < .05$ ). Participants were all undergraduate students from Twente University.

### Questionnaire

Risk perception was measured by a 14-item instrument with five-point Likert scales, indicating either disagreement (1) or agreement (5) with the statements about the severity of the risk. The first three questions measured risk perception in general. Respondents indicated how much risk they perceived was involved in a fire in general. The other 11 items measured risk perception in relation to the stimulus newspaper article. Respondents indicated how much risk they perceived was involved in the fire described in the article, how dangerous this situation was for people and the environment, and how

likely it was that a fire of this extent would occur. The risk perception items formed a very reliable scale ( $\alpha = .91$ ).

Involvement was measured using a four-item scale indicating either disagreement (1) or agreement (5) with statements about the levels of perceived involvement with regard to the risk topic. The scale was very reliable ( $\alpha = .88$ ). Respondents were asked how relevant a fire such as those presented was for them, how interested they were in knowing about such a fire, how committed they felt about the topic and how important it was for them to obtain information regarding the possible risks that could occur.

Intention to seek information was also measured within the questionnaire, using two items. The items asked respondents whether they would seek information about the fire and whether they would notice the information provided about the fire. Also these two items were measured using statements. Respondents were asked to indicate their level of disagreement (1) or agreement (5) with these two statements. These two items correlated strongly ( $r = .65$ ). Actual information seeking behavior was measured by asking respondents to choose between four different website links. Two links were relevant to the risk described in the previously read articles, for instance [www.dangerousubstances.nl](http://www.dangerousubstances.nl) fire. Choosing either of these links would indicate actual information seeking behavior (score: 1). The other two links were not risk relevant, for instance [www.studynet.nl/studychoice](http://www.studynet.nl/studychoice), and thus did not indicate risk information seeking behavior (score: 0).

## Results

There were no differences between the four conditions in age ( $F(3,90) = .52, p = .67$ ), gender ( $F(3,90) = 1.10, p = .35$ ), or education ( $\chi^2(3) = 2.26, p = .52$ ). The four different conditions were supposed to create different levels of involvement and risk perception. Using an ANOVA, a main effect of involvement was found ( $F(1,88) = 55.34, p < .01$ ) in the assumed direction (see Table 2), indicating that respondents in the high-involvement conditions showed higher levels of perceived involvement than respondents in the low involvement conditions. Using an ANOVA, we also found a main effect of risk perception ( $F(1,88) = 31.59, p < .01$ ), indicating that respondents in the high-risk perception conditions showed significantly higher levels of perceived risk than respondents in the opposite conditions. No interaction effect between risk perception and involvement was found. Table 2 summarizes the mean scores for the major variables in study 1 for each of the four conditions.

FRIS assumes that respondents with high levels of involvement should be more willing to seek relevant information than those with low levels of involvement. In study 1, we asked subjects to actually choose a link that enabled them to obtain further information about the risk, and we asked for their behavioral intention to seek additional risk information. The results support the FRIS assumption (Table 2). There is a main effect of involvement on actual information seeking behavior ( $F(1,88) = 20.51, p < .01$ ). In addition, we found a main effect of involvement on the intention to seek relevant risk information ( $F(1,88) = 16.00, p < .01$ ). Participants that scored high on involvement did choose a relevant link statistically significantly more often than did participants that scored low on involvement, and they also

**Table 2 Study 1: mean scores for personal involvement (PI), risk perception (RP), the intention to seek risk information (INS) and actual information seeking (AcT) in the four conditions.**

	Low involvement	Low involvement	High involvement	High involvement
Mean scores	Low-risk perception (n = 24)	High-risk perception (n = 22)	Low-risk perception (n = 23)	High-risk perception (n = 23)
PI	2.75	1.99	3.12	3.44
RP	2.75	3.35	2.82	3.51
INS	2.25	2.57	3.13	3.37
AcT	.58	.55	.83	.78

indicated that they had a higher intention to do so. The correlation between actual information seeking and the intention to seek information was  $.30$  ( $p < .01$ ). FRIS also assumes that high levels of risk perception (established in the articles containing the graphic descriptions of fires) would generate high levels of information seeking behavior. However, as shown in Table 2, no mean differences were found between the high or low-risk perception conditions ( $F(1,88) = .13$ ,  $p = .72$ ). In addition, no difference was found in the intention of participants to seek relevant risk information ( $F(1,88) = 1.73$ ,  $p = .19$ ). These results are not consistent with the FRIS assumption.

## Discussion of study 1 and implications for study 2

The results of the first study support the assumptions of the FRIS. Both the manipulations of personal involvement and risk perception were successful, and we succeeded in measuring both behavioral intention and actual information seeking behavior. Comparisons of the four experimental groups indicated that personal involvement is a good predictor of risk information seeking. It predicts both the intention to seek information and the actual risk information seeking behavior. Provided with the choice, approximately 80% of the individuals in the high personal involvement condition will take the opportunity to gather additional risk information. However, we did not succeed in finding significant impacts of risk perception on the intention to seek risk information or the actual risk information seeking. With respect to intention, the means of the low- and high-risk conditions differed in the predicted direction, and thus the absence of significant results herein might be due to insufficient sample sizes (a post hoc power analysis yielded an eta of  $.26$ , which supports our assumption regarding sample sizes). However, with regard to actual information seeking, no relation with risk perception could be found in this study. The question is, How can this be understood?

A possible explanation is that the manipulation of risk perception was not as powerful as the manipulation of personal involvement. The risk perception manipulation was inspired by the study of Petty and Cacioppo (1986), involving a varying number of risk arguments in the message. Although the manipulation in itself was successful, the overall level of risk perception was, even in the high-risk perception condition, only moderate. In order to improve the risk

perception manipulation, in the replication study (#2), we decided to change two important aspects. First, we decided to use an alternative risk – terrorism – which we presumed would lead to higher levels of risk perception. Following the terrorist attacks in New York, London, and Madrid, terrorism is seen as one of the most serious and unpredictable risks in society (Beck, 2002). Terrorism has a profound, multidimensional impact on society and has become a pivotal factor in the policies of governments around the world (Danieli, Brom & Sills, 2004). Terrorism therefore leads to profound feelings of unease for large groups of society (Schotzko, Richardson & Kiragu, 2006).

Second, we also applied an alternative way to manipulate risk perceptions, namely by using fear appeals. As discussed above, although the manipulation of risk perception seemed to be effective, levels of perceived risk in the high-risk perception condition seemed to be only moderate. Therefore, we also decided to use a different type of risk manipulation in order to increase perceived levels of risk. We assumed that changing both the subject of the experiment and the type of the manipulation would lead to higher levels of perceived risk among respondents.

Fear appeals are persuasive messages designed to scare or frighten people into complying with a particular message by describing the awful and terrible things that will happen to them if they do not act in accordance with the message (Witte, 1992). Fear itself can best be understood as a negatively valenced emotion, accompanied by a high level of arousal that is perceived to be both significant and personally relevant and that motivates people to action (Easterling & Leventhal, 1989). Although research remains inconclusive, and some research states that fear appeals do not always create higher levels of risk perception (Slater et al., 2002), other research provides proof for the assumption that fear appeals do indeed lead to higher levels of risk perception. According to Vincent and Dubinsky (2004), fear appeals create higher levels of risk perception among respondents than do messages that do not contain a fear appeal. In addition, according to a meta-analysis conducted by Witte and Allen (2000), the stronger the fear appeal, the greater the fear aroused, the greater the severity of the threat perceived, and the greater the susceptibility to the threat perceived. In study 2, we assumed that fear appeals will indeed increase the levels of risk perception.

Another explanation for the lack of coherence between actual risk information seeking and risk perception is that the persuasive messages in study 1 did not contain any content that would guide subjects on how to deal with the risk adequately. One might argue that messages that heighten the levels of risk perception without providing adequate advice about risk-mitigating solutions will not motivate the subjects to look further. They may expect to find no additional risk-mitigating information, given that the experimenter provided incomplete information to begin with. Considering this possible argumentation, we therefore decided to provide information to stimulate the subject's response efficacy in study 2. The factor of response efficacy seems to be important in information behavior (see e.g. Witte, 1992). Response efficacy can be described as the perceived effectiveness of the adaptive response in mitigation of the threat (Beirens et al., 2007). According to Griffin, Neuwirth, and Dunwoody (1999), whether or not a person will engage in information behavior depends upon their perceived information-

gathering capacity. Although this concept mainly includes self-efficacy beliefs, it also states that information behavior is only likely when a person perceives that information seeking will lead to desired outcomes, which can be thought of as response efficacy. That is, when a person feels that he or she will be able to cope with a certain threat, that person will be more likely to seek relevant information than a person who does not feel that he or she can perform the appropriate actions. This is one of the arguments for FRIS to assume that self-efficacy is a key element in enhancing information seeking behavior.

However, in addition, according to Noar et al. (2006), whether or not the internet was used as a tool for finding relevant information about safer sex practices is partially dependent on the response efficacy of the respondent. Thus, whether respondents will seek for more information about a certain risk or threat depends upon the perceived efficacy of the advice that is provided to cope with the risks. Following Noar et al's (2006) argument, we decided to study whether high levels of response efficacy enhance risk information seeking.

## Study 2

### Research questions

The aim of study 2 is three-fold. First, we tried to replicate study 1, by manipulating levels of personal involvement and perceived risk, in order to show that personal involvement and risk perception can be used in an experimental setting to increase the intention for risk information seeking as assumed by FRIS. A different risk topic and manipulation was used in order to improve the risk manipulation and corresponding results. The second question that was addressed in study 2 is, What is the relation between risk information seeking and the intention to take preventive or risk-mitigating behavior? Since the seeking of relevant risk information is only effective when this seeking of information leads to the adoption of preventive or risk-mitigating behavior, it seems of interest to explore the relationship between these two variables. Assumptions are that high levels of risk information seeking leads to higher levels of preventive or risk-mitigating behavior among respondents. The third established research question asks, What is the impact of messages conveying high or low on risk perception, involvement, and response efficacy on the intention to take preventive or risk-mitigating behavior? FRIS assumes that high levels of risk perception, involvement and efficacy would lead to high levels of risk information seeking, which in turn is assumed to lead higher levels of preventive or risk-mitigating behavior, assumptions are that high levels of risk perception, involvement and response efficacy also lead to high levels of preventive or risk-mitigating behavior.

### Design

The study was a 2 (risk perception - fear appeal: high vs. low) x 2 (involvement: high vs. low) x 2 (response efficacy: high vs. low) between-subjects experiment, adding to study 1 the manipulation of response efficacy. Undergraduate students from the University of Twente

were sent an email message containing a website link that gave them access to the study. Participants were told that they would participate in a study analyzing written texts (INTACT). Thereafter, participants were asked to describe how they felt about the subject of 'terrorism'. After answering this question, the computer displayed a message stating that the program INTACT would generate advice based on the given answer. After 10 seconds, all respondents were given feedback about their interest in the topic of terrorism and their ability to cope with the possible dangers (Rimal, 2001). Without actually calculating a score, randomly half of the participants received feedback that consisted of the manipulation of high-risk perception, high personal involvement, and high response efficacy. The other half of the participants received feedback that was assumed to indicate low-risk perception, low personal involvement, and low response efficacy. All manipulations were tested extensively for their efficacy in a separate pilot experiment, and proved to be successful. The high involvement message explained the subjects they were in the top 10% with regard to interest in terrorism issues. The low involvement message told the subjects they belonged to the bottom 10%. The high-response efficacy message contained several examples of actions that could be undertaken to minimize the possibility of a terrorist attack. The low response efficacy group was told that not many things could be done. After reading this advice, the computer program asked respondents to move on to the next screen, on which participants were told that they were about to see the front page of a newspaper. They were asked to read this front page in its entirety. In doing so, they were confronted with the manipulation of risk perception. The high-risk perception group was given a high fear arousing picture. The low-risk perception group received a neutral picture.

Both front pages consisted of four different newspaper articles. The first article was the target article, titled 'The Netherlands against terrorism' and gave information about terrorism and the safety measures that can be taken. Three other articles were unrelated to the topic of terrorism. After reading the front page, respondents were asked to indicate which article they would like to read in its entirety by choosing one of the four articles. We assumed that their choice would indicate their actual risk information seeking behavior. Subsequently, participants were asked to complete a questionnaire. Table 3 summarizes the eight experimental conditions.

### Participants

A total of 168 undergraduate students from Twente University (aged 18–33 years) participated in the study. The distribution of respondents among the conditions varied between 20 and 26. Slightly more females (54%) than males (46%) participated in the study ( $\chi^2(1) = 1.17, p < .05$ ).

### Measures

All questions were based on previous studies (Ter Huurne, 2008). All questions were measured on a five-point Likert-type scale, with extremes from strongly disagree (1) to strongly agree (5), unless stated otherwise. Risk perception was measured using a reliable 14-item scale ( $\alpha = .95$ ). Respondents were asked to indicate how severe and risky terrorism is, and how high they think the chance is that a terrorist attack will happen in the Netherlands. Other questions related

to the level of personal risk for the subjects, how severe the consequences are for them, how dangerous terrorism is for them, and how likely it is that a terrorist attack will occur in their environment.

*Involvement.* Levels of involvements were measured using a four-item scale, which resulted in a reliable scale ( $\alpha = .89$ ). The items measured the amount of interest respondents had in terrorism, the influence it had on their lives, their involvement in terrorism, and the amount of information a person would want to obtain about a possible attack.

*Intention to seek risk information.* The intention to seek risk information was measured using a two-item scale. These items correlated strongly ( $r = .65$ ). The items asked respondents whether they would seek information about terrorism and whether they would pay attention to information provided about terrorism.

*Actual risk information seeking behavior.* To measure the information seeking behavior among respondents, respondents were asked, after reading the front page of the newspaper, to indicate which of the four articles they would like to read in detail. One of the presented articles actually reported about terrorism, and thus it was relevant in relation to the topic (score: 1). The others were not relevant to the topic (score: 0).

*Response efficacy.* The amount of response efficacy respondents experienced was measured using seven items. This scale seemed reliable ( $\alpha = .84$ ). The questions in the questionnaire with regard to response efficacy assessed whether respondents felt they could do something

**Table 3. Experimental manipulations in study 2.**

	Low response efficacy	High response efficacy
<i>Low involvement</i>		
Low fear-appeal	Bottom 10% of population involvement Not possible to ward of the threat Message containing no fear-appeal	Bottom 10% of population involvement Possible to ward of the threat Message containing no fear-appeal
High fear-appeal	Bottom 10% of population involvement Not possible to ward of the threat Message containing fear appeal	Bottom 10% of population involvement Possible to ward of the threat Message containing fear-appeal
<i>High involvement</i>		
Low fear-appeal	Top 10% of population involvement Not possible to ward of the threat Message containing no fear-appeal	Top 10% of population involvement Possible to ward of the threat Message containing no fear-appeal
High-fear appeal	Top 10% of population involvement Not possible to ward of the threat Message containing fear-appeal	Top 10% of population involvement Possible to ward of the threat Message containing fear-appeal

against terrorism, whether they thought the government does something against terrorism and the effect of seeking information about terrorism with regard to anti-terrorism measures. *Intention to adopt risk-mitigating behavior.* The intention for risk-mitigating behavior was measured using three reliable items ( $\alpha = .86$ ). Respondents were asked how likely they were to take precautionary measures, whether they would adhere to recommendations given, and whether they would adhere to given instructions.

**Table 4 Study 2: mean scores for the intention to seek risk information (INS), actual information seeking (AcT), and the intention to adopt behavioral change (ABC) with low or high fear appeal, low or high involvement and low or high response efficacy.**

Fear appeal	Low				High			
Involvement	Low		High		Low		High	
R. efficacy	Low	High	Low	High	Low	High	Low	High
INS	2.60	2.20	2.80	3.35	2.63	3.23	2.62	4.03**
AcT	.95#	.20	.35	.75	.30	.27	.76	1.00**
ABC	2.21#	2.52	2.45	2.52	2.72	3.58**	3.13**	3.75**

\*\*Indicates significantly higher than in other conditions at  $p < .01$ .

#Indicates significantly lower than in other conditions at  $p < .01$ .

## Results

No differences between the eight conditions for gender ( $F(7,160) = .15, p = .99$ ), age ( $F(7,160) = .96, p = .47$ ) or education ( $\lambda^2(7) = 4.75, p = .69$ ) were found. The manipulation check revealed main effects for risk perception, response efficacy, and involvement, all in the predicted direction (risk perception  $F(1,160) = 111.05, p < .01$ ; response efficacy  $F(1,160) = 20.26, p < .01$ , and involvement  $F(1,160) = 5.03, p < .05$ , respectively). As can be concluded, all manipulations in this experiment were successful. Table 4 summarizes the mean scores for the dependent variables in study 2 by condition.

### Replicating study 1 and testing study 2 research questions on information seeking

For the replication of study 1, using ANOVA, the effect of the independent variables on risk perception and involvement in actual and intended information seeking behavior was analyzed. As shown in Table 4, a main effect of risk perception ( $F(1,164) = 8.30, p < .01$ ) and involvement ( $F(1,164) = 55.06, p < .01$ ) on actual information seeking behavior was found.

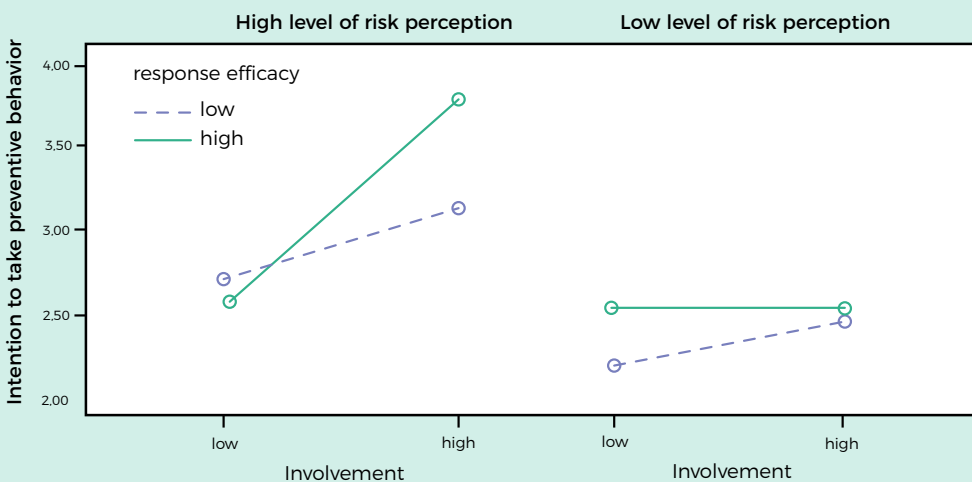
In addition, main effects of risk perception ( $F(1,164) = 7.52, p < .01$ ) and involvement ( $F(1,164) = 12.08, p < .01$ ) were found for the intention to seek risk information. All differences were in the assumed direction. Analysis of the correlations revealed a moderate correlation between actual and intended risk information seeking ( $r = .35$ ). The correlation between the intention to take adopt risk-mitigating behavior and actual information seeking ( $r = .26$ ) and the



intention to seek information ( $r = .42$ ) were low to moderate. The correlations do, however, support the assumption that information seeking coincides with a higher level of intention to adopt behavioral change. Therefore, these results support the basic assumption of FRIS that risk perception and personal involvement have an impact on (actual and intended) risk information seeking and that risk information seeking coincides with a higher intention to adopt risk-mitigating behavioral measures.

### The impact of risk perception, involvement and response efficacy on intention to adopt risk-mitigating behavior

Using ANOVA, the effect of risk perception, involvement, and response efficacy on the intention to take risk-mitigating behavioral measures was tested. Main effects of risk perception ( $F(1,160) = 22.70, p < .01$ ), involvement ( $F(1,160) = 12.25, p < .01$ ), and response efficacy ( $F(1,160) = 3.01, p < .01$ ) on the intention to adopt risk-mitigating behavior were found. All differences are in the predicted direction, indicating that subjects who received messages with high levels of risk perception, involvement, or response efficacy had a higher intention to adopt behavioral change. Furthermore, the three-way interaction between risk perception, involvement, and response efficacy on the intention to adopt risk-mitigating behavior was significant ( $F(1,160) = 4.07, p < .05$ ), as can be seen in Figure 2. The interaction indicated that under the high-risk perception and high-involvement condition, significantly more intention to adopt risk-mitigating behavior was generated by a high-response efficacious message than by a low efficacious message ( $t(39) = 2.64, p < .01$ ). In the high-risk perception and low involvement condition, and in both low-risk perception conditions, no significant differences in behavioral intention were observed (all t-tests yielded non-significant results).



**Fig. 2** The three-way interaction between risk perception, involvement, and response efficacy. (Scale: 1 = no behavioral change, 5 = high levels of behavioral change.)

## Overall discussion and conclusion

The purpose of these experiments was two-fold. First, we set out to test, in a laboratory experiment, several of the basic assumptions of the FRIS. To date, the work on FRIS had been correlational and based on cross-sectional survey data (see Ter Huurne, 2008). The experiments indicated that risk perception and personal involvement, as FRIS predicts, have an impact on risk information seeking. That is, when people perceive risks to be higher and perceive the risk as more personally relevant, their intention to seek (additional) risk information is higher as well. Although FRIS assumes that the relationship between risk perception and involvement is mediated by affective responses, information sufficiency, and informational subjective norms (Figure 1), we did look for a direct relationship. We feel it is important here to mention that this study is the first experimental study regarding this Framework, in which we had to establish a solid experimental procedure and valid and reliable measuring instruments. For this reason, we decided to focus on two of the core concepts of the Framework. Future studies may involve analyzing direct vs. indirect effects on risk information seeking. Other studies will focus on manipulating affective reactions, information sufficiency, and informational subjective norms to enhance levels of risk information seeking. The importance of this step-by-step approach is underlined by the finding that, although we were able to demonstrate that risk perception and personal involvement actually do lead to people making an effort to obtain more information, we found this in study 2 but not in study 1. After study 1, we assumed that the risk object that subjects were informed about (a fire in a university building with hazardous materials released [study 1] vs. the threat of terrorism [study 2]), and in the absence (study 1) or presence (study 2) of response-efficacious information, could be responsible for this. In study 2, we also applied a risk perception manipulation (fear appeal) that we assumed was stronger than the one applied in study 1 (multiple arguments). As study 2 yielded results as expected, we conclude that the original FRIS assumption was supported. Additional work, however, is needed to determine whether the factors (the risk itself, the manipulation of risk perception or the framing of response efficacy) make the difference in the level of actual information seeking. We interpret the findings as a first, but important, step in further empirical support for the FRIS. Because both studies also showed positive, but moderate, correlations between actual information seeking and the intention to adopt risk-mitigating behavior, these studies are an indication of the potential for the concept of risk information seeking to provide a better understanding of risk communication effectiveness. We note here that actual information seeking was measured with a single dichotomy, which may have resulted in an underestimation of the relationship between actual information seeking and the intention to seek information. Additional work on the measure of actual information seeking is needed. It also needs mentioning that finding direct relations between risk perception, personal involvement, and information seeking does not mean that the basic assumption of FRIS is refuted, we simply did not look at mediating effects to keep the study design in this first phase relatively simple.

The second goal of the study was to test the impact of different stimuli - messages that convey a low- or high-risk perception, low or high involvement, and low or high response efficacy - on

the intention to adopt risk-mitigating behavior. The results showed that a message lacking fear appeal (and thus with low-risk perception), in combination with low levels of involvement and response efficacy, leads to the least information seeking behavior. Therefore, the respondents who read the message without a fear appeal, who were uninvolved and did not know how to cope with the communicated risk, chose less often than subjects in the other conditions to seek additional risk-relevant information. However, this was not the case for intended information seeking behavior. The lowest intention to seek relevant information was found among respondents who read a message without fear appeal and were uninvolved but who assessed the message as response-efficacious. Thus, high levels of response efficacy do not necessarily lead to high levels of information seeking behavior. As experiment 2 indicated, this was only observed when the risk perception was high and when personal involvement was high.

That a message containing a fear appeal, together with high levels of involvement and response efficacy, leads to the highest intention to adopt behavioral change is in accordance with the Protection Motivation Theory (PMT) (Rogers, 1983). That is, respondents who experience high levels of risk perception, are highly aware of terrorism and feel that the message helps to cope with the threat, show more intention to change their risk-mitigating behavior than respondents who experience low levels of risk perception, involvement or efficacy. In addition, respondents who read the low-fear message and who experienced low levels of involvement and response efficacy, showed the least behavioral change. That is, respondents who experienced low levels of risk perception – who were not aware of terrorism and felt that they were not able to cope with this threat – showed less behavioral change than respondents who experienced high levels of these elements. This can be seen as an indication that the concepts and methodologies used in health risk communication work (like PMT and others) and may be applicable in studying processes of behavioral adaptation in the domain of man-made risks.

In conclusion, one can state that messages that convey a high level of fear are indeed effective in enhancing information seeking behavior and behavioral change. Respondents who read a high-fear message showed higher levels of information seeking and behavioral change than did respondents who read the low-fear front page. However, this phenomenon only occurred when the high-fear message was accompanied by either involvement or response efficacy. Thus, a fear appeal on its own does not enhance risk-reducing behaviors. Furthermore, high levels of response efficacy and involvement were effective in enhancing information seeking behavior and behavioral change. Therefore, the results of this study indicate that the best combination in enhancing information seeking behavior and behavioral change would be to use a message that contains a fear appeal among respondents highly involved within the risk topic and to provide examples of how an individual can cope with the risk described.

# CHAPTER 4

## MAKING IT STICK:

EXPLORING THE EFFECTS OF INFORMATION AND BEHAVIORAL TRAINING ON

SELF-PROTECTIVENESS OF CITIZENS IN A REAL-LIFE SAFETY SETTING.

*This chapter is based on: Kievik, M., Misana-ter Huurne, E.F.J., Cutteling, J.M. & Giebels, E. (accepted for publication). Making it stick: exploring the effects of information and behavioral training on self-protectiveness of citizens in a real-life safety setting. *Safety science*.*

Around the world, citizens are faced with many low-probability high-consequence risks. One example of such a risk is the transportation of highly dangerous chemical substances by train. The likelihood of the occurrence of such a serious incident is fairly small and many high quality precautionary measures are being taken by the government to diminish the potential threat (Ministry of Infrastructure and Environment, 2014). However, the consequences of a serious incident – as for instance illustrated by the effect of the fatal freight train crash in the Belgian municipality Wetteren in 2013 - can be severe and quick and accurate responses of citizens are crucial since early threat detection might give those at risk important additional time (NOS, 2014). Therefore, in mitigating the potential outcomes of low-probability high-consequence risks, the importance of individual citizens' responsibilities in taking risk-preparatory action is stressed. In addition to the already existing precautionary measures, protection of the public is best served by encouraging additional self-protective measures and resilience. Also in other safety fields where individuals' behavior is a key element in reducing possible negative consequences of risks - such as for instance health safety and occupational safety - insight in factors that stimulate the adoption of adequate risk behaviors is necessary. Since inadequate behavior of individuals in these fields might also lead to injuries and even fatalities (Eurostat, 2013; Silva et al., 2017), individuals should undertake self-protective actions in order to reduce potential negative risk outcomes.

In order to seek for determinants influencing adequate risk behavior of citizens, self-protectiveness has emerged as an important topic within the risk communication literature (e.g. ter Huurne & Gutteling, 2008; Terpstra, 2010; Kievik & Gutteling, 2011; Kievik et al., 2012). Several studies have been conducted within the safety domain looking at the determinants of persuasion of the at-risk audiences, stimulating the adoption of self-protective behavior. These studies show that perceived feasibility (self-efficacy) and usefulness (response-efficacy) of self-protective behaviors are, besides risk perception, important predictors of self-protectiveness (Kievik & Gutteling, 2011; Lindell & Perry, 2012).

However, some pieces of the puzzle are still missing. We still do not know when an individual perceives risk mitigating options as feasible (self-efficacy) and useful (response-efficacy). This calls for a better understanding of the factors that influence the perceived feasibility and usefulness of risk mitigating options and how these factors ultimately affect individuals' behavioral adaptations in the face of a specific risk. Although research shows that citizens perceiving risk mitigating options as more feasible and useful are more likely to undertake adequate self-protective measures (e.g. Kievik & Gutteling, 2011; Lindell & Perry, 2012), we still do not understand when and why levels of self- and response-efficacy are most optimally stimulated.

In this study, we propose that actively processing relevant risk information might be the missing piece to our puzzle. In most studies on self-protective behavior, the results are based on responses of respondents after receiving mere information only (e.g. Kievik & Gutteling, 2011; Kievik et al, 2012; Lindell & Perry, 2012). Although providing information seems promising, this rather passive approach does face possible limitations: during stressful events declarative knowledge (facts) must be remembered and then transferred into action (Burke & Hutchins,

2007). During highly stressful situations such as incidents with freight trains transporting highly dangerous chemical substances, declarative memory may not be activated as easily as procedural knowledge (de Quervain et al., 1998; Kuhlmann et al., 2005). Procedural knowledge is defined as knowing how to perform a certain task and can be acquired through behavioral training (Anderson, 1982; Tulving, 1983). Increasing the levels of procedural knowledge (instead of declarative knowledge only) seems to be beneficial in such situations. This might lead to more knowledge on how to perform a certain task, which is necessary in order to behave adequately during highly stressful situations such as disasters (Tulving, 1983). Previous research in different safety domains shows that self-protective behavior can be more effectively trained through highly engaging measures such as behavioral trainings (Burke et al., 2011). For instance, research in the field of occupational safety shows that trainings in which participant-interaction is actively stimulated and in which trainees are asked to practice relevant risk behaviors, are particularly effective (Glendon, Clarke & McKenna, 2006). Behavioral trainings increase knowledge and adequate risk mitigating behaviors of participants. During a behavioral training, participants are far more likely to remember the presented information when compared to passive forms of communication such as only hearing words or reading the relevant material (Glendon et al., 2006). Not only will the level of procedural knowledge increase making the behavior a routine activity, the behavioral training will also increase perceived levels of feasibility and usefulness (Sitzman, 2011). When citizens engage in relevant risk mitigating behavior during a behavioral training, they receive important feedback on how easily these self-protective measures can be executed and how these behaviors reduce the threat. Training these risk mitigating behaviors in a real life setting thus increases citizens' understanding of the usefulness (the level of perceived response-efficacy) and feasibility (the level of perceived self-efficacy) of such behaviors (Kinateder et al., 2013).

In the current study, we propose that behavioral training (an active way of processing information) is a key element in enhancing citizens' procedural knowledge as well as their perceived levels of self-efficacy and response-efficacy and, subsequently, their self-protective behavior.

## Theory and Hypotheses

Over the last few years, some studies have contributed to our understanding why citizens do, or do not, engage in self-protective actions with regard to safety risks (Terpstra & Gutteling, 2008; Kievik & Gutteling, 2011; Kievik et al., 2012). Firstly, the level of risk perception is an important predictor of adequate risk behavior. Moderate to high levels of risk perception are seen as necessary conditions for individuals to take action (Larsman et al., 2012). This might be one explanation for the lack of motivation to take precautionary measures among residents (Miceli et al., 2007). Secondly, both self-efficacy and response efficacy are significant predictors of self-protectiveness. Following Bandura (Bandura, 1991), - self-efficacy can be defined as "people's beliefs about their capabilities to exercise control over their own level of functioning

and over events that affect their lives” – or the level of perceived feasibility. Response efficacy is defined as the belief that a specific response will help effectively diminish a certain risk (Bandura, 1986) – or the perceived usefulness of risk mitigating behavior. Research shows that, when citizens do not know whether they are capable of executing actions that may reduce their vulnerability to risks (low level of self-efficacy), and they are uncertain that advised actions may be effective in mitigating the threat (low level of response-efficacy), they will not engage in risk mitigating behavior (Rimal & Real, 2003; Gore & Bracken, 2005; Kievik & Gutteling, 2011).

According to the Extended Parallel Process Model (EPPM) (Witte, 1992) the combination of elevated levels of risk perception, self-efficacy, and response-efficacy would motivate people to adopt self-protective measures. The more individuals believe they are susceptible to a serious threat, the more motivated they are to evaluate the efficacy of the recommended response. If the threat is perceived as irrelevant or insignificant, then there is no motivation to further process the message, and people will simply ignore the message. In contrast, when a threat is believed to be serious and relevant, individuals may become motivated to take some sort of action to reduce the induced level of fear (Witte & Allen, 2000).

The EPPM further predicts that perceived self-efficacy and response-efficacy jointly determine whether people will become motivated to control the danger or control their fear about the threat. Under these conditions, people carefully think about the recommended responses advocated in the persuasive message and adopt those as a means to control the danger. Alternatively, when people are uncertain about the effectiveness of recommended actions (i.e., the advice is perceived as low on self-efficacy and/or response efficacy), they are motivated to control their fear through denial, defensive avoidance, or reactance (Witte & Allen, 2000).

Recently, studies within the safety domain show evidence supporting these assumptions. For instance, the Protective Action Decision Model shows that threat perceptions as well as protective action perceptions are important predictors of self-protective behavior. Higher levels of self-protectiveness were seen among citizens who perceived a certain risk as risky and felt that protective actions were useful and feasible (Lindell & Perry, 2012). Furthermore, a study conducted by Kievik and Gutteling (2011) on flooding preparedness showed that higher levels of self-protectiveness are indeed seen when respondents have both high levels of risk perception as well as high levels of efficacy beliefs. Perceiving a risk as threatening and judging risk-mitigating options as both feasible and useful, leads to the intention to engage in self-protectiveness.

However, other studies on the intentions of citizens to engage in self-protectiveness with regard to severe weather circumstances (van Leeuwen, 2012) and citizens' behavior during crisis situations (Gutteling & de Vries, 2016), show that efficacy beliefs were insignificant predictors of adequate risk behavior. These studies show that stressing the fact that certain behavior is adequate in mitigating a threat does lead to a slight increase in perceived efficacy. However, although a significant change in perceived efficacy was found, the average scores on efficacy beliefs – even after this increase – were relatively low (around 3 on a scale from 1 to 5). Other studies that did find an effect of efficacy beliefs on self-protectiveness reported much higher

scores on average (Rimal & Real, 2003; Kievik et al., 2012). Therefore, and similar to results found in studies on other risk behaviors such as the risks of speeding and HIV risk behavior (De Leonardis et al., 2004; Rosenstock et al., 1994), we argue that the perceived usefulness and feasibility of adequate risk behaviors need to be enhanced substantially in order to increase self-protectiveness. In this study, we take the perspective that the way in which relevant risk information is processed, active vs. passive information processing, is a crucial factor. We hypothesize that behavioral training on self-protectiveness (the active approach) will increase respondents' procedural knowledge as well as their perceived feasibility and usefulness of risk mitigating behaviors to a larger extent than the passive approach (merely reading about it) or having no information at all. The active approach will lead to a substantial increase in efficacy beliefs and, subsequently, lead to more actual self-protective behavior than the more passive approach.

### **The effect of behavioral training**

Adequate behavioral reactions of citizens during disasters are of great importance. And although providing relevant risk information that citizens perceive as both feasible and useful seems promising (e.g. Kievik & Gutteling, 2011; Kievik et al., 2012), there are some possible limitations to these results. As already pointed out, during stressful events declarative knowledge (facts) must be remembered and then transferred into action (Burke & Hutchins, 2007). Research shows that in highly stressful situations, it is more difficult to activate declarative knowledge than procedural knowledge (de Quervain et al., 1998; Kuhlmann et al., 2005), and therefore increasing levels of procedural knowledge may be beneficial. Procedural knowledge is defined as knowing how to perform a certain task and can be acquired through behavioral training (Anderson, 1982; Tulving, 1983). Recent meta-analysis show that safety behaviors such as drivers' threat detection can be more effectively trained through highly engaging measures such as behavioral trainings (Burke et al., 2011; Sitzman, 2011). Behavioral training is known to have several positive outcomes on learning and transfer of knowledge (e.g. Bell & Kozlowski, 2008). For example, a study looking at drivers' threat detection strategies, shows that a behavioral training improved respondents skills more compared to a passive classroom lecture (Romoser & Fisher, 2009). Applied to the current topic, increasing procedural knowledge and training relevant skills might thus be beneficial.

In addition, behavioral training also positively influences citizens' perception of the usefulness (response efficacy) and feasibility (self-efficacy) of risk mitigating behavior. For example, a driving training program that provided feedback during the training was found to lead to a more internalized locus of control (Huang & Ford, 2012). After the training, respondents felt more capable and confident than prior to the training, as is in line with research conducted by Bandura (1986) on the positive influence of high levels of self-efficacy on adequate behavior. The idea that behavioral training might lead to a more positive judgment of risk mitigating behaviors is also supported by research from the educational domain. Research looking at the influence of actively practicing certain tasks on adequate behavior shows that when a message is processed actively by the audience, this will positively affect individuals' knowledge as well



as behavior (Oblinger, 2004). Actively processing the risk communication messages has a positive impact on the judgement of the effectiveness of self-protective options as well as the intention to engage in self-protectiveness. These findings are corroborated by a literature review looking at studies on risk related behaviors of citizens who experienced a natural disaster, showing that actively processing risk messages and engaging in self-protectiveness leads to more knowledge as well as higher problem solving capacities (Lindell & Perry, 2012). In the field of disaster research, people's beliefs about their own level of responsibility for protection from a hazard is generally believed to be an important predictor of intentions to engage in self-protective behavior, contributing to the further understanding of why people fail or succeed in protecting themselves from hazards (Lindell & Perry, 2000; Paton, 2003). Research shows that individuals who believe that protection against risks is their personal responsibility, will perceive risk mitigating options as more useful and feasible (Nouwen et al., 2009). This might be because responsibility motivates people to be open to and actively process risk-mitigating information. On the other hand, denial of personal responsibility (e.g. by attributing all risk-mitigating responsibility to governmental authorities or a higher-order being, or fate) might lead to a lack of interest in information. We thus assume that, from a psychological perspective, levels of responsibility are related to perceptions of efficacy beliefs. Also, research shows that higher levels of personal responsibility as well as perceived efficacy might lead to a stronger tendency to take protective actions (Lindell & Perry, 2000; Paton, 2003; Terpstra & Gutteling, 2008).

Thus, increasing procedural knowledge is likely to have a positive effect on the perceived levels of personal responsibility (e.g. De Young, 1993; Pongiglione, 2011) as well as on efficacy beliefs (e.g. Kinatader et al., 2013), which might lead to a more positive judgement of risk mitigating options and ultimately create higher levels of self-protectiveness. We therefore conclude that a behavioral training might lead to higher levels of perceived feasibility (self-efficacy) and usefulness (response-efficacy) of adequate risk behaviors than mere information or no information at all. We expect to find a similar relation with personal responsibility. This might subsequently lead to more actual self-protectiveness in the domain of railroad transportation risks for citizens.

### Current study

The current study focuses on safety behavior with regard to freight train incidents concerning dangerous chemical substances. We used Borne (a small town in the Eastern part of the Netherlands with approximately 22.000 inhabitants [CBS, 2015]) as an area for experimentation. Trains transporting highly dangerous chemical substances ride through the center of this village daily, making it a high risk area. Expectations are that the number of freight trains passing Borne will increase drastically over the next few years (Ministry of Infrastructure and Environment, 2014). Adequate behavioral reactions to disasters with dangerous chemical substances is therefore of great importance in this area. Citizens should be able to estimate when to evacuate or shelter in place, based on the type of incident (a fire with the possibility of explosion or the release of highly toxic chemicals). The aim of the present study is to

determine the effect of behavioral training (the active approach) compared to the situation in which citizens received mere information (the passive approach), or no information at all, on efficacy beliefs and self-protective behavior. The following hypotheses are formulated:

**H1a.** Behaviorally trained participants feel more self- and response-efficacious than passively informed participants and uninformed participants.

**H1b.** Behaviorally trained participants show more adequate self-protective behavior than passively informed participants and uninformed participants.

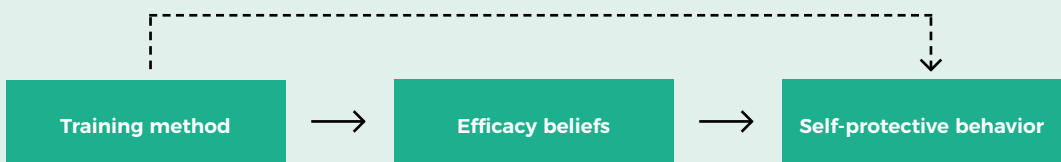
With regard to the effect of efficacy beliefs on self-protective behavior, we expect to find similar results as in previous studies (Kievik & Gutteling, 2011). Therefore, the following (replication) hypothesis is formulated:

**H2.** High levels of efficacy beliefs lead to higher levels of self-protective behavior than low levels of efficacy beliefs.

Finally, following the procedure of Baron and Kenny (1986), we hypothesize that the efficacy beliefs act as mediators between the independent variable instructional method and the dependent variable self-protective behavior (see Fig. 1). Since the aim of governmental campaigns is to enhance the self-protectiveness among citizens (Grothmann & Reusswig, 2006) and the assumption is that the judgment of risk mitigating options in terms of usefulness and feasibility is an essential link between the risk campaign and individual risk behavior, efficacy beliefs are assumed to mediate the relationship between the provided stimuli and behavior. In this respect we follow the conclusions drawn in studies on health behaviors in which efficacy beliefs proved to mediate this relationship (Nouwen et al., 2009). We expect stronger effects on self-protectiveness due to the trainings' impact on efficacy beliefs (the cognitive support of having procedural knowledge) than between instructional method and self-protectiveness directly. Therefore, the final hypotheses that have been established are as following:

**H3a.** Self-efficacy mediates the relationship between the independent variable instructional method and the level of self-protectiveness of citizens

**H3b.** Response-efficacy mediates the relationship between the independent variable instructional method and the level of self-protectiveness of citizens



**Fig. 1.** Model of expected mediation efficacy beliefs.

# Method

## Research context

The Dutch railways include some of the world's most intensively used stretches of track (Ministry of Infrastructure and Environment, 2014). Due to a new program introduced in 2014 by the Dutch government called "Programma Hoogfrequent Spoorvervoer" ("Program Highfrequent Railtransport"), these tracks will be used even more intensively over the next few years, transporting highly dangerous chemical substances through the centers of many densely populated cities and villages in the Netherlands (Ministry of Infrastructure & Environment, 2014). Although many high quality precautionary measures are being taken to diminish potential risks related to the transportation of these substances by train and it actually is a low-probability risk, accidents with freight trains – the impact of which has been painfully illustrated by the effect of fatal freight train crashes in the Belgian municipality Wetteren in 2013 and later that year in Lac Megantic in Canada (NOS, 2014) – might have severe consequences. This poses a serious threat to the public.

Potential rail incidents, especially the ones concerning dangerous chemical substances, develop quickly in time. The Dutch government is aware that under such circumstances it cannot guarantee full calamity protection to its citizens. When dangerous chemical substances are released in case of a freight train accident, quick evacuation is crucial since early threat detection might give users important additional time. Therefore, in mitigating the potential outcomes of such low-probability high-consequence risks the government is stressing the importance of individual citizens' responsibilities in taking risk-preparation activities. The protection of the public is best served by encouraging additional self-protective measures and resilience (Grothmann & Reusswig, 2006; de Wit et al., 2008). Citizens are expected to proactively prepare themselves for potential freight train incidents to increase their personal safety.

As discussed above, we used Borne (a small town in the Eastern part of the Netherlands with approximately 22.000 inhabitants [CBS, 2015]) as an area for experimentation since this area is prone to the risks related to chemical substance transportation by train.

## Two studies: behavioral training effectiveness study and main study

The current research consists of a behavioral training effectiveness study and a main study with a random sample of the Borne population. The behavioral training effectiveness study (n=47) was conducted with inhabitants who voluntarily attended a behavioral training. This study was done in order to see whether the behavioral training indeed led to an increase in self-efficacy, response-efficacy and self-protectiveness. Since, to our knowledge, not many studies have been conducted on the effect of behavioral training on self-protectiveness in a real-life safety setting, we first wanted to see whether there was a short-term effect on our independent and dependent variables.

In our main study (n=614) we tested our hypotheses by means of a questionnaire, on the effect of instructional method on perceived efficacy and self-protectiveness and on the mediating

role of efficacy beliefs in the relationship between instructional method at the one hand and actual self-protective behavior at the other. The participants in this main study were randomly selected citizens of Borne, all equally prone to the risk of getting affected by a potential disaster concerning freight trains, since everyone lived equally close to the railroad in Borne. The random sample included citizens in all three instruction categories.

### Behavioral training effectiveness study

**Procedure.** A behavioral training was developed to see whether practicing relevant risk-mitigating behaviors concerning freight train incidents would lead – as expected – to elevated levels of efficacy beliefs and self-protective behavior. During the behavioral training, it is important that participants are able to increase their procedural knowledge, experience the feasibility and usefulness of risk mitigating behaviors and receive adequate feedback (e.g. Kinateder et al., 2013, Wang et al., 2015). In order to do so, together with governmental institutions (Safety Region Twente; the municipality of Borne; and the local fire department), a short behavioral training was developed in which state-of-the-art risk mitigating options of risks related to the transportation of dangerous chemical substances by train were practiced. During a freight train accident with dangerous chemical substances, three different scenarios can occur, asking for different responses of the public. Freight trains can either 1) release highly toxic chemicals, 2) be on fire and/or 3) explode. Adequate behavioral reactions to these scenarios is of great importance. Citizens should be able to:

- 1) Estimate whether dangerous toxic chemicals were released during the accident;
- 2) Estimate whether the accident concerns a fire with a possible risk of explosion;
- 3) Make a proper judgement on whether to evacuate (in case of potential explosion risk) or shelter in place (in case of the release of toxic chemicals).

These adequate risk behaviors were trained during a behavioral training on a Saturday in November 2014, making sure that it was easy for citizens to attend the training. Before the training, several real life scenarios were created simulating these possible risks of freight train accidents. For instance, in one scenario, the risk of a possible explosion of a train carrying Liquid Petroleum Gas (LPG) was simulated by showing footage and simulating the high-tone sound of such a disaster. During the training, participants went through several of these



**Fig. 2.** Pictures of the behavioral training illustrating the training environment and one footage of a risk scenario.

scenarios actively practicing the risk mitigating options related to the scenario provided. They were asked to indicate which self-protective behavior they perceived as adequate in every scenario using electronic voting devices. Also, they were asked to actually behave in a way they thought was suitable to the situation. In every scenario they could choose whether they would evacuate (which would be appropriate in case of a possible explosion or a fire), shelter in place (which would be appropriate when toxic chemicals are released) or do nothing (when there is no risky situation). Also, adequate behaviors such as shutting down ventilation systems and choosing the right emergency route are risk mitigating options that were actively practiced. Each participant went through every scenario and each scenario was then extensively evaluated and discussed with all participants.

**Participants.** A total of 47 residents of Borne signed up for the behavioral training and participated. Of the 47 participants, 20 were female and 27 were male.

**Measures.** A pre- and posttest was conducted measuring levels of self-efficacy, response-efficacy and levels of self-protectiveness. Approximately ten minutes prior to the training as well as directly after the training, respondents were asked to fill out a questionnaire measuring these three variables. The questionnaire was based on a previously validated questionnaire (ter Huurne, 2008). This questionnaire, unless stated otherwise, measured responses on five-point Likert scales, with extremes *strongly disagree* (1) to *strongly agree* (5).

*Self-efficacy.* Level of self-efficacy was measured in the pre- and posttest using a self-evaluation item, namely "I deem myself capable of responding adequately in these specific high-risk situations". The answers on this item showed sufficient variance.

*Response-efficacy.* Level of response-efficacy was measured in the pre- and posttest using a self-evaluation item, namely "I perceive this risk mitigating options provided as effective in reducing the threat". The answers on this item showed sufficient variance.

*Intention to engage in self-protectiveness.* Intention to engage in self-protectiveness was measured in the pre- and posttest using a self-evaluation item, namely "I have the intention to protect myself against this threat". The answers on this item showed sufficient variance.

### **Main study: A representative sample comparing the effects of instructional method.**

**Procedure and participants.** In this study we want to determine whether attending a behavioral training leads to higher levels of self-efficacy and response-efficacy, subsequently leading to more self-protective behavior in a real life safety setting compared to mere information only and no information. Also, we wanted to see whether perceived levels of personal responsibility could affect the levels of efficacy beliefs and self-protectiveness, as would be expected based on recent research (e.g. De Young, 1993; Lindell & Perry, 2002; Paton, 2003; Terpstra & Gutteling, 2008; Pongiglione, 2011; Rickard et al., 2014). Since these studies have shown that feeling personally responsible for taking self-protective actions has a positive influence on actual levels of self-protectiveness, we included this variable in our study as a vital addition to our other measures.

In December of 2014, a total of 2731 randomly selected residents of Borne were asked to participate in our main study. They received a letter from the municipality of Borne inviting

them to fill out an online-questionnaire. Respondents were informed that the objective of the questionnaire was to measure their opinions, ideas and thoughts on the transportation of chemical substances by train through Borne. The questionnaire measured their levels of risk perception, efficacy beliefs, personal responsibility and levels of self-protectiveness. A total of 614 randomly selected residents of Borne filled out the questionnaire (22% response). The mean age of participants was 57 years. Of the initial cohort, 55% of the participants were female and 45% male. The cohort was divided into three conditions in order to look at differences in efficacy beliefs and self-protectiveness between respondents who attended a behavioral training, received information only or were uninformed (see table 1).

**Table 1. Conditions based on received instructional method.**

Condition 1 - n = 26 Behaviorally trained	Condition 2 - n = 363 Informed	Condition 3 - n = 225 Uninformed
Attended the behavioral training and passively informed	Did not attend the behavioral training, but passively informed	Did not attend the behavioral training and not informed

Control group (n = 225) - Respondents that we assigned to the control group are all respondents that had self-reported to have not read information on the risks related to the transportation of chemical substances by train. In the Summer of 2014, governmental institutions communicated with the public about the risks related to the transportation of dangerous chemicals by train. All residents of Borne received information about these risks, including adequate risk mitigating options. The information was spread using newsletters, pamphlets, leaflets and the website of the municipality of Borne, making sure that every household had access to the information. All respondents that had self-reported to have not read this information nor participated in the behavioral training were assigned to the control group. These respondents were all uninformed.

Information condition (n = 363) - Respondents in the information condition had self-reported to have received and read the relevant risk information on freight train transportation. We assigned all respondents that had self-reported to have read the information provided by the government but did not attend the behavioral training, to the information only condition.

Behavioral training condition (n = 26) - During the risk communication effort, all residents were also asked to sign up for the behavioral training as previously discussed. All participants who had self-reported to have received and read the information provided by the government as well as attended the behavioral training were assigned to the behavioral training condition. These respondents were passively informed as well as behaviorally trained. Between the three conditions, no differences were found in gender ( $\chi^2(2) = 2.13$ , n.s.) or education ( $\chi^2(18) = 18.82$ , n.s.). However, a significant difference in age was found ( $F(2,611) = 6.94$ ,  $p < .01$ ). Respondents in the control group (no information) were significantly younger than respondents in the behavioral training condition ( $t(237) = 2.37$ ,  $p < .05$ ) and 2 ( $t(581) = 3.32$ ,  $p < .01$ ).

**Measures.** All respondents were asked to fill out a questionnaire measuring levels of self-efficacy, response-efficacy, risk perception, personal responsibility and self-protective behavior. This questionnaire was filled out by respondents approximately two weeks after the behavioral training effectiveness study was conducted. The questionnaire was based on a previously validated questionnaire (Ter Huurne, 2008). This questionnaire, unless otherwise stated, measured responses on five-point Likert scales, with extremes *strongly disagree* (1) to *strongly agree* (5).

*Self-efficacy.* Level of self-efficacy was measured using a three-item scale ( $\alpha = .75$ ). Respondents were asked to indicate to what extent they thought they could prepare themselves for the risks related to the transportation of dangerous chemical substances by train.

*Response-efficacy.* Level of response-efficacy was measured using a three-item scale ( $\alpha = .76$ ). Respondents were asked to indicate to what extent they thought the risk mitigating options provided by governmental institutions were effective in reducing the risks related to the transportation of dangerous chemical substances by train.

*Risk perception.* Level of risk perception was measured using a ten-item scale ( $\alpha = .83$ ). Respondents were asked to indicate to what extent they thought they were susceptible to the risks related to the transportation of dangerous substances as well as indicate the severity of these risks.

*Personal responsibility.* Perceived personal responsibility was measured using a three-item scale ( $\alpha = .86$ ). Respondents were asked to indicate to what extent they thought they themselves were responsible for seeking relevant risk information as well as engage in self-protective actions.

*Self-protective behavior.* Actual levels of self-protective behavior was measured using nine items concerning various self-protective behaviors (e.g. did you install the official governmental warning service on your mobile phone?; did you practice shutting down the ventilation system in your house?; do you have a flyer with the disaster instructions at home?; did you seek for relevant risk information online?). Engagement in a specific type of self-protective behavior was scored 1. If not, they were scored a 0. The scores were added and divided by the total number of items to create one total construct measuring actual levels of self-protectiveness and thus creating a score somewhere between 0 (not self-protective) to 1 (fully self-protective).

## Analysis of the results

In order to test our first set of hypothesis regarding the effect of instructional method on (predictors of) self-protective behavior, we used analysis of variance. Our second hypothesis on the effect of efficacy beliefs on self-protectiveness was tested using regression analysis. In order to test our final set of hypothesis regarding a possible mediation effect of efficacy beliefs on the relationship between instructional method and self-protective behavior, mediation analysis was conducted following the procedure of Baron and Kenny (1986). Since the instructional method consisted of different conditions, two dummy variables were constructed following the procedure of Hayes and Preacher (2014), in order to be able to conduct the mediation analysis.

## Results

### Results behavioral training effectiveness study

Table 2 shows the mean scores of all 47 participants on self-efficacy, response-efficacy and self-protectiveness. A significant increase in self-efficacy, response-efficacy as well as intention to engage in self-protective behavior was found, indicating that the behavioral training enhanced these factors. The results indicate that – after a behavioral training – respondents are more self-efficacious as well as self-protective than prior to the training. Since we did not compare behaviorally trained citizens to merely informed and uninformed citizens in this first study, our second main study will focus on the differences between respondents receiving different instructional methods (behavioral training vs. information only vs. no information).

**Table 2. Mean scores pre- and posttest of independent and dependent variables**

	Pre-test (n = 47) Prior to behavioral training	Post-test (n = 47) After behavioral training
Self-efficacy	2.78	3.94**
Response-efficacy	3.21	4.00**
Intention self-protectiveness	3.26	4.19**

\*\* significant at .01 level

## Results main study

**Descriptive statistics.** Table 3 presents the correlations of the main variables in our study. Significant correlations were found between levels of response-efficacy and personal responsibility on the one hand and self-protectiveness on the other (respectively  $r=.16$  and  $r=.11$ ). However, risk perception and self-efficacy did not significantly correlate with self-protectiveness (respectively  $r=-.03$  and  $r=.06$ ).

**Table 3. Correlations between the main variables of the representative sample (n = 614).**

	1.	2.	3.	4.
1.Risk perception				
2.Self-efficacy	-.14**			
3.Response-efficacy	.11**	.19**		
4.Responsibility	-.15**	.29**	.20**	
5.Self-protectiveness	-.03	.06	.16**	.11**

\*\* significant at .01 level



**Effect of the instruction method.** Of all respondents participating in this study, more than 36% self-reported to have not read the information provided by the government on the risks related to the transportation of chemical substances by train and were thus uninformed. Almost 60% of the respondents were merely informed since they self-reported to have read the information provided by the government, but did not attend the behavioral training. The other respondents were informed as well as behaviorally trained.

With regard to the effect of the instructional method on efficacy beliefs as well as self-protectiveness, our first hypotheses 1a and 1b were tested with an analysis of variance. As can be seen in table 4, between the three conditions, significant differences were found in levels of self-efficacy ( $F(2,612) = 6.86, p < .01$ ), response-efficacy ( $F(2,612) = 9.71, p < .01$ ) and self-protective behavior ( $F(2,612) = 75.69, p < .01$ ).

**Table 4. Mean scores of independent and dependent variables between conditions.**

	Behaviorally trained	Informed	Uninformed
	n = 26	n = 363	n = 225
Risk perception	3.63	3.57	3.58
Self-efficacy	3.90 <sup>b,c**</sup>	3.49 <sup>ac*</sup>	3.23 <sup>ab**</sup>
Response-efficacy	3.90 <sup>bc**</sup>	3.38 <sup>ac**</sup>	3.09 <sup>ab**</sup>
Responsibility	3.33 <sup>c**</sup>	3.00 <sup>c**</sup>	2.67 <sup>ab**</sup>
Self-protectiveness	.44 <sup>bc**</sup>	.20 <sup>ac**</sup>	.10 <sup>ab**</sup>

\*\* significant at .01 level \* significant at .05 level

Self-protectiveness was measured on a scale from 0 (no self-protectiveness) till 1 (absolute self-protectiveness). Other variables on a scale from 1 (low levels) till 5 (high levels)

<sup>a</sup>significant difference with trained, <sup>b</sup>significant difference with informed, <sup>c</sup>significant difference with uninformed

Respondents who attended the training scored significantly higher on self-efficacy, response-efficacy and self-protectiveness than respondents who were merely informed or were uninformed. Merely informed respondents scored significantly higher on these variables than uninformed respondents. These results support our first set of hypotheses. Also, we found significant differences between the three conditions in level of personal responsibility ( $F(2,612) = 9.11, p < .01$ ). Behaviorally trained and informed respondents felt significantly more responsible to take self-protective actions than respondents who had not read information about the risks related to the transportation of dangerous chemical substances by train. However, no significant differences in personal responsibility were found between the behaviorally trained and informed groups. Also, no differences were found between the conditions in level of risk perception ( $F(2,612) = .09, n.s.$ ).

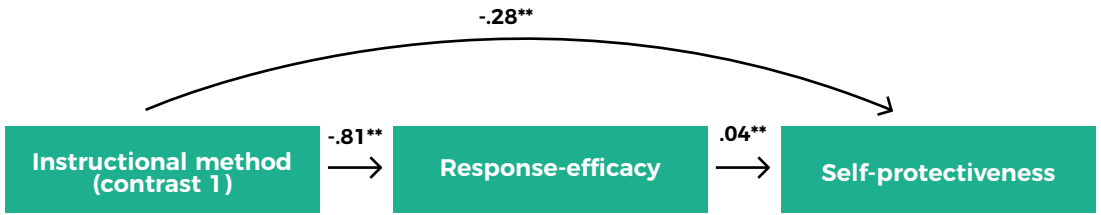
**Effect of efficacy beliefs.** With regard to the effect of efficacy beliefs on self-protectiveness, our second hypothesis was tested using regression analysis. Regression analysis involving all participants showed that the relation between response efficacy and self-protectiveness proved to be significant ( $b = .04, p < .01$ ), indicating that high levels of response-efficacy indeed

lead to high levels of self-protectiveness. However, self-efficacy did not show a significant relation with self-protectiveness ( $b = -.01$ , n.s.). Therefore, our second hypothesis can only be partially confirmed in that response-efficacy indeed is a predictor of self-protective behavior whereas self-efficacy in this case is not.

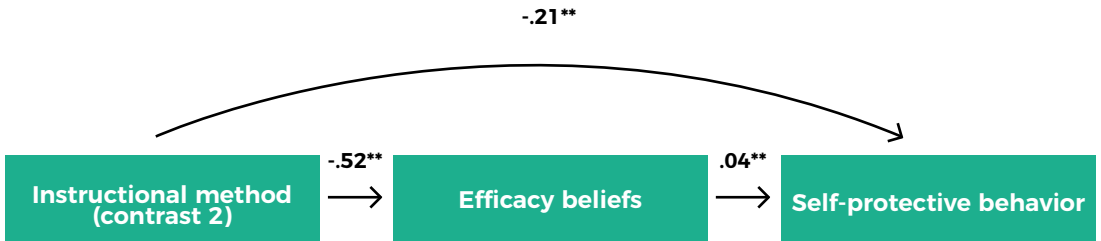
**Mediation effect efficacy beliefs.** A mediation analysis tested the final hypothesis 3a and 3b that self-efficacy and response-efficacy mediate the relationship between instructional method on the one hand and self-protective behavior on the other hand. Since self-efficacy showed to have an insignificant relation with self-protectiveness, the hypothesis that self-efficacy mediates the relations between the instructional method as independent variables and self-protectiveness as dependents variable (hypothesis 3a), could not be confirmed. Therefore, mediation analysis was only conducted with response-efficacy as a mediator.

**Instructional method.** Since the instructional method consisted of different conditions, two dummy variables were constructed. The first dummy variable (contrast 1) looked at the contrast between behaviorally trained (code: 0) and uninformed (code: 1) respondents. The second dummy looked at the contrast between behaviorally trained (code: 0) and informed (code: 1) respondents.

The first regression analysis with the level of self-protectiveness as a dependent variable and instructional method as an independent variable yielded a significant relation for both contrast 1 ( $b = -.31$ ,  $p < .01$ ) and contrast 2 ( $b = -.23$ ,  $p < .01$ ). Since the behaviorally trained condition was coded 0 and the informed and control conditions were coded 1, the negative betas imply that more elaborate instruction leads to higher levels of self-protectiveness. The second regression analysis with the mediator (response efficacy) as the dependent variables and instructional method as the predictor, showed that the instructional method influences response-efficacy (contrast 1 ( $b = -.81$ ,  $p < .01$ ); contrast 2 ( $b = -.52$ ,  $p < .05$ )) significantly. Behaviorally trained respondents experienced higher levels of response efficacy than merely informed and uninformed respondents. Subsequently, a regression analysis with instructional method and the mediator as predictors and self-protectiveness as the dependent variable was conducted. Although the relationship between the instructional method and self-protectiveness became less significant for both contrast groups (contrast 1 ( $b = -.28$ ,  $p < .01$ ); contrast 2 ( $b = -.21$ ,  $p < .01$ )), these relations stayed significant. The relation between response efficacy and self-protectiveness proved to be significant ( $b = .04$ ,  $p < .01$ ), indicating a partial mediation of response efficacy on the relationship between instructional method and self-protectiveness (Fig. 2 and 3). A Sobel test confirmed this effect ( $Z = -3.33$ ,  $p < .01$ ) partially supporting hypothesis 3b.



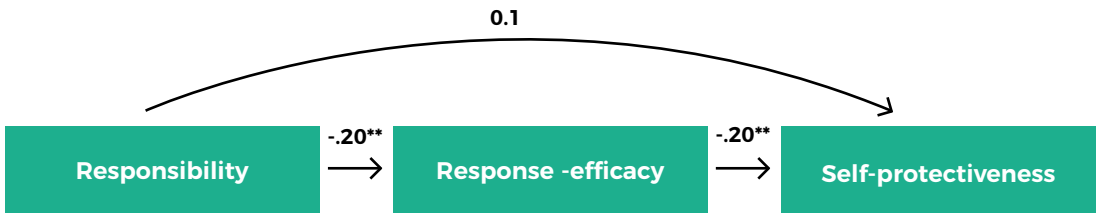
**Fig. 2.** Mediation model efficacy beliefs contrast 1 (behaviorally trained vs. no information) showing betas (N=251)



**Fig. 3.** Mediation model efficacy beliefs contrast 2 (behaviorally trained vs. informed) showing betas (N=389)

**Personal responsibility.** Finally, we also tested whether efficacy beliefs mediate the relationship between personal responsibility and self-protectiveness. Since self-efficacy showed to have an insignificant relation with self-protectiveness, mediation analysis was only conducted with response-efficacy as a mediator.

The first regression analysis with the level of self-protectiveness as a dependent variable and personal responsibility as an independent variable yielded a significant relation ( $b = .01, p < .05$ ). The second regression analysis with the mediator (response-efficacy) as the dependent variable and responsibility as the predictor, showed that personal responsibility influences response-efficacy ( $b = .20, p < .01$ ) significantly. Subsequently, a regression analysis with responsibility and the mediator as predictors and self-protectiveness as the dependent variable revealed that the previously found relationship between responsibility and the intention to take self-protective behavior became non-significant ( $b = .01, n.s.$ ), whereas the mediator response-efficacy showed a highly significant relation ( $b = .20, p < .01$ ), which indicated full mediation of response efficacy (Fig. 4). A Sobel test confirmed that response-efficacy fully mediates the relation between responsibility and the intention of respondents to engage in self-protection ( $Z = 5.07, p < .01$ ), supporting our final hypothesis.



**Fig. 4.** Mediation model response efficacy responsibility showing betas (N=614)

## Discussion

Research on self-protectiveness in a man-made-low-probability-high-consequence risk domain is receiving increasing scholarly attention (Ter Huurne & Gutteling, 2008; Rickard et al., 2014). This study provides new insights in the effect of instructional method on efficacy beliefs and self-protectiveness in this domain. Results show that citizens who are behaviorally trained and have gained experience by this training with risk mitigating options are more inclined to engage in self-protectiveness, possibly because their procedural knowledge has been increased. This research project with participants that actually live in an area prone to the risks related to the transportation of dangerous chemical substances by train thus indicates that adequate risk communication can be effective in stimulating actual self-protective behavior. Also, this study shows support for the idea that personal responsibility is a vital element in enhancing self-protectiveness of citizens. Feeling personally responsible for taking self-protective actions leads to higher levels of self-efficacy and response-efficacy, subsequently leading to a stronger tendency to take protective actions.

To our knowledge, this is one of the first studies aiming at measuring actual levels of self-protectiveness in the public domain. Unlike studies that measure intentions only, this study gives insight in actual behavior of citizens in a real-life setting. Also, no behavioral training has ever been developed within this safety field for as far as we know. This behavioral training with state-of-the-art risk mitigating behaviors is therefore unique and the results are promising, showing that its usage positively influences self-protectiveness.

This study stresses the need for additional and more active ways to inform the public about relevant risks. As the results in this study show, the passive approach often used by the government (merely informing citizens) is not sufficient. Actively informing citizens (by means of a behavioral training) increases levels of efficacy beliefs and self-protectiveness to a significantly larger extent than the passive approach, thus indicating that an active approach is more effective in increasing the resilience of the population. Furthermore, although the passive approach provides the public with relevant risk information, this does not necessarily mean that the receiver also processes this information effectively. Results in this study indicate that more than one-third of the public doesn't feel the need or urgency to read and process the received information, making the risk communication effort ineffective. These results

are societally important since the evidence that self-protective behavior can be stimulated using appropriate risk communication tools is scarce. Although this study specifically focused on the risks related to the transportation of dangerous chemical substances by train, the results might also be relevant to other safety domains – such as for instance occupational health and safety – since a behavioral training might be effective in stimulating a wide range of adequate risk behaviors. A behavioral training might be more beneficial than standard passive techniques of risk communicating in making knowledge on all kinds of adequate risk behaviors stick. This asks for further research on the effect of behavioral trainings on adequate risk behaviors regarding different types of safety risks within several safety fields.

Contrary to our expectations, the perceived feasibility (self-efficacy) proved to be an insignificant predictor of actual self-protectiveness. Whether self-efficacy has an effect on self-protectiveness or not, remains questionable. Some studies show support for a positive relationship between these two constructs (Kievik & Gutteling, 2011; Kievik et al., 2012), whereas this study, in line with others (f.i. Gutteling & de Vries, 2016), did not find a significant effect of self-efficacy on self-protectiveness. We assume that a possible explanation for these differences in results might be due to different risk domains being studied. The type of risk (based on f.i. whether people are familiar with a risk; whether they have ever experienced a certain risk; the novelty of a risk) might influence the perceived feasibility of risk mitigating options. However, since the current study doesn't provide proof for this assumption, further research is necessary in order to look further into the relationship between self-efficacy and self-protective behavior. In the current study, however, we did observe that respondents perceiving risk-mitigating options as useful (response-efficacy), are more inclined to engage in self-protective actions than respondents perceiving the opposite.

Furthermore, response-efficacy turned out to be a (respectively) full and partial mediator between the independent variables personal responsibility and instructional method and the dependent variable self-protectiveness. This indicated that enhancing the perceived usefulness of risk mitigating options provided by the government has a positive influence on the intention to take preventive actions. This study thus shows support for the idea that risk communication can only be effective when recommended risk mitigating actions can be viewed by the public as effective in mitigating the threat (Kievik & Gutteling, 2011). Therefore, risk communication efforts should focus utmost on communicating risk-mitigating options that the target audience perceives useful and each effort should be tailored to the needs of the audience in order to be effective (Collins McLaughlin & Mayhorn, 2014). Providing citizens with the opportunity to practice these behaviors as well as emphasizing their own personal responsibility are two options that might positively influence this perceived usefulness of risk mitigating options.

This study was conducted in a real-life safety setting. From an academic point of view, the nature of this study led to some remaining questions that need to be addressed. First of all, participants attending the behavioral training and that thus were assigned to the 'behavioral training condition', were all citizens that signed up for the training voluntarily. It is not quite clear whether – due to the self-selection – this group differs from the other respondents in

characteristics that might be potentially relevant for the training's success (e.g. some specific interest in the risk). Secondly, although every participant in the main study was randomly selected and the number of participants was fairly high, they were assigned to a condition based on their self-reported received instructional method (behavioral training vs. information vs. no information). The question that thus remains is whether these results would be replicated in a more controlled setting randomly assigning respondents to a condition. Finally, the impact assessment of the behavioral training effectiveness study was conducted immediately after the training session, since the focus was on the immediate effect of the behavioral training. This results in a lack of insight in the trainings' long-term effects. Also, the results in our main study might not be consistent over time. A possible decay of learned information may arise, asking for a longitudinal study to see if attitudes and behavioral changes persist over a longer time period.

Despite these remaining questions, the results found in this study are highly useful and valuable from a more practical point of view. First of all, this study was conducted in a real-life safety setting and can therefore be seen as very similar to a real-life crisis or disaster. The results therefore more adequately describe citizens' actual behavior during a freight train incident than studies that use non-realistic scenarios. Secondly, it is very important that the behavioral training does have a significant impact on attitudes and behavior. Unfortunately it is impossible to ensure that 100% of the public is prepared for a possible crisis or disaster, since risk communication has to compete with a myriad of other messages and activities in citizens' daily lives. However, the respondents that were assigned to the 'behavioral training' condition in this study all voluntarily signed up for the training (maybe due to some sort of foreknowledge and interest in the risk topic). Perhaps this group can be considered as people that might spread their knowledge and motivation to others, and strive to help others in time of need. The fact that the behavioral training is very beneficial for this research group in particular is promising. Thirdly, this study anticipates upon the changing roles of recipients and communicators in the risk communication process. Although governmental institution often still rely upon a passive, one-way approach in communicating risks aimed at enhancing risk awareness, the current study shows proof for the effectiveness of a novel, more active, two-way approach of risk communication aimed at enhancing self-protectiveness.

The current study is one, though a quite promising study in a real-life situation aiming at measuring actual levels of self-protectiveness in the public domain. In order to gain more insight in the effect of behavioral training on self-protectiveness in real-life safety settings, more research on this topic is needed within multiple safety domains. This might increase our knowledge on how to enhance actual self-protective behavior of individuals regarding safety risks and how we can make these behaviors stick. More insights in the conditions under which a behavioral training is beneficial as an addition to standard-passive - more inexpensive - forms of risk communication is highly relevant, since it helps increase our understanding of the cost-effectiveness of different risk communication efforts aimed at increasing the overall resilience of the population.

## Conclusion

The results provide valuable implications for future risk communication efforts directed at preventive actions. First, the results of this study indicate that risk communication can no longer be seen as a passive, one-way process in which citizens are informed using standard techniques. Based on this study, an active two-way approach in which adequate behavior is actively trained, procedural knowledge of risk mitigation is increased and in which people feel they are personally responsible for taking preparatory measures should be the new consensus. Secondly, the results of this study suggest that risk messages aimed at promoting self-protectiveness are effective under the conditions that the advised actions are perceived by the public as useful. Providing such messages that stress the usefulness of risk mitigating options is thus of the utmost importance. The designers of these messages can therefore no longer suffice to take their own perception of message effectiveness as the sole guideline. Messages should be carefully crafted and designed along the lines of behavioral actions that are seen as efficacious by large numbers of people in the target audience. Crafting messages that stress the usefulness of risk-mitigating options and ensuring the active processing of this information by the public most likely will lead to more effectiveness of risk communication campaigns.

# CHAPTER 5

## NO MAN IS AN ISLAND:

**SOCIAL NORM AS A PREDICTOR OF SELF-PROTECTIVE BEHAVIOR OF PRIMARY  
SCHOOL CHILDREN REGARDING REAL-LIFE SAFETY RISKS.**

*This chapter is based on: Kievik, M., Giebels, E., Domrose, J. & Gutteling, J.M. (under review).  
No man is an island: social norm as a predictor of self-protective behaviour of primary school children  
regarding real-life safety risks.*



The adoption of adequate risk behavior by citizens is of the utmost importance in order to deal with real-life threats, including natural hazards and man-made risks. An increasing amount of research has been aiming to understand why and when individuals take risk mitigating measures in order to protect themselves and significant others against risks, crises and disasters (ter Huurne & Gutteling, 2008; Terpstra, 2010; Kievik & Gutteling, 2011; Kievik et al., 2012; Lindell & Perry, 2012; Yang et al. 2014). As a result, our understanding of self-protective behavior of citizens regarding safety risks has developed rapidly. The emphasis of these studies has been on developing theoretical models for predicting self-protective behavior (Witte, 1992; Lindell & Perry, 2012; Kievik & Gutteling, 2011), such as the Protection Motivation Theory (Rogers, 1975) and the Extended Parallel Process Model (Witte, 1992; see also Kievik & Gutteling, 2011; Kievik, Ter Huurne & Gutteling, 2012). Based on ample empirical support, these models posit that levels of perceived risk as well as self-efficacy – the perceived feasibility of risk mitigating options – and response-efficacy – the perceived usefulness of risk mitigating options – are key predictors of self-protectiveness (Rogers, 1975; Witte, 1992; Mileti & Peek, 2000; Witte & Allen, 2000).

One factor that arguably influences self-protectiveness but has not been studied intensively within the safety domain, is the prevalence of social norm. The concept of social norm is a well-known predictor of behavior in social psychological theoretical models, such as the Theory of Planned Behavior (Ajzen, 1991). According to Ajzen (1991), social norm can be defined as the perceived social pressure to perform or not to perform certain behavior. Research shows that people rely on significant others – especially peers – when determining on how to act in a certain situation (Latkin et al., 2003). Research also demonstrates that a more positive social norm leads to more positive behavior (such as healthier choices), especially among children and adolescents (Neighbors et al., 2007). Furthermore, research shows that the form of communication (active vs. passive) used when communicating about desirable behavior might influence the perceived social norm of individuals. An active way of communicating about adequate behavior in which peer interaction is stimulated, is more effective in stimulating a positive social norm and subsequently adequate behavior than a passive way of informing individuals about adequate behavior (Carter et al., 2014). During a crisis or disaster, the social context is of the utmost importance. In times of crisis, citizens may have a variety of sources available to help them cope with the crisis (Verroen, Gutteling & de Vries, 2013). According to Verroen, Gutteling and de Vries (2013), people's behavior in preparing for a crisis as well as their behavior during a crisis is partly predicted by their perceived social norm regarding safe behavior. In the current study and in line with Verroen, Gutteling and de Vries (2013), we define social norm as people's judgment of the perception of significant others towards the risk at hand and possible risk mitigating options.

The focus of the current study will be twofold. First, this study focusses on the effect of social norm on adequate risk behavior and whether social norm, in addition to efficacy beliefs, can predict self-protectiveness. Second, we will more closely look into the effect of different types of risk communication (active vs. passive) on social norm and subsequently self-protective behavior. Since children are increasingly vulnerable to modern day risks (Schwebel & McClure,

2010) and the perceived social norm is of particular importance among children when deciding on how to act in a certain situation (Bandura, 1977; 1986; 2004), this study will focus on the predictive value of social norm on self-protective behavior among primary school children.

## Theory and Hypotheses

Over the last few years, studies have contributed to our understanding why citizens do, or do not, engage in self-protective actions with regard to safety risks (Terpstra & Gutteling, 2008; Lindell & Perry, 2000; Kievik & Gutteling, 2011; Kievik et al., 2012). Based on models from health risk communication, such as the Protection Motivation Theory (Rogers, 1975) and the Extended Parallel Process Model (Witte, 1992), these studies have shown that risk perception and efficacy beliefs are important predictors of self-protectiveness. Firstly, the level of risk perception is an important predictor of adequate risk behavior. Moderate to high levels of risk perception are seen as necessary conditions for individuals to take action (Larsman et al., 2012). The more individuals believe they are susceptible to a serious threat, the more motivated they are to evaluate the efficacy of the recommended response. If the threat is perceived as irrelevant or insignificant, then there is no motivation to further process the message, and people will simply ignore the message. In contrast, when a threat is believed to be serious and relevant, individuals may become motivated to take some sort of action to reduce the induced level of fear (Witte & Allen, 2000).

Secondly, both self-efficacy and response efficacy are often considered significant predictors of self-protectiveness. The EPPM predicts that perceived self-efficacy and response-efficacy jointly determine whether people will become motivated to control the danger or control their fear about the threat. Under these conditions, people carefully think about the recommended responses advocated in the persuasive message and adopt those as a means to control the danger. Alternatively, when people are uncertain about the effectiveness of recommended actions (i.e., the advice is perceived as low on self-efficacy and/or response efficacy), they are motivated to control their fear through denial, defensive avoidance, or reactance (Witte & Allen, 2000). Higher levels of self-protectiveness are seen among citizens who perceive a certain risk as risky and feel that protective actions are useful and feasible in dealing with a threat (ter Huurne & Gutteling, 2008; Terpstra, 2010; Kievik & Gutteling, 2011; Kievik et al., 2012; Lindell & Perry, 2012).

### **Social norm as a predictor of self-protectiveness.**

The influence of social norm on behavior has been studied intensively within social psychology. According to the Social Learning Theory (Bandura, 1977) – later renamed as Social Cognitive Theory (Bandura, 1986) – behavior is most strongly influenced by cognitive processes that occur through observation of social modelling. This process can occur via the observation of a social role model. The memory of this observation will then be used later to inform

an individuals' response when a similar situation arises. In addition, the influence of this observation is usually stronger when the model is an important person, such as a teacher, parent or close friend. Social norm proves to be an important predictor of many types of health-behaviors. Research on for instance smoking (Sunstein, 1996), HIV-prevention (Latkin et al., 2003) and alcohol-usage (Neighbors et al., 2007) all show that the perceived social norm is an important predictor of desirable behavior.

Another social psychological theoretical model indicating that social norm is an important predictor of behavior, is the Theory of Planned Behavior (TPB) (Ajzen & Fishbein, 1980). When predicting behavior, this model identifies three different components. According to the TPB, attitude, perceived behavioral control as well as subjective social norm are predictors of behavior (Armitage & Conner, 2001; McEachen et al., 2012). When comparing the antecedents incorporated in social psychological theoretical models such as the TPB to the antecedents described in models predicting safety behaviors such as the EPPM, considerable similarities can be found in the predictive variables. That is, the factor 'attitude' refers to the level of perceived usefulness of behavior (or the so called response efficacy) as well as the perceived level of threat (or the so called risk perception). The variable 'perceived behavioral control' is comparable to the perceived level of self-efficacy, since it refers to the feasibility of behavior. However, social norm is an element that has not been incorporated in the EPPM as a predictor of adequate behavior and therefore is often not incorporated in research on predictors of self-protectiveness. Indeed, a review study on hazard adjustment conducted by Lindell & Perry (2000) demonstrates that models predicting adequate risk behavior either neglect the social context as a predictor of behavior or provide poor accounts for the social influence on risk mitigating behaviors, recognizing the need for further research on the influence of the social context on behavior.

A model that does incorporate the social context as a predictor of adequate risk behaviors, is the Protective Action Decision Model (Lindell & Perry, 2012). This model derives from the Protection Motivation Theory (Rogers, 1975) and refers to 'social cues' as a predictor of protective action decisions. The model shows that 'social cues' from the social context of individuals - officials, news media and peers - can influence people's own behavior, persuading them to take risk mitigating options (Lindell & Perry, 2000). Furthermore, research on the influence of social norm on self-protective behavior shows that social norm can even have a larger impact on behavior than other factors such as physiology, personality traits, culture or family (Cross & Peisner, 2009). For instance, research shows that the first consumption of alcohol and cigarettes strongly depends on the personal judgment of what significant others - or peers - would approve or disapprove of (Hampson, Andrew & Barckley, 2007; Payton et al., 2000; Godin & Kok, 1996). More recently, research also shows that social norm can be seen as a predictor of safety behaviors. For instance, in a study on driving-behavior, results indicate that adolescent driving is strongly influenced by parenting styles and modeling of behavior (Simons-Morton et al., 2008). Observational studies demonstrate significant concordance between parent and adolescent driving styles. Furthermore, young drivers who have strong parental role models that provide positive feedback about safe driving report

less risk taking and more commitment to safe and less aggressive driving (Simons-Morton et al., 2008; Carter et al., 2014). Research on safety behaviors even shows that the perceived social norm might predict adequate risk behaviors more strongly than perceived levels of efficacy. That is, according to research conducted by Johnston & Warkentin (2006) cyber safety within companies is more strongly predicted by social norm than it is by the judgment of the feasibility and usefulness of self-protective behaviors. Also, in a study conducted on adequate risk behaviors regarding the risks of flooding, users of Twitter see information of peers as trustworthy. These tweets of peers influence individuals' own self-protectiveness significantly (Vieweg, Hughes, Starbird & Palen, 2010).

In the current study we will more closely look into the effect of social norm - over and above the effect of efficacy beliefs - on self-protectiveness. Since children are increasingly vulnerable to risks in our modern society (Schwebel & McClure, 2012) and the perceived social norm seems to be of extreme importance among children when deciding how to behave in a certain situations (Ostrom, 2014), this study focusses on predictors of self-protectiveness among children.

### **A new way of communicating risks - the role of instructional method**

Research shows that people rely on significant others - especially peers - when determining on how to act in a certain situation (Latkin et al., 2003). When significant others show adequate risk behaviors, it is most likely that someone will engage in similar safe behaviors when confronted with comparable risks and threats. That is, according to the Social Cognitive Theory (Bandura, 1986), adequate behaviors can best be stimulated by using role models that demonstrate these healthy and safe behaviors, especially among youth (Bandura, 2004). The instructional method used when communicating about risks (a passive or an active way) might therefore influence the perceived social norm of individuals. When an active way of communicating about risks is used, in which interaction with peers is stimulated, this might lead to a better and more adequate insight of the social norm of these peers in relation to behavior (Berk, 2009; Cross & Peisner, 2009). During interaction, peers are able to discuss their attitudes towards safe behavior and they are able to observe how significant others behave in certain unsafe situations. Since research shows that peer interaction in small groups positively influences perceived social norm and behavior (Webb, 1989; Anderson et al., 2001), we suggest that the instructional method used when communicating about risks (active vs. passive), influences social norm and subsequently behavior. That is, when risk communication occurs in an active manner (e.g. behavioral training) in which peers are able to interact and function as role models in small groups, this might positively influence individuals' social norm towards safe behavior and subsequently self-protectiveness. Passive forms of risk communication (e.g. presentations / written text) in which interaction with peers is less likely and not stimulated, might not as strongly influence the perceived social norm towards safe behavior and therefore will probably lead to less adequate risk behavior.

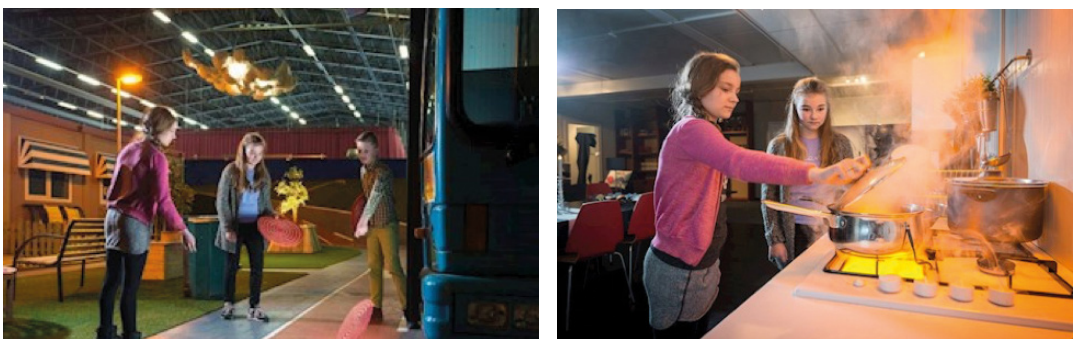
## Current study

The aim of the present study is to gain insight in the added value of social norm as a predictor of self-protective behavior over and above the effect of the well-studied predictors self-efficacy and response-efficacy. With regard to the effect of social norm on self-protectiveness, we hypothesize that **(1)** the more positive the perceived social norm of participants regarding safe behavior, the more self-protective behavior participants will show. Moreover, we hypothesize that **(2)** social norm predicts variance in self-protectiveness over and above the efficacy beliefs (self-efficacy and response-efficacy). Furthermore, since research indicates that the way in which risk communication is conducted (the instructional method: active vs. passive) might influence the perceived social norm as well as levels of self-protectiveness (Bandura, 1986; 2004), we finally hypothesize that **(3)** behaviorally trained participants show a more positive social norm and higher levels of self-protectiveness than passively informed and uninformed participants.

## Method

### Research context

We conducted our study in The Risk Factory (fig. 1) – a state-of-the-art safety education center in which children experience real-life-risks first hand and learn how to deal with dangerous situations (Brandweer Twente, 2016). The Risk Factory is located in Twente – a region in the eastern part of The Netherlands. The purpose of the Risk Factory is to increase the self-protectiveness of children regarding real-life safety risks – both natural hazards as well as man-made risks – by showing them the usefulness and feasibility of self-protective behaviors regarding safety risks (e.g. traffic safety; internet safety; emergency situations and fire safety). In the Risk Factory, small groups of children (6 to 8) receive relevant risk information regarding a safety risk from experts and are then stimulated to actively practice corresponding self-protective behaviors together with peers. Since the Risk



**Fig. 1.** Pictures of the Risk Factory illustrating two different safety scenario's (traffic safety and fire safety) (Brandweer Twente, 2017).



Factory stimulates an active way of learning adequate risk behaviors regarding safety risks as well as peer interaction in small groups, we used the Risk Factory as an area for experimentation. In the current study, we focused on primary school children (age: 9-13) as our population for three reasons. First, children are our future and an increasingly greater role for children is conferred as a social group to influence norms, values, policies and practice in society (Hill & Tisdall, 2014). This stresses the importance to communicate risks particularly with this group. Second, research shows that especially among children, knowledge and skills can be learned easily and transformed into action (Broström, Johansson, Sandberg, & Frøkjær, 2014). This gives support for the idea that communicating about risks and teachings individuals how to deal with unsafe situations is especially effective during childhood. Third, since the amount of risks in our society increases and children become increasingly vulnerable to these modern day risks, the necessity of learning children how to cope with risks and threats - as an addition to basic skills such as reading, writing and arithmetic - becomes more evident (Livingstone, Haddon, Görzig, & Ólafsson, 2010; Schwebel & McClure, 2010).

In this study, we focused on two risk topics within the Risk Factory - "fire safety" and "emergency situations". We chose these two topics since concrete and easy-to-understand self-protective behaviors can be communicated with the children regarding these risks. Also, we wanted to use two risks differing in level of familiarity (with fire safety being a well-known risk and emergency situations being more novel) to see whether this influences the effect of risk communication on levels of self-protectiveness. A state-of-the-art behavioral training was developed together with Fire department Twente regarding "fire safety" and "emergency situations" in order to see whether actively practicing relevant risk behaviors in small groups with peers leads to a more positive social norm and subsequently higher levels of self-protectiveness among children (Bandura, 1986; Webb, 1989; Anderson et al., 2001; Bandura, 2004). We made sure that in both scenarios children's risk perception was enhanced and that self-protective behaviors were provided that are feasible and useful, as is in accordance with predictors of self-protectiveness (Witte, 1992). Also, peer interaction in small groups (6 to 8 children) was actively stimulated.

### Participants.

A total of 365 primary school children from 14 primary school classes in the region of Twente (183 female, 182 male,  $M_{\text{age}}=11.2$  years, age range: 9 - 13 years) participated in the study. Primary schools in Twente visit the Risk Factory on a regular basis as part of their educational program. The schools participating in this study were invited by the Fire Department Twente and signed up for the experiment voluntarily. The ethical board of the University of Twente approved the current study and an informed consent from the parents of the children was received prior to the study. Children that already visited the Risk Factory or had previously attended an educational program concerning "fire safety" or "emergency situations" were excluded from the experiment. This did however not occur.

## Procedure

All participating children from the 14 school classes were randomly assigned to one of three conditions (behavioral training vs. passive information vs. no information).

Behavioral training condition (n = 113) - The children assigned to the behavioral training condition visited the Risk Factory. When children arrived at the Risk Factory, they were divided in small groups of 6 to 8 children and then guided by an expert – usually a fireman - along the different scenarios. In the “fire safety” scenario (fig. 2), risks related to fire in their own living environment (e.g. the kitchen) were shown and the importance of a smoke detector and effective emergency plan in case of a fire were discussed. Subsequently, children were asked to actively practice the following self-protective behaviors in small groups:

- 1) Check several areas (e.g. kitchen; bedroom; living room) for existing fire risks;
- 2) Install a smoke detector and make an emergency plan for their own home;
- 3) Call 112 (the Dutch emergency number).

In the “emergency situation” scenario (fig. 2), children were shown by means of a video which emergency situations can occur in Twente (e.g. a prolonged power outage; storm; flu epidemic). Afterwards, it was discussed that one can recognize an emergency situation because of 1) receiving a message from NL Alert – a mobile phone application similar to the texting service (Bouwmeester et al., 2012) - or 2) hearing the Dutch emergency sirens go off. They were told what to do in such situations and asked to practice the following behaviors in the same small groups:

- 1) Go inside and close all windows and doors;
- 2) Shut down ventilation systems;
- 3) Tune the radio in to the emergency station, or tune on the TV;
- 4) Install NL-Alert on your mobile devices.

At the end of each scenario, feedback was provided by the expert on the children’s behavior. The total duration of the visit to the Risk Factory was approximately two hours.

Passive-information condition (n = 112) – the children in the passive-information condition received the same information as the children in the behavioral training condition. These children did not visit the Risk Factory. However, they received the information at school by means of a PowerPoint-presentation. The content of the presentation was exactly the same as the information provided to the children that visited the Risk Factory. Both “fire



**Fig. 2.** Pictures of the Risk Factory illustrating two different safety scenario’s (traffic safety and fire safety) (Brandweer Twente, 2017).

safety” and “emergency situations” were extensively discussed. An expert explained to children why these risks are risky and which self-protective behaviors are useful and feasible in order to diminish the risks. However, the children were not allowed to practice the self-protective behaviors nor was peer interaction stimulated. For that reason this condition was called passive-information. The total duration of the presentation was approximately one and a half hours.

**Table 1. Conditions based on received instructional method (n = 365).**

Condition 1 - n = 113	Condition 2 - n = 112	Condition 3 - n = 140
Behaviourally trained	Passively informed	Uninformed
Visited the Risk Factory where self-protective behaviours were actively practiced with peers.	Received information at school by means of a presentation. No activity, no interaction.	Received no information at all. No activity, no interaction.

No-information condition (n = 140) - The children in the no-information condition received no information at all. A post-test was conducted among all respondents by means of a questionnaire (Table 1).

Between the three conditions, no difference was found in gender ( $\chi^2(2) = 1.56, n.s.$ ). A significant difference was however found between the three conditions in age ( $F(2,362) = 8.67, p < .01$ ). The age of respondents in the behavioral training condition was slightly higher ( $M = 11.37$ ) than the age of respondents in the passive information condition ( $M = 10.95$ ) ( $p < .01, 95\% CI [.22, .36]$ ) and the no information condition ( $M = 11.11$ ) ( $p < .05, 95\% CI [.07, .45]$ ).

### Measures

All respondents were asked to fill out a questionnaire measuring levels of risk perception, self-efficacy, response-efficacy, social norm and self-protective behavior approximately a week after the manipulation (behavioral training and passive information condition). The no information condition filled out the same questionnaire at the same time as the other two groups. The questionnaire was based on a previously validated questionnaire (ter Huurne, 2008). This questionnaire, unless otherwise stated, measured responses on five-point Likert scales, with extremes strongly disagree (1) to strongly agree (5). Since we wanted to see whether responses of participants differ between risks, we constructed different scales on each variable for fire safety and emergency situations.

**Risk perception.** Level of risk perception regarding fire safety was measured using a three-item scale ( $\alpha = .79$ ). Respondents were asked to indicate how dangerous they thought certain situations concerning fire safety are and how they would feel in these situations. Level of risk perception regarding emergency situations was measured using a three-item scale ( $\alpha = .83$ ). Respondents were asked to indicate how dangerous they thought certain situations concerning emergency situations are and how these situations would make them feel.

**Self-efficacy.** Level of self-efficacy with regard to fire safety was measured using a seven-item scale ( $\alpha = .74$ ). Respondents were asked to indicate to what extent they thought they could



prepare themselves for the risks related to fire safety. Level of self-efficacy regarding emergency situations was measured using a five-item scale ( $\alpha = .67$ ). Respondents were asked to indicate to what extent they thought they could prepare themselves for emergency situations.

**Response efficacy.** Level of response efficacy regarding fire safety was measured using a five-item scale ( $\alpha = .65$ ) and measured to what extent respondents thought certain behaviors such as evacuating are useful in case of a fire. Level of response efficacy with regard to emergency situations was measured using a six-item scale ( $\alpha = .67$ ). Respondents were asked to indicate to what extent they thought the risk mitigating options such as going inside and shutting doors and windows are useful in case of an emergency situation.

**Social norm.** Social norm regarding fire safety was measured using a seven-item scale ( $\alpha = .70$ ). Respondents were e.g. asked to indicate what they thought their best friend would do in certain risky situations concerning fire safety. Social norm regarding emergency situations was measured using a five-item scale ( $\alpha = .72$ ). Respondents were e.g. asked to indicate what they thought their best friend would do in certain risky situations concerning emergency situations.

**Self-protective behavior.** Self-protective behavior regarding fire safety was measured using an eleven-item scale ( $\alpha = .64$ ). Respondents were asked to indicate what they would do in certain risky situations concerning fire safety (e.g. call 112; evacuate; warn neighbors). Self-protective behavior regarding emergency situations was measured using a four-item scale ( $\alpha = .69$ ). Respondents were asked to indicate what they would do in certain risky situations concerning emergency situations (e.g. go inside; close doors and windows; warn an adult).

## Results

### Descriptive statistics

Table 2 presents the correlations and descriptive statistics of the main variables in our study. Within the fire safety scenario, highly significant correlations can be found between the dependent variable self-protectiveness and the predictors risk perception ( $r = .31$ ), self-efficacy ( $r = .49$ ), response efficacy ( $r = .34$ ) and social norm ( $r = .37$ ). With regard to emergency situations, a significant correlation between risk perception and self-protectiveness is found ( $r = .27$ ). Interestingly, even stronger correlations are observed between self-protective behavior and levels of self-efficacy ( $r = .57$ ), response efficacy ( $r = .76$ ) and social norm ( $r = .71$ ).

**Table 2. Correlations between the main variables of the representative sample (n = 365).**

	Risk perception	Self-efficacy	Response-efficacy	Social norm	Self-protectiveness	Means scores	St. deviations	
	Emergency situations							
Risk perception		.13**	.26**	.26**	.27**	3.58	.91	
Self-efficacy	.28**		.52**	.46**	.57**	3.65	.99	
Response- efficacy	.19**	.22**		.65**	.76**	4.15	.73	
Social norm	.24**	.39**	.28**		.71**	3.92	.78	
Self-protectiveness	.31**	.49**	.34**	.37**		4.26	.82	
Mean scores	3.39	4.21	4.58	4.03	4.41			
St. deviations	.88	.61	.47	.51	.52			

\*\* significant at .01 level Fire safety is placed in the rows and emergency situations in the columns.

### Manipulation check risk perception

Since research shows that moderate to high levels of risk perception are seen as necessary conditions for individuals to take action (Larsman et al., 2012), we wanted to make sure that the children in our behavioral training condition and passive information condition perceived the risk of fire and emergency situations as dangerous and that higher levels of risk perception were observed when compared to the control group. As can be seen in table 3, significant differences were found between the three conditions in risk perception for both the fire safety scenario ( $F(2,362) = 7.51, p < .01, \eta^2 = .04$ ) as well as the emergency situation scenario ( $F(2,362) = 5.51, p < .01, \eta^2 = .03$ ). Respondents who visited the Risk Factory or were passively informed at school showed elevated levels of risk perception. Their level of perceived risk was significantly higher than the risk perception of respondents who received no information.

**Table 3. Mean scores of risk perception between conditions for both fire safety and emergency situations.**

	Behaviourally trained	Behavi-ourally trained	Passively informed	Passively informed	Uninformed	Uninformed
	n = 113	n = 113	n = 112	n = 112	n = 140	n = 140
	Fire	Emergency	Fire	Emergency	Fire	Emergency
Risk perception	3.45 <sup>a</sup> *	3.71 <sup>c</sup> *	3.16 <sup>c</sup> *	3.69 <sup>c</sup> *	3.19 <sup>ab</sup> *	3.38 <sup>ab</sup> *

All variables were measured on a scale from 1 (low levels) till 5 (high levels)

<sup>a</sup> significant difference with trained, <sup>b</sup> significant difference with informed, <sup>c</sup> significant difference with uninformed

## Relationship between independent variables and level of self-protectiveness.

The effect of the predictor social norm on self-protective behavior was tested using linear regression analysis. With regard to the fire safety scenario, self-protectiveness is significantly predicted by the perceived social norm ( $\beta = .17, p < .01$ ), next to self-efficacy ( $\beta = .38, p < .01$ ) and response-efficacy ( $\beta = .20, p < .01$ ). Together, these variables accounted for 31% of the variance in self-protectiveness ( $R^2 = .31$ )<sup>1</sup>. Using a two stage hierarchical multiple regression with self-protectiveness as the dependent variable, the added value of social norm as a predictor of self-protectiveness regarding fire safety was tested. At stage one, self- and response-efficacy were entered and at stage two social norm was entered. The hierarchical multiple regression revealed that at stage one, self-efficacy and response-efficacy contributed significantly to the regression model ( $F(2,362) = 72.70, p < .01$ ) and accounted for 28.3% of the variation in self-protectiveness. Introducing social norm explained an additional 2.3% of the variation in self-protectiveness and this change in  $R^2$  was significant ( $F(1,361) = 11.91, p < .01$ ).

With regard to emergency situations, self-protectiveness is significantly predicted by the perceived social norm ( $\beta = .23, p < .01$ ), next to self-efficacy ( $\beta = .10, p < .01$ ) and response-efficacy ( $\beta = .67, p < .01$ ). Together, these variables even accounted for 80% of the variance in self-protectiveness ( $R^2 = .80$ )<sup>1</sup>. Using a two stage hierarchical multiple regression with self-protectiveness as the dependent variable, the added value of social norm as a predictor of self-protectiveness regarding emergency situations was tested. At stage one, self- and response-efficacy were entered and at stage two social norm was entered. The hierarchical multiple regression revealed that at stage one, self-efficacy and response-efficacy contributed significantly to the regression model ( $F(2,362) = 614.14, p < .01$ ) and accounted for 77.1% of the variation in self-protectiveness. Introducing social norm explained an additional 2.8% of the variation in self-protectiveness and this change in  $R^2$  was significant ( $F(1,361) = 49.88, p < .01$ ). These results are fully in line with our first and second hypotheses, indicating that (1) the more positive the perceived social norm of participants regarding safe behavior, the more self-protective behavior participants will show. Moreover, (2) social norm explained an additional 2.3% (regarding fire safety) and 2.8% (regarding emergency situations) of the variation in self-protectiveness, indicating that social norm predicts additional variance over and above the effect of efficacy beliefs.

<sup>1</sup> Within the regression model, we controlled for age and gender with these factors not effecting the model.

## Effect instructional method on social norm and self-protectiveness

Our final hypothesis on the effect of the instructional method on social norm and self-protective behavior was tested with an analysis of variance. With regard to the fire safety scenario, as can be seen in table 4, between the three conditions significant differences were found in levels of social norm ( $F(2,362) = 10.24, p < .01, \eta^2 = .05$ ) and self-protective behavior ( $F(2,362) = 7.26, p < .01, \eta^2 = .04$ ). Respondents who visited the Risk Factory or were passively informed at school about fire safety showed a significantly more positive social norm than respondents who received no information. However, no significant difference was found between the behavioral training condition and the passively informed condition (95%  $CI [-.22, .09]$ , n.s.).

Also, significant differences in levels of self-protectiveness were found between respondents who visited the Risk Factory and respondents who were passively informed on the one hand and the no-information condition on the other hand. No significant difference between the behaviorally trained and passively informed condition was found (95% *CI* [-.13, .19], *n.s.*). These results partially support our final hypothesis (3) that behaviorally trained participants show a more positive social norm and higher levels of self-protectiveness than passively informed and uninformed participants.

With regard to the emergency situation scenario, significant differences between the three conditions were found in levels of social norm ( $F(2,362) = 49.21, p < .01, \eta^2 = .21$ ) and self-protective behavior ( $F(2,362) = 92.91, p < .01, \eta^2 = .34$ ). Respondents who visited the Risk Factory scored significantly higher on social norm and self-protectiveness than respondents who were passively informed at school or were uninformed. Passively informed respondents scored significantly higher on these variables than uninformed respondents. Although no differences were found between behaviorally trained and passively informed respondents in the fire safety scenario, in the emergency situation scenario behaviorally trained participants did score significantly higher on social norm and self-protectiveness than passively informed respondents, fully supporting our final hypothesis (3).

**Table 4. Mean scores of social norm and self-protectiveness between conditions fire safety and emergency situations.**

	Behaviourally trained	Behaviourally trained	Passively informed	Passively informed	Uninformed	Uninformed
	n = 113	n = 113	n = 112	n = 112	n = 140	n = 140
	Fire	Emergency	Fire	Emergency	Fire	Emergency
Social Norm	4.09 <sup>c**</sup>	4.31 <sup>bc**</sup>	4.15 <sup>c**</sup>	4.08 <sup>ac**</sup>	3.89 <sup>ab**</sup>	3.92 <sup>ab**</sup>
Self-protectiveness	4.51 <sup>c*</sup>	4.75 <sup>bc**</sup>	4.48 <sup>c*</sup>	4.51 <sup>ac**</sup>	4.28 <sup>ab*</sup>	3.67 <sup>ab**</sup>

\*\* significant at .01 level \* significant at .05 level

All variables were measured on a scale from 1 (low levels) till 5 (high levels)

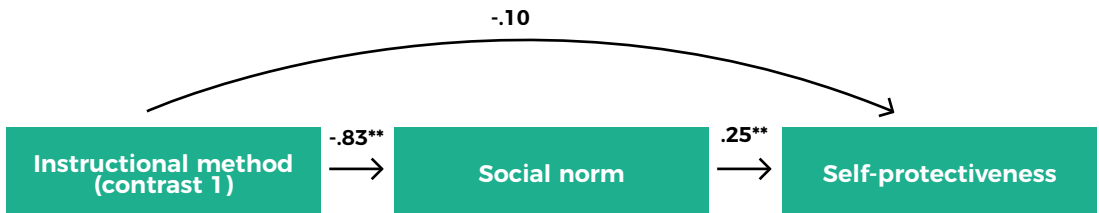
<sup>a</sup>significant difference with trained, <sup>b</sup>significant difference with informed, <sup>c</sup>significant difference with uninformed

### Risk communication effectiveness

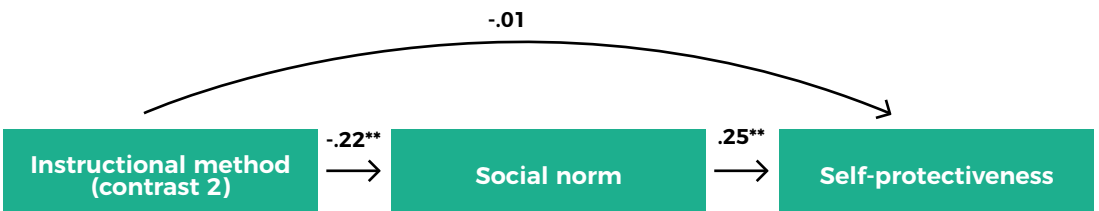
Finally, as an addition, we wanted to see which form of instructional method used (active vs. passive) is most effective in enhancing social norm and subsequently self-protectiveness. The best way to test our assumption that active forms of risk communication have the most positive effect on the perceived social norm and subsequently self-protective behavior, is by means of a mediation analysis (Baron & Kenny, 1986). Using mediation analysis, we tested our assumption that social norm mediates the relationship between instructional method on the one hand and self-protective behavior on the other hand. Significant differences between the three conditions in social norm and self-protective behavior were only found

within the emergency situation scenario. Therefore, we will focus on this scenario only. Since the instructional method consisted of different conditions, two dummy variables were constructed (Hayes & Preacher, 2014). The first dummy variable (contrast 1) looked at the contrast between behaviorally trained (code: 0) and uninformed (code: 1) respondents. The second dummy looked at the contrast between behaviorally trained (code: 0) and passively informed (code: 1) respondents.

The first regression analysis with the level of self-protectiveness as a dependent variable and instructional method as an independent variable yielded a significant relation for both contrast 1 ( $b = -1.08, p < .01$ ) and contrast 2 ( $b = -.26, p < .05$ ). Since the behaviorally trained condition was coded 0 and the passively informed and uninformed conditions were coded 1, the negative betas imply that more elaborate instruction leads to higher levels of self-protectiveness. The second regression analysis with the mediator (social norm) as the dependent variable and instructional method as the predictor, showed that the instructional method influences social norm (contrast 1 ( $b = -9.45, p < .01$ ); contrast 2 ( $b = -.22, p < .01$ )) significantly. Behaviorally trained respondents showed a more positive social norm than passively informed and uninformed respondents. Subsequently, following the procedure of Baron and Kenny (1986), a regression analysis with instructional method and the mediator as predictors and self-protectiveness as the dependent variable was conducted. The relation between social norm and self-protectiveness proved to be highly significant ( $b = 0.25, p < .01$ ), whereas the relationship between the instructional method and self-protectiveness became insignificant for both contrast groups (contrast 1 ( $b = -.10, n.s.$ ); contrast 2 ( $b = -.01, n.s.$ )). These results indicate a full mediation of social norm for the relationship between instructional method and self-protectiveness (Fig. 3 and 4). A Sobel test (Baron & Kenny, 1986) confirmed



**Fig. 3.** Mediation model social norm contrast 1 (behaviourally trained vs. no information) showing betas (N=253)



**Fig. 4.** Mediation model social norm contrast 2 (behaviourally trained vs. passively informed) showing betas (N=225)

this effect (resp.  $Z = 5.79, p < .01$ ;  $Z = 2.28, p < .05$ ). Instruction methods that allow and stimulate social interaction between the participants increase perceived social norm most optimally which leads to a higher level of self-protectiveness.

## Discussion

This study provides new insights in the predictive value of social norm on self-protective behavior of children. Although the concept of social norm is a well-known predictor of behavior (Ajzen, 1991; Godin & Kok, 1996; Payton et al., 2000; Hampson, Andrew & Barckley, 2007), it has not been studied intensively within the safety domain. The current study shows that social norm – together with self-efficacy and response-efficacy – are important predictors of self-protective behavior regarding safety risks among children. These results indicate that when preparing individuals for a disaster or crisis by means of risk communication, one ideally should also take the social context of recipients into account. When a crisis or disaster occurs, the perceived social norm regarding safe behavior – people’s judgment of the perception of significant others towards the risk at hand and possible risk mitigating options – proves to significantly predict people’s own behavior above and beyond well-known predictors such as efficacy beliefs. Citizens that have a positive social norm and perceive risk mitigating options as both feasible (high levels of self-efficacy) and useful (high levels of response-efficacy) are most likely to engage in adequate risk behaviors. Thus, it seems advisable to focus on the social context of citizens as an addition to providing risk mitigating options that are both useful and feasible.

The current study also recognizes the need for more active – and socially active – ways of communicating about risks. To our knowledge, this is one of the first studies showing that a more active way of receiving information (by means of a behavioral training) leads to a more positive social norm and subsequently higher levels of self-protectiveness than standard-passive-techniques of risk communication. Passively informing people about risks thus seems to be insufficient when aiming at enhancing the resilience of the population optimally and stimulating a positive social norm towards adequate risk behavior. Our results also indicate that a positive social norm is of additional value when trying to enhance self-protectiveness. A more positive social norm towards risk mitigating behaviors positively influences the relationship between instructional method (behavioral training vs. passive information vs. no information) and self-protectiveness. This indicates that for people who think significant others have a positive attitude towards safe behaviors, an active way of risk communication leads to an even higher levels of self-protectiveness (Anderson et al., 2001).

Contrary to our expectations, the influence of instructional method on social norm and self-protectiveness was only found within an emergency situation context. In the fire safety scenario, no differences between behaviorally training and passively informing respondents were found. We speculate that this might be due to the familiarity or novelty of both risks. Since fire safety is a familiar risk for children and they are well aware of some of the risk

mitigating options, actively practicing self-protective behaviors may not lead to a significant increase in the judgement of self-efficacy and response-efficacy nor will it lead to a more positive social norm. Their past experience might already have led to a decision on how to act in case of a fire. Emergency situations is a relatively new and unfamiliar risk for respondents. Actively practicing corresponding risk mitigating options might help them decide whether self-protective behaviors are useful and feasible and it provides insights into the behavior of peers regarding safe behavior in case of emergencies. Further research on this topic is needed. This study was conducted in the Risk Factory – a state-of-the-art safety education center in which children (age 9 – 13) experience real-life-risks first hand and learn how to deal with dangerous situations. Although a meta-analysis shows that age does not affect the processing of risk messages (Witte & Allen, 2000) and the current results are promising showing that the predictors of self-protectiveness among adults also apply to a population of children, more research is needed in order to be able to generalize results over different populations. A second remaining question that needs to be addressed is whether the results found in this study remain consistent over time. In the current study, measures were taken approximately one week after the intervention took place. Since the emphasis of risk communication is to make sure that citizens are resilient during a crisis or disaster, the effect of risk communication should preferably be persistent over time. It thus seems advisable to conduct a longitudinal study to see if attitudes and behavioral changes persevere over a longer time period. Finally, since different results were found between the two different risk topics in this study (fire safety and emergency situation) in the effect of instructional method on social norm and self-protectiveness, the question remains whether the type of risk is of importance when determining the risk communication method used to communicate about a certain risk or threat. These findings ask for a better understanding of individuals' black boxes - the psychological concepts underlying their decision to engage in self-protective behavior - regarding different safety risks. More insight in the influence of different types of risk communication on these concepts as well as self-protectiveness regarding different safety risks, may lead to more knowledge on effective ways to tailor risk communication in order to increase the resilience of the population.

This study anticipates upon the changing roles of recipients and communicators in the risk communication process. Although governmental institution often still rely upon a passive, one-way approach in communicating risks to enhance citizens' risk awareness, the current study provides proof for the effectiveness of a novel, more active, two-way approach of risk communication aimed at enhancing self-protectiveness. The social context proves to be an important additional element that needs to be considered when communicating about risks in the future.

## Conclusion

The results provide valuable implications for future risk communication aiming at increasing the resilience of the population. First, the results indicate that the social context of individuals is of the utmost importance when determining on how to act in case of a crisis or disaster. Citizens that have a positive social norm regarding safe behaviors, are more willing to engage in self-protectiveness. This stresses the need to incorporate social norm in current risk communication campaigns. It also provides new opportunities by using peers and significant others as role models when communicating about risks. Second, the results of this study suggest that risk messages aimed at promoting self-protectiveness are effective under the conditions that the advised actions are perceived by the public as useful and feasible. Providing such messages that stress the usefulness and feasibility of risk mitigating behaviors, together with enhancing a positive social norm, is therefore important. Finally, the results of the current study suggest that under certain circumstances, active ways of communicating about risks might be beneficial when trying to enhance the perceived social norm and self-protectiveness. This stresses the need for risk communication that is designed in order to actively prepare citizens for crises or disasters in groups of peers, using messages that are seen by the audience as useful and feasible. This will most likely lead to more effective risk communication campaigns.





CHAPTER 5 - NO MAN IS AN ISLAND



# CHAPTER 6

## THE KEY TO RISK COMMUNICATION SUCCESS.

**THE LONGITUDINAL EFFECT OF BEHAVIORAL TRAINING AND REPEATING RISK**

**MESSAGES ON ACTUAL SELF-PROTECTIVE BEHAVIOR.**

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The key to risk communication success. The longitudinal effect of behavioral training and repeating risk  
messages on actual self-protective behavior. *Journal of risk research.**



With the increase of safety risks in modern society, the necessity of enhancing citizens' self-protectiveness by means of risk communication efforts is recognized by governments and gaining scholarly attention (Rickard et al., 2014). Over the last few decades, risk communication has emerged as a widely used tool seeking to make people aware of risks and threats in their environment. The emphasis of risk communication is to increase citizens' self-protectiveness by offering them tools to cope with risks and threats that may cause harm in the future (McComas, 2006). Risk communication stimulates changing thoughts about risks as well as enhancing knowledge on how to deal with a risk and stimulating self-protective behavior (e.g. Witte & Allen, 2000; Ruiters, Abraham & Kok, 2001). These self-protective behaviors should be consistent over time in order to be able to behave adequately in times of crisis or disaster (Shi & Smith, 2016).

Although risk communication is an often-used tool in order to inform citizens about risks, probabilities, responsibilities and risk mitigating behaviors, it proves to be more difficult than might be expected (Visscher et al., 2009). Research on the effectiveness of risk communication often focusses on the way in which information about risks can best be communicated to the public, studying the effectiveness of several presentation formats – such as frequencies, percentages, graphs, verbal information and risk ladders – on risk awareness and adequate risk behavior (Stone, Yates & Parker, 1997; Fischhoff, 1995; Weinstein, 1999). Although these studies provide valuable insight in the effect of using different frames and formats within risk communication in order to enhance risk comprehension and self-protectiveness, questions about the precise elements and content – such as form, frequency and predictors of self-protectiveness - that make risk communication a success, remain (Visscher et al., 2009).

The current paper adds to the literature on self-protectiveness by testing the added value of repetitive risk messages on (predictors of) self-protective behavior in both the short- and long-term. While a large amount of literature in advertising and persuasion try to explain the influence of message repetition on attitudes and behavior (Zajonc, 1968; Berlyne, 1971; Cacioppo & Petty, 1989), within the risk communication literature the effect of message repetition on self-protectiveness has not been studied intensively (Witte, 1992, 1994; Shi & Smith, 2016). The current research adds to the literature in three ways. Firstly, this study focuses on the added effect of repeating risk messages on self-protectiveness over and above the effect of behavioral training. Since recent research indicates that a behavioral training is more effective in increasing self-protectiveness than standard-passive techniques of risk communication or providing no information at all (Burke et al., 2011; Kinatader, 2013), we therefore use a behavioral training as a form of risk communication in this research. Secondly, it does not only investigate the intentions to engage in self-protective measures, but also the actual level of self-protectiveness. Until now most studies only focus on intentions instead of actual behavior, whereas research shows that the intention of someone to behave in a certain manner does not necessarily lead to actual behavior (Ajzen & Cote, 2008). Thirdly, we deliberately chose a population of primary school children because only few studies have included this specific population while children are increasingly vulnerable to modern day risks (Schwebel & McClure, 2010).

# Theory and Hypotheses

## Message repetition

A large volume of literature exists providing evidence that message repetition shapes people's emotions (Zajonc, 1968, 2001), attitudes towards advertising (Nordhielm, 2002) and persuasive credibility (Koch & Zerback, 2013). For instance, in the field of advertisement, a large amount of literature has investigated the effects of repetition on behavior (Berlyne, 1970, 1971; Pechmann & Stewart, 1988, 1989; Campell & Keller, 2003). The two-factor theory is an often used theory explaining advertising repetition effects (Berlyne, 1971). The theory states that an inverted U-curve exists for the effect of message repetition on behavior, indicating that the first few exposures to an add – the wear-in phase – leads to a significant positive effect on attitudes and behavior. During the wear-out phase that occurs after a few exposures, the add no longer influences attitudes nor behavior and message repetition in this phase might even have a negative effect (Pechmann & Stewart, 1988). Later experimental research on the occurrence of the wear-in and the wear-out phase shows consistently that advertisement wear-out begins after the fourth exposure when negative thoughts increasingly outnumber positive thoughts (Schumann, Petty & Clemons, 1990; Campell & Keller, 2003), indicating that message repetition positively influences attitudes and behavior up to and including four message repetitions.

In the broader field of persuasion, which has been studied since the 1970s, research provides inconsistent evidence on the effect of message repetition on people's attitudes and behavior (Cacioppo & Petty, 1979, 1989; Garcia-Marques & Mackie, 2001). According to Cacioppo and Petty (1979, 1989) a moderate level of message repetition leads to more positive attitudes towards the message and more favorable behavior of message receivers. This is especially the case for messages containing strong arguments, since message repetition in these cases gives receivers the opportunity to scrutinize the arguments, enhancing message elaboration. In contrast, research conducted by Garcia-Marques and Mackie (2001) shows that message repetition has a negative effect on attitudes towards the message: even a single message repetition led to a decrease in favorable attitudes towards the message.

Within the risk communication domain, the effect of message repetition on self-protectiveness has not been studied intensively (Beck & Frankel, 1981; Witte, 1992; Shi & Smith, 2016). Although research on the effect of repeating risk messages on behavior is scarce, a recent study conducted by Shi and Smith (2016) does shed some light on the effect of message repetition on self-protectiveness. In their study, they focused on the effect of repeating risk messages aiming at increasing individuals' risk awareness regarding skin cancer. Following the Extended Parallel Process Model (Witte, 1992), Shi and Smith (2016) studied the effect of fear appeal message repetition on perceived threat, efficacy beliefs and the intention of individuals to take risk-mitigating options, with efficacy beliefs consisting of self-efficacy – the perceived feasibility of risk mitigating behaviors – and response efficacy – the perceived usefulness of risk mitigating behaviors. The results show that after repeated exposure to a fear appeal message– a video message on preventing melanoma – the perceived threat

as well as the perceived efficacy of respondents increased significantly. These results were found shortly after the risk messages were provided as well as in the long-term. However, the behavioral intention of all recommended behaviors did not change after repeated exposure. Similar findings were found in research conducted by Lu et al. (2015), showing that repeating risk messages on the dangers of consuming energy drinks enhances the risk perception of the message receivers. Respondents thought that energy drinks were more dangerous after receiving a risk message multiple times. Furthermore, respondents' perception of the usefulness of provided risk mitigating options increased significantly after message repetition. The perceived feasibility of individuals also increased after repeating the risk message, however not significantly. However, no significant increase in intentions to engage in self-protective behavior was observed indicating that message repetition in this study did not lead to higher levels of self-protectiveness.

### **A new way of communicating risks and enhancing self-protective behavior**

When communicating about risks in order to increase self-protectiveness, the type of risk communication used in order to increase the resilience of the population is rather monotonous often providing one single risk message only (Kinatader, 2013). Although providing information seems promising, research shows that this rather passive approach does not optimally stimulate the adoption of self-protective behavior of citizens (Kinatader, 2013). Previous research in different safety domains shows that self-protective behavior can be more effectively adopted through highly engaging instructional methods such as behavioral trainings (Burke et al., 2011; Kinatader, 2013; Kievik et al., under review). Active and highly engaging risk communication efforts are more effective in enhancing self-protectiveness behavior (Burke et al., 2011; Kievik et al., under review) and is correlated with important predictors of self-protective behavior (Terpstra & Gutteling, 2008; Kievik & Gutteling, 2011; Kievik et al., 2012).

Over the last few decades, a growing body of research focused on studying the antecedents that predict self-protective behavior and the way risk messages can stimulate the adoption of risk mitigating behaviors (Witte, 1992; Gore & Bracken, 2005; Witte & Allen, 2000; Terpstra & Gutteling, 2008; Kievik & Gutteling, 2011; Kievik et al., 2012). Following the Extended Parallel Process Model (Witte, 1992), these studies show that when an individual is confronted with a risk message, the individual's risk perception together with the perceived feasibility (i.e. self-efficacy) and perceived usefulness (i.e. response efficacy) of risk mitigating behavior jointly determine whether people will become motivated to control the danger or their fear. High levels of risk perception together with the perception that provided risk mitigating options are useful and feasible, will lead to the adoption of risk mitigating behavior (Terpstra & Gutteling, 2008; Lindell & Perry, 2012; Kievik & Gutteling, 2011, Kievik et al., 2012). Additionally, research also shows that the perceived social norm - people's judgment of the perception of significant others towards the risk at hand and possible risk mitigating options - is a significant predictor of adequate risk behaviors as well (Lindell & Perry, 2012; Verroen, Gutteling & de Vries, 2013). The social context of individuals - officials, news media and peers - can influence people's

own behavior, persuading them to take risk-mitigating options (Lindell & Perry, 2000). Especially peers can influence individuals' own behavior, since information of peers are seen as trustworthy and their attitudes as important (Vieweg, Hughes, Starbird & Palen, 2010). During a behavioral training, risk-mitigating behaviors can be actively practiced. This increases their perceived risk perception as well as the perceived feasibility and the perceived usefulness of risk mitigating behaviors (Sitzman, 2011; Kinatader, 2013). When peer interaction is stimulated, a more positive social norm is also to be expected among participants of behavioral training (Latkin et al., 2013; Bandura, 2004), leading to higher levels of self-protectiveness when compared to standard-passive forms of risk communication merely informing citizens about risks or providing no information at all. In a study conducted by Kievik, Giebels, Domrose & Gutteling (under review) among children (age: 9 - 13), results show that respondents receiving a behavioral training in which peer interaction is stimulated show a significantly more positive social norm as well as higher intentions to take risk mitigating behavior than respondents receiving risk information passively by means of a presentation and respondents receiving no information.

## Current study

**Children as research population.** In the current study, we will focus on primary school children (age 9 - 13) as our population for several reasons. Firstly, research shows that especially among children, knowledge and skills can be learned easily and transformed into action (Broström, Johansson, Sandberg & Frøkjær 2014). This provides support for the idea that teaching individuals how to deal with unsafe situations is most effective during childhood. Secondly, since the amount of risks in our society increases and children become increasingly vulnerable to these modern day risks, it is necessary to teach children how to deal with these risks. As an addition to basic skills such as reading, writing and arithmetic, it becomes more evident to learn children how to cope with risks and threats in their environment (Livingstone, Haddon, Görzig & Ólafsson 2010; Schwebel & McClure 2010). Thirdly, since children are our future and they will influence norms, values, policies and practice in society over the coming years (Hill & Tisdall 2014), communicating about risks and desirable risk mitigating behaviors with this specific group becomes more relevant.

**Aim of the current study.** The aim of the current study is to more closely look into the effect of message repetition on predictors of self-protectiveness (risk perception, efficacy beliefs and social norm), the intention to engage in self-protective behaviors as well as actual levels of self-protectiveness. Furthermore, this study focusses on the long-term effect of active ways of communicating about risks (by means of a behavioral training) and risk message repetition on intention as well as actual levels of self-protectiveness.

In the present study, the following hypothesis is tested regarding the predictors of self-protectiveness:

**H1.** Repeating risk messages will lead to higher levels of risk perception, efficacy beliefs and a

more positive social norm than providing one risk message only or providing no risk message at all. With regard to the intentions as well as actual levels of self-protectiveness, the following hypotheses are tested:

**H2a.** Repeating a risk message will exhibit a larger short- and long-term increase of intentions as well as actual self-protective behavior than providing one risk message only or providing no risk message at all.

**H2b.** Providing one single risk message (by means of a behavioral training) will exhibit a larger short- and long-term increase of intentions as well as actual self-protective behavior than providing no risk message at all.

## Method

### Research context

We conducted our research in the Risk Factory - a new and innovative concept aiming at enhancing self-protectiveness of primary school children by means of behavioral training (Brandweer Twente, 2017). The Risk Factory is a state-of-the-art safety education center in which children (age: 9 - 13) experience real-life-risks first hand and learn how to deal with dangerous situations. The Risk Factory is located in Twente - a region in the eastern part of the Netherlands. In the Risk Factory, nine interactive and realistic 'scenarios' - such as fire safety, emergency situations, internet safety and the risks of using alcohol - have been developed in order to enable visitors to experience risks first hand. At first, in every risk scenario, the risk perception of participants is enhanced by emphasizing the severity of the risk at hand. Then,



**Fig. 1.** Pictures of the Risk Factory illustrating two different safety scenario's (traffic safety and internet safety) (Brandweer Twente, 2017).

participants get the opportunity to actively practice with corresponding risk mitigating option, increasing levels of self-efficacy - the perceived feasibility - and response efficacy - the perceived usefulness - of these self-protective behaviors. In every scenario, small groups of children (6 to 8) receive the risk information from experts - mostly firemen - and are then stimulated to actively practice corresponding self-protective behaviors together with

peers. The Risk Factory thus stimulates an active way of learning adequate risk behaviors in small groups of peers by means of a behavioral training, making it an excellent area for experimentation.

### Risk topics and the behavioral training

In the current study, we test the assumption that repeating risk messages will lead to higher levels of (predictors of) intentions to engage in self-protective behavior and actual self-protective behavior than providing a single risk message or no risk message at all (hypothesis 1). We also test the long-term effect of a behavioral training and risk message repetition on (predictors of) self-protectiveness (hypotheses 2a and 2b). The current study is a partial replication of another study we conducted in the Risk Factory in which we tested the assumption that a behavioral training is more favorable in increasing (predictors of) self-protectiveness than passive forms of risk communication (Kievik, Giebels, Domrose & Gutteling, under review). In that study, we focused on the intentions of children to take risk mitigating behaviors regarding two risk topics: “fire safety” and “emergency situations” (such as prolonged power outage; storm; flu epidemic). Whereas for “emergency situations” a behavioral training proved to be more effective when trying to increase (predictors of) self-protectiveness, within the “fire safety” scenario no differences were found between the behavioral training condition (visiting the Risk Factory) and the passive information condition (receiving information at school by means of a presentation). We hypothesized that this might be due to the familiarity or novelty of both risks. Since “fire safety” is a familiar risk for children and they are well aware of some of the risk mitigating options, actively practicing self-protective behaviors may not lead to a significant increase in the judgement of self-efficacy and response-efficacy nor will it lead to a more positive social norm or higher levels of self-protectiveness. Their past experience might already have led to a decision on how to act in case of a fire. “Emergency situations” is a relatively new and unfamiliar risk for respondents. Actively practicing corresponding risk mitigating options might help them decide whether self-protective behaviors are useful and feasible and it provides insights into the behavior of peers regarding safe behavior in case of emergencies.

Since a behavioral training seems to be beneficial in enhancing (predictors of) self-protectiveness, this form of risk communication will be used in our current study testing the effect of message repetition on actual self-protective behavior in both the short- and long-term. However, since the added effect of a behavioral training was only found for “emergency situations”, in the current study we chose to focus on “emergency situations” as well as two other scenario’s within the Risk Factory both being novel for children but with easy to understand risk mitigating options – “internet safety” and “calling the Dutch emergency number (112)”.

### Participants

A total of 265 primary school children from 12 primary school classes in Twente (153 female, 112 male,  $M_{age}=11.4$  years, age range: 10 - 13 years) participated in the study. Children that already visited the Risk Factory or had previously attended an educational program concerning “emergency situations”, “internet safety” or “calling 112” were excluded from the experiment. No children had to be excluded.



## Procedure

All participating children from the 12 primary school classes participating in this study were randomly assigned to one of three conditions (behavioral training repetition vs. behavioral training vs. no information). In order to be able to provide a risk message repetition, we developed a 'serious game' – an online game aimed at learning individuals how to cope with realistic threats in their environment by providing a realistic scenario in which adequate risk behaviors can be actively practiced (Connolly et al., 2012; Mayer et al., 2014). The serious game was developed for all three scenario's, with the information provided and the risk mitigating options practiced in the serious game being entirely similar to the scenario's practiced in the Risk Factory.

Behavioral training repetition (n = 71) - The children assigned to the behavioral training repetition condition visited the Risk Factory and were asked to participate in a serious game later on as a means of risk message repetition. When children arrived at the Risk Factory, they were divided in small groups of 6 to 8 children and then guided along the different scenarios. The "emergency situation" was similar to the scenario used in our pilot study. In the "internet safety" scenario, children received information on "online bullying" and learned how to make a proper judgment of the trustworthiness of online requests (such as a friendship request from someone on Facebook). After receiving the information, children practiced judging the trustworthiness of several fake accounts and practiced how to deal with online request from unfamiliar people. Furthermore they received pop-ups asking for personal information such as their name and phone number and were asked to properly handle these requests by ignoring the pop-ups. In the "calling 112" scenario, children received information on the Dutch emergency number 112. They learned to determine in which situations it is important to call the emergency number and in which situations you should ask for an ambulance, the police department or the fire department. They were also told that it is important to have an ICE (In Case of Emergency) number in your own mobile telephone, in order for others to be able to quickly contact significant others in case of emergency. Finally, they were asked to call 112 and to make sure that either the ambulance, police or fire department received all necessary information in order to rescue someone in danger. The total duration of the visit to the Risk Factory was approximately two hours. Two weeks after the visit to the Risk Factory, all children were asked to play the 'serious game' at school in which the risk messages received during the Risk Factory visit were repeated.

Behavioral training (n = 90) - the children in the behavioral training condition visited the Risk Factory and received exactly the same information as the children in the behavioral training repetition condition. However, they were not allowed to play the serious game and thus received the information only one single time.

No-information condition (n = 104) - The no-information condition received no information (table 1).

**Table 1. Conditions based on number of risk messages received (n = 265).**

Condition 1 - n = 71	Condition 2 - n = 112	Condition 3 - n = 140
Behavioral training repetition	Behavioral training only	Uninformed
Visited the Risk Factory and played the serious game.	Merely visited the Risk Factory.	Received no information at all.

Between the three conditions, no difference was found in gender ( $\chi^2(2) = 2.78, n.s.$ ). A significant difference was however found between the three conditions in age ( $F(2,262) = 4.67, p < .01$ ). The age of respondents in the behavioral training condition was slightly lower ( $M = 11.27$ ) than the age of respondents in the behavioral training repetition condition ( $M = 11.46$ ) and the no information condition ( $M = 11.52$ ).

**Measures**

Longitudinal data was collected by means of a questionnaire with a pre-test, a post-test three weeks after the behavioral training in the Risk Factory and a second post-test 3 months after the Risk Factory visit.

**Table 2. Timeframe measurements**

Behavioral training repetition condition (n = 90)	O <sub>1</sub>	X <sub>1</sub>	X <sub>2</sub>	O <sub>2</sub>	O <sub>3</sub>
Behavioral training condition (n = 71)	O <sub>1</sub>	X <sub>1</sub>		O <sub>2</sub>	O <sub>3</sub>
No information condition (n = 104)	O <sub>1</sub>			O <sub>2</sub>	O <sub>3</sub>

O<sub>1</sub> = pre-test O<sub>2</sub> = post-test after 3 weeks, O<sub>3</sub> = post-test after 3 months, X<sub>1</sub> = Risk Factory, X<sub>2</sub> = serious game after 2 weeks

All respondents - including the ones in the no information condition - were asked to fill out the questionnaires at the same point in time, measuring levels of risk perception, self-efficacy, response-efficacy, social norm and intentions to engage in self-protective behavior. In the post-test 3 months after the Risk Factory visit, actual levels of self-protectiveness were also measured.

The questionnaire was based on a previously validated questionnaire (Ter Huurne, 2008). Since we wanted to minimize a possible test-retest effect, we measured responses - unless otherwise stated - on a ten-point Likert scale, with extremes strongly disagree (1) to strongly agree (10). Since respondents were asked to fill out the same questionnaire three times, we used as few items as possible to measure the several constructs.

**Risk perception.** Level of risk perception was measured using a reliable four-item scale ( $\alpha = .61$ ) focusing on indicating respondents' perceived risk towards emergency situations and internet safety. Respondents were asked to indicate how dangerous they thought certain situations concerning emergency situations are and how these situations would make them feel.

Furthermore, respondents were asked to indicate whether they thought they were susceptible for risks related to internet safety (*How likely do you think it is that someone unfamiliar will ask you for your name and address online?*). No items with regard to respondents' risk perception regarding "calling 112" were added to this scale, since no risks are related to this scenario.

**Self-efficacy.** Level of self-efficacy was measured using a reliable four-item scale ( $\alpha = .67$ ) asking respondents to what extent they thought they could prepare themselves for a crisis or disaster (related to emergency situations), how feasible they thought it is to call 112 and whether they thought they are capable of providing adequate information to when calling 112 (related to "calling 112") and how capable they thought they are in recognizing situation in which it is unwise to provide personal information online (related to "internet safety").

**Response efficacy.** Response efficacy regarding emergency situations was measured on a reliable four-item scale ( $\alpha = .64$ ) asking respondents to indicate how useful they think it is to leave the crisis site in case of a disaster and to go home and shut doors and windows (related to emergency situations), how useful they think it is to call 112 in case of an emergency ("Calling 112") and how useful they think it is to enter personal information such as name and phone number on websites they are not familiar with (related to internet safety). This last items was converted before analyzing the data.

**Social norm.** Social norm regarding emergency situations was measured using an open ended question asking respondents *"What do you think your best friend would do when the emergency sirens go off?"*, scoring 1 point for every risk mitigating option mentioned being adequate in this situation. Since three risk-mitigating options were actively practiced in this study, respondents received a score from 0 (no correct risk mitigating option) to 3 (all correct risk mitigating options). Social norm regarding "calling 112" and "internet safety" was measured using a reliable three-item scale ( $\alpha = .64$ ) asking respondents how likely they thought it would be that their best friend would call 112 in case of emergency, how likely they think it is that their best friend enters personal information on an unknown website and how likely they think it is that their best friend accepts a friendship request from someone he or she doesn't know (with the first question referring to the "calling 112 scenario" and the last two questions referring to the "internet safety" scenario).

**Intention to take self-protective behavior.** The intention of respondents to take self-protective behavior regarding emergency situations was measured using one open ended question asking respondents: *"What would you do when the emergency sirens go off?"*, scoring 1 point for every risk mitigating option mentioned being adequate in this situation. Since three risk-mitigating options were actively practiced in this study, respondents received a score from 0 (no correct risk mitigating option) to 3 (all correct risk mitigating options). With regard to "calling 112" intention of self-protectiveness was measured using one item asking respondents how likely they think it is for them to call 112 in case of an emergency. Intention of self-protectiveness regarding internet safety was measured using one item asking respondents whether they would leave personal information on an unfamiliar website.

**Actual self-protective behavior.** Actual self-protectiveness was only measured for internet safety and "calling 112", since it is ethically impossible to measure actual behavior during

a crisis or disaster. With regard to calling 112, actual behavior was measured by checking whether children had added an ICE-contact on their mobile devices. Children who added an ICE-contact scored a 1. Children who didn't scored a 0. Actual self-protectiveness regarding internet safety was only measured in the second post-test (3 months after the Risk Factory visit) by means of a pop-up. In the final post-test, respondents were asked to fill out the questionnaire on a computer. A pop-up was developed asking respondents for their name and e-mail address. While filling out the final questionnaire, respondents received the pop-up in which they were asked to enter their personal information in order to enter a race for winning an iPhone. If respondents entered their personal information, they scored a 0. If respondents did not enter their personal information and denied the pop-up, they scored a 1.

## Results

### The effect of message repetition on predictors of self-protectiveness

With regard to the effect of risk message repetition on risk perception, self-efficacy, response efficacy and social norm, hypotheses 1 was tested with an analysis of variance (ANOVA). Using Post Hoc analysis, we more closely looked into the differences between the three conditions on time 2 (3 weeks after the interventions) and subsequently on time 3 (3 months after the interventions). At time 1 (before the interventions) no significant differences between conditions were found in risk perception ( $F(2,255) = 1.66$ , n.s.), self-efficacy ( $F(2,256) = 1.89$ , n.s.), response-efficacy ( $F(2,257) = 0.08$ , n.s.), nor social norm ( $F(2,236) = 1.40$ , n.s.), indicating that the attitudes regarding adequate risk behaviors of all respondents were similar prior to the study. Table 3 provides an overview with mean scores and standard deviations of all predictors of self-protectiveness regarding the first (post-test), second (three weeks after the Risk Factory visit) and third measurement (three months after the Risk Factory visit) of all three conditions. Significant differences between conditions will be discussed in more detail.

**Table 3. Mean scores and standard deviations of the predictors.**

	Behavioral training repetition (n = 71)		Behavioral training (n = 90)		No information (n = 104)	
<i>Measurement 1: post-test (time 1)</i>						
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Risk perception	5.80	1.54	5.99	1.62	5.60	1.37
Self-efficacy	7.53	1.30	7.93	1.30	7.79	1.20
Response-efficacy	7.80	1.30	7.87	1.49	7.79	1.18
Social norm emergency	.42	.86	.25	.61	.27	.54
Social norm other scenario's	6.89	1.64	7.33	1.67	7.17	1.35
<i>Measurement 2: 3 weeks after intervention (time 2)</i>						
Risk perception	5.87	1.32	5.75	1.54	5.66	1.35
Self-efficacy	8.00	1.08	8.31	1.24	7.95	1.22
Response-efficacy	8.36 <sup>c**</sup>	1.18	8.61 <sup>c**</sup>	1.04	7.83 <sup>ab**</sup>	1.04
Social norm emergency	1.41 <sup>c†</sup>	1.28	1.37 <sup>c†</sup>	1.25	.32 <sup>ab†</sup>	.62
Social norm other scenario's	7.59 <sup>c†</sup>	1.33	7.23	1.72	6.90 <sup>a†</sup>	1.29
<i>Measurement 3: 3 months after intervention (time 3)</i>						
Risk perception	5.42	1.38	5.47	1.86	5.40	1.53
Self-efficacy	8.15	1.18	8.48	1.04	8.16	1.28
Response efficacy	8.87 <sup>c**</sup>	1.08	8.66 <sup>c**</sup>	1.12	7.95 <sup>ab**</sup>	1.06
Social norm emergency	1.59 <sup>bc†</sup>	1.22	1.19 <sup>ac†</sup>	1.01	.81 <sup>ab†</sup>	1.00
Social norm other scenario's	7.73 <sup>c**</sup>	1.26	7.42	1.92	6.74 <sup>a**</sup>	1.14

\*\* significant at .01 level \* significant at .05 level All variables were measured on a scale from 1 (low levels) till 10 (high levels) except for social norm with regard to emergency situation. This was measured from 0 (negative) till 3 (positive).

<sup>a</sup>significant difference with trained and repeated, <sup>b</sup>significant difference with trained, <sup>c</sup>significant difference with uninformed

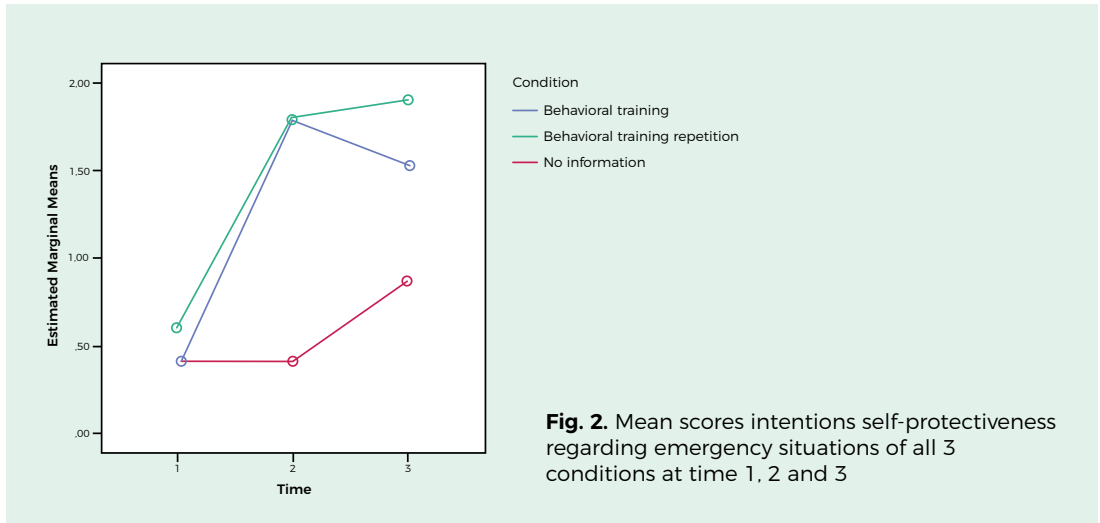
Time 2 - results 3 weeks after the first intervention (the training) show that significant differences are found between the three conditions in level of perceived response-efficacy ( $F(2,241) = 12.13, p < .01, \eta^2 = .09$ ) and level of perceived social norm regarding emergency situations ( $F(2,241) = 29.87, p < .01, \eta^2 = .20$ ) as well as the other risk scenario's ( $F(2,224) = 4.05, p < .05, \eta^2 = .04$ ). Respondents in the behavioral training repetition condition as well as the behavioral training condition scored significantly higher on the perceived usefulness of risk mitigating options than respondents in the no information condition. However, between the behavioral training repetition condition and the behavioral training condition, no differences in response-efficacy were found. With regard to social norm, respondents in the behavioral

training repetition condition and the behavioral training condition showed a significantly more positive social norm than respondents in the no information condition with regard to “calling 112” and “internet safety”. With regard to emergency situations, a significant difference was only found between the behavioral training repetition condition and the control condition. Time 3 - results 3 months after the first intervention took place, as expected, similar to results found 3 weeks after the interventions. As can be seen in table 3, significant differences are found between the three conditions in level of perceived response-efficacy ( $F(2,241) = 16.70, p < .01, \eta^2 = .12$ ) and level of perceived social norm regarding emergency situations ( $F(2,241) = 29.87, p < .01, \eta^2 = .20$ ) as well as the other risk scenario's ( $F(2, 224) = 8.33, p < .01, \eta^2 = .07$ ). Respondents from the behavioral training repetition condition and the behavioral training condition perceived risk mitigating options as more useful than respondents who received no information. However, no differences between the behavioral training repetition and behavioral training condition were found. Furthermore, respondents from the behavioral training repetition condition and the behavioral training condition showed a significantly more positive social norm towards adequate risk behavior than respondents from the no information condition. These results were found for both the emergency situation scenario as well as the other risk scenarios. Interestingly, after 3 months, the behavioral training repetition group also showed a significantly more positive social norm towards adequate risk behavior regarding emergency situations than respondents who merely visited the Risk Factory. The results discussed above show that message repetition leads to a significant higher increase of perceived social norm regarding emergency situations when compared to providing a single risk message (only visiting the Risk Factory) or providing no information, only partially supporting our second hypothesis. With regard to the other predictors, no significant differences between message repetition (the behavioral training repetition condition) and providing a single risk message (only visiting the Risk Factory) were found. Significant differences between these two conditions and the no information condition were observed.

### The effect of message repetition on (actual) self-protectiveness

Our final set of hypotheses (2a and 2b) proposed that risk message repetition will lead to a higher short-term as well as long-term increase in intentions and actual self-protective behavior than providing one single risk message or providing no risk message at all. Furthermore, we proposed that one single risk message by means of a behavioral training will exhibit a larger short- and long-term increase of intentions as well as actual self-protective behavior than providing no risk message at all. Using analysis of variance (ANOVA), differences between conditions are studied, using Post Hoc analysis to look more closely into the differences between conditions. We will study the three risk scenarios - emergency situations, “calling 112” and internet safety - separately for intentions and behavior. Using Repeating Measures analysis of variance, we tested the effect of the amount of risk messages provided on intentions as well as actual behavior over time. The pre-test - time 1 - revealed no significant differences between the three conditions in intentions to take self-protective

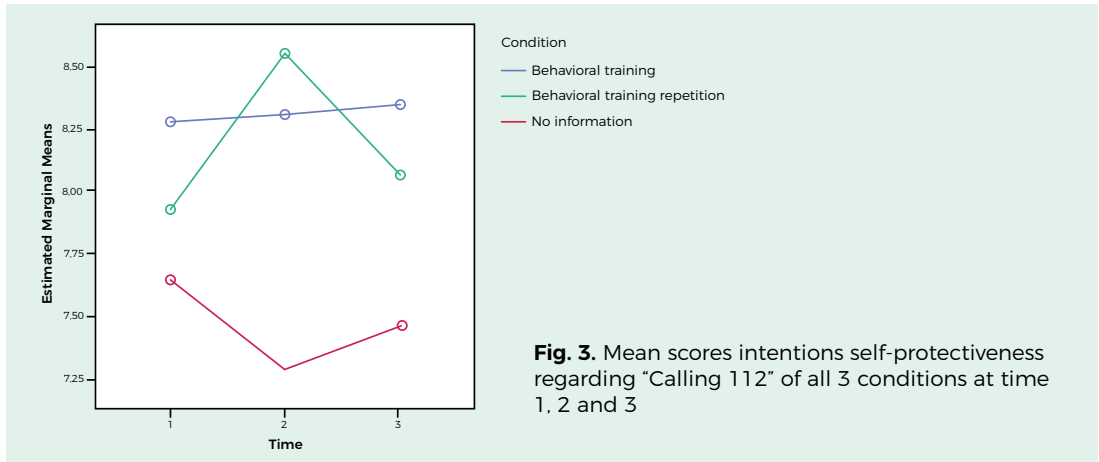
actions regarding emergency situations ( $F(2,262) = 1.90$ , n.s.), “calling 112” ( $F(2,262) = 2.47$ , n.s.), nor internet safety ( $F(2,262) = 2.32$ , n.s.). Also, no difference in actual behavior - installing an ICE-contact on a mobile phone - was found between the three conditions ( $F(2,262) = 1.86$ , n.s.).



**Fig. 2.** Mean scores intentions self-protectiveness regarding emergency situations of all 3 conditions at time 1, 2 and 3

**Between conditions analysis for intentions.** Between the three conditions, a significant difference in intentions to take self-protective behavior was found at time 2 (3 weeks after the interventions) with regard to the emergency situations scenario ( $F(2,243) = 49.13$ ,  $p < .01$ ,  $\eta^2 = .29$ ) and the “calling 112” scenario ( $F(2,230) = 12.37$ ,  $p < .01$ ,  $\eta^2 = .10$ ). For the internet safety scenario, no significant difference was found ( $F(2,243) = .91$ , n.s.). Post Hoc analysis revealed that respondents in the behavioral training repetition condition ( $M = 1.79$ ,  $SD = 1.30$ ;  $M = 8.57$ ,  $SD = 1.54$ ) and the behavioral training condition ( $M = 1.77$ ,  $SD = 1.14$ ;  $M = 8.29$ ,  $SD = 2.13$ ), scored significantly higher than the no information condition ( $M = .42$ ,  $SD = .73$ ;  $M = 7.35$ ,  $SD = 2.08$ ) on intentions to engage in self-protective behaviors regarding emergency situations and “calling 112” respectively. After three months, a significant difference between the three conditions in intentions to take self-protective behaviors with regard to emergency situations ( $F(2,242) = 19.20$ ,  $p < .01$ ,  $\eta^2 = .14$ ) still existed (fig. 2), with respondents in the behavioral training repetition condition ( $M = 1.87$ ,  $SD = 1.09$ ) scoring significantly higher than respondents in the behavioral training ( $M = 1.50$ ,  $SD = .97$ ) and no information conditions ( $M = .88$ ,  $SD = 1.03$ ). Furthermore, respondents in the behavioral training condition scored significantly higher than respondents in the no information condition. After three months, the significant difference between conditions in the “calling 112” scenario disappeared ( $F(2,242) = 4.39$ , n.s.), with mean scores of the behavioral training repetition group dropping drastically ( $M = 8.11$ ,  $SD = 1.54$ ), whereas mean scores of the behavioral training condition ( $M = 8.40$ ,  $SD = 1.87$ ), and no information condition ( $M = 7.54$ ,  $SD = 2.10$ ), increased slightly (fig. 3).

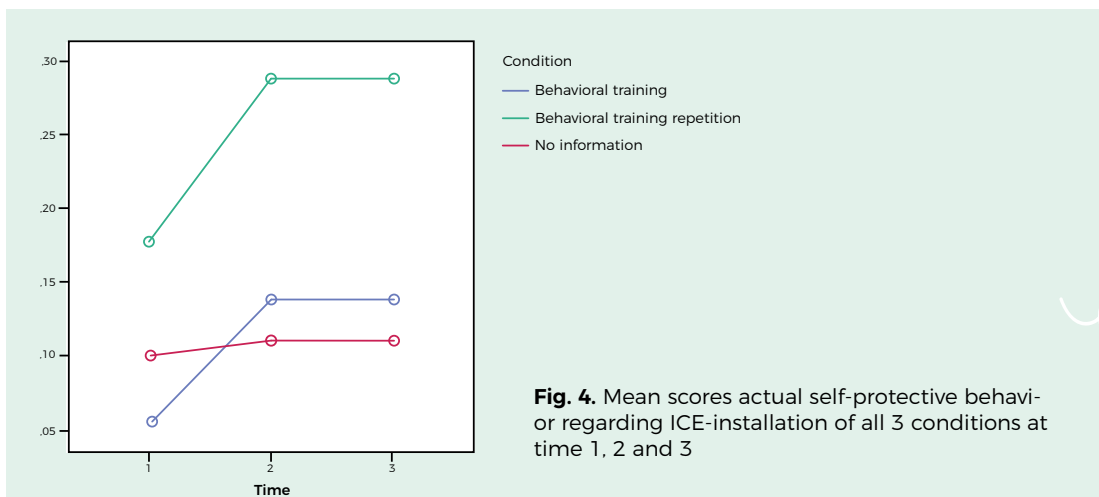
**Within-subject analysis for intentions.** When the three groups are compared for the emergency situations scenario over time using a within-subject Repeated Measures analysis, a



**Fig. 3.** Mean scores intentions self-protectiveness regarding "Calling 112" of all 3 conditions at time 1, 2 and 3

significant effect of Time ( $F(2,454) = 104.81, p < .01, \eta^2 = .32$ ), and a Time x Condition interaction ( $F(2,3928) = 18.78, p < .01, \eta^2 = .14$ ) is found, indicating that both the behavioral training repetition condition and the behavioral training condition showed a significant larger long-term increase of intention to take risk mitigating behavior than the no information condition (fig. 2). These effects were not found for both the "calling 112" scenario and the internet safety scenario, since no significant differences were found at respectively time 3 and time 2 and 3.

**Between conditions analysis for actual behavior.** Between the three conditions, a significant difference in the installation of an ICE-contact on their mobile phones was found after 3 weeks ( $F(2,215) = 3.61, p = .03, \eta^2 = .03$ ) as well as after 3 months ( $F(2,224) = 3.89, p = .02, \eta^2 = .03$ ). Post Hoc analysis revealed that respondents in the behavioral training repetition condition scored significantly higher on actual self-protectiveness on respectively time 2 and time 3 ( $M = .26, SD = .44; M = .23, SD = .42$ ) than the behavioral training condition ( $M = .13, SD = .33; M = .11, SD = .32$ ) and the no information condition ( $M = .10, SD = .31; M = .09, SD = .29$ ). The behavioral training condition scored significantly higher on actual self-protective behavior than the no information condition. With regard to internet safety (the pop-up), no differences between



**Fig. 4.** Mean scores actual self-protective behavior regarding ICE-installation of all 3 conditions at time 1, 2 and 3



the three conditions were found in actual behavior, since 97% of all respondents showed the adequate risk behavior ( $F(2,99) = 0.11$ , n.s.).

**Within-subjects analysis for actual behavior.** When comparing the three conditions over time with regard to the actual installation of an ICE-contact on their mobile phones using a within-subject Repeated Measures analysis, a significant effect of Time ( $F(2,388) = 4.39$ ,  $p < .05$ ,  $\eta^2 = .02$ ) is found. However, no Time x Condition interaction ( $F(2,3992) = .84$ , n.s.) was found. Results indicate that self-protective behavior increases after the interventions with significant differences found between the three conditions. These results remain consistent over time (fig. 4).

The results discussed above show partial support for our final hypotheses, indicating that a behavioral training exhibits both a larger short- and long-term increase of intentions as well as actual self-protective behavior than providing no risk message (fully supporting hypothesis 3b). Risk message repetition only seems to be beneficial for actual behavior, but does not show a larger increase in intention when compared to a single risk message by means of a behavioral training (partially supporting hypothesis 3a).

## Discussion

The current paper adds to the literature on self-protectiveness by testing the added value of repetitive risk messages on (predictors of) self-protective behavior in both the short- and long-term. While a large amount of literature in advertising and persuasion indicates that message repetition positively influences attitudes and behavior (Zajonc, 1968; Berlyne, 1971; Cacioppo & Petty, 1979), within the risk communication literature the effect of message repetition on self-protectiveness has not been studied intensively (Witte, 1992, 1994; Shi & Smith, 2016). The current study shows that risk message repetition positively influences actual self-protective behavior in both the short- and long-term. Respondents that visited the Risk Factory and received a risk message repetition showed a larger increase in actual self-protectiveness – installing an ICE-contact on their mobile devices – than respondents merely visiting the Risk Factory and respondents receiving no information at all. Furthermore, a significant larger increase in intentions to take self-protective actions with regard to emergency situations was observed among the respondents receiving a risk message repetition when compared to respondents receiving a single risk message or receiving no risk message at all in the long-term. These results indicate that when preparing citizens for a disaster or crisis by means of risk communication, one way of enhancing levels of self-protectiveness in the long-term is by means of risk message repetition. These results are novel, since a limited amount of studies is available on the predictive value of risk message repetition on self-protectiveness. Since recent studies on the effect of risk message repetition showed that repeating risk messages does not increase the self-protectiveness of citizens (Lu et al., 2015; Shi & Smith, 2016), to our knowledge, the current study is one of the first studies providing evidence that risk message repetition might be beneficial when trying to increase actual self-protectiveness

over time. We speculate that this might be due to the form of risk communication used. Whereas for instance the study conducted by Shi and Smith (2016) used a passive form of risk communication by means of a video, the active way of risk communication used in the current study might be beneficial in enhancing self-protective behavior in the long-term. The current study also recognizes the need for more active ways of communicating about risks. This study shows that active ways of communicating risks – with the Risk Factory as an example – leads to higher levels of risk perception, self-efficacy, response-efficacy, social norm as well as self-protectiveness than standard-passive-techniques of risk communication or providing no information at all. To our knowledge, this is one of the first studies showing that a more active way of receiving information (by means of a behavioral training) leads to higher levels of self-protectiveness than standard-passive-techniques of risk communication. These often used standard-passive forms of risk communication in which intensive elaboration of risk information by practicing risk mitigating options is not stimulated, do not optimally increase (predictors of) self-protectiveness. Using active forms of risk communication might be one of the keys to risk communication success.

Contrary to our expectations, risk message repetition did not add to the effect of behavioral training when focusing on the predictors of self-protectiveness. No significantly larger increase in risk perception, self-efficacy and response-efficacy was observed when compared to respondents merely visiting the Risk Factory. Only for social norm, a larger increase was found within the behavioral training repetition group on the long-term when compared to the behavioral training and no information conditions. Furthermore, results show that risk message repetition only leads to an increase of (intentions to take) self-protective actions with regard to emergency situations and “Calling 112”. For internet safety, no short- nor long-term effect of message repetition on self-protectiveness was found. These differences between risk scenarios might be due to the way in which we measured self-protective behavior regarding internet safety. In the second post-test, respondents were asked to fill out the questionnaire on a computer. A pop-up was developed asking respondents for their name and e-mail address. While filling out the final questionnaire, respondents received the pop-up in which they were asked to enter their personal information in order to enter a race for winning an iPhone. This measurement of actual behavior might have been too obvious, encouraging all respondents to show the adequate risk behavior and denying the pop-up. Less transparent ways of measuring actual behavior therefore seems advisable for future research.

This study was conducted in the Risk Factory – a state-of-the-art safety education center in which children (age 9 – 13) experience real-life-risks first hand and learn how to deal with dangerous situations. We chose primary school children as our population because only few studies have included this specific population while children are increasingly vulnerable to modern day risks (Schwebel & McClure, 2010). Although a meta-analysis shows that age does not affect the processing of risk messages (Witte & Allen, 2000) and the current results are promising, more research is needed in order to be able to generalize results over different populations and to gain additional insight in enhancing self-protectiveness of children as a specific population. Secondly, since results on the effect of repeating risk messages was

inconsistent between the different risk scenarios, more research is needed in order to see whether the type of risk is of importance when determining the risk communication method used to communicate about a certain risk or threat. Finally, this is one of the first studies aiming at testing the effect of risk message repetition on long-term self-protectiveness. Although our results are promising indicating that risk message repetition might be beneficial in enhancing self-protective behavior, the predictive value of risk message repetition as an addition to single active risk messages was not as apparent for all variables measured. Furthermore, our results are not entirely in line with other recent studies on the effect of risk message repetition (Lu et al., 2015; Shi & Smith, 2016), stressing the importance of further research on the effect of repeating risk messages on long-term self-protectiveness of citizens.

This study provides new insights in the way risk communication can serve as a means to increase the resilience of the population regarding safety risks, stressing the importance of new and novel ways to communicate with citizens about risks. Although governmental institutions often still rely upon a passive, one-way approach in communicating risks aimed at enhancing risk awareness, the current study provides some first evidence for the effectiveness of a more active, two-way approach in risk communication repeating risk messages aimed at enhancing self-protectiveness in the long-term.

## Conclusion

The results provide novel insights into the keys to risk communication success aiming at enhancing citizens' self-protectiveness regarding safety risks. First, the results indicate that citizens who receive multiple similar risk messages are more willing to engage in risk mitigating behavior immediately after receiving these messages. These self-protective behaviors prove to be consistent over time. When trying to increase the resilience of the population and making sure that citizens are able to behave adequately in times of crisis or disaster, repeating risk messages might be key. This stresses the need to incorporate risk message repetition in current risk communication campaigns. Second, the results of the current study suggest that active ways of communicating about risks in which risk mitigating behavior is actively practiced, might be beneficial when trying to increase (predictors of) self-protectiveness. This stresses the need for novel risk communication campaigns repeating risk messages that are developed to actively prepare citizens for crises or disasters in order to increase the populations' resilience.

# **CHAPTER 7**

## **GENERAL DISCUSSION**



This thesis aimed at gaining an in-depth understanding of (the predictors of) self-protective behavior of citizens regarding real-life safety risks. It also focused on studying the way in which risk communication can be used as a means to enhance the self-protective behavior of at-risk populations. Many risk communication studies focus on studying just one type of risk. In this thesis I studied multiple risk types varying in newness, the number of people exposed to the risk, the dreadfulness of certain hazards and I incorporated both man-made risks as well as natural hazards to be able to generalize the findings on self-protectiveness regarding safety risks in general. In order to generalize our results over a broad population as well, I also included a variety of population within society – ranging from primary school children (age 9 – 13) to adults prone to the risks studied - in this thesis.

The research in this thesis specifically shows that response efficacy - the extent to which individuals perceive risk mitigating options as useful in mitigating a threat - is a key predictor of adequate risk behavior. This variable proved to be a strong predictor of self-protectiveness in all our studies, showing that it predicts risk behavior for a variety of risks and within a variety of populations. The main contribution of this thesis, however, involves insight in the additional factors – over and above the well-known predictors risk perception, self- and response-efficacy – that influence actual self-protective behavior of different populations. First, our research showed that the social context in terms of social norm is a significant additional predictor of self-protectiveness: individuals that have a positive social norm regarding safe behavior and feel self- and response-efficacious are more inclined to engage in relevant risk behaviors than individuals with a negative social norm. Second, our research provided some first evidence that when trying to increase self-protective behavior active forms of risk communication are more effective than passive-standard techniques. Specifically, active forms of risk communication that are repeated over time are most effective in enhancing long-term self-protectiveness.

In the next parts of this discussion, the overall findings and the theoretical implications that emerge for the risk communication and risk psychology literature are discussed. Furthermore, implications for future research efforts will be considered by suggesting how the insights gained during the project could be used to further study self-protective behavior. Finally, practical recommendations for risk communicators in the field are described.

## Summary of the results and theoretical contributions

This thesis goes beyond previous studies in five ways. One, I tested the basic assumptions of the EPPM – the most prominent model used in this thesis – in a controlled laboratory setting as well as in field studies with regard to safety risks. Two, I added variables to the basic assumptions of the EPPM, namely involvement, social norm and personal responsibility. Three, I studied the effect of different risk communication efforts – differing in the number of risk message repetitions and the instructional method used (active vs. passive risk communication) – on self-protectiveness in both the short- and long-term. Four, I studied actual behavior instead of intentions only. Five, I focused on various risk topics and populations, namely primary school children (age: 9 – 13) and adults. Together, the findings discussed in this thesis address both the predictors of actual self-protectiveness as well as the way in which risk communication can most optimally stimulate self-protective behavior – the so called “delivery mode”. One may conclude that insight in both the predictors of self-protective behavior in real-life safety settings and the delivery mode that is most effective in increasing self-protectiveness contributes to a better understanding of self-protective behavior of citizens. In order to do so, my co-authors and I focused on the psychological elements stimulated in risk communication messages (risk perception, self-efficacy, response-efficacy, involvement and personal responsibility), the social environment (perceived social norm) and the delivery mode of risk information (instructional method and number of risk message repetitions) as research topics.

In order to provide an overview of the results found in this thesis, the results are summarized in two tables. In table 7.1, an overview of the effect of the predictors of self-protectiveness on self-protective behavior is provided by showing correlation coefficients, beta-coefficients as well as effect sizes found in the different studies. In table 7.2, an overview of the effect of different delivery modes on self-protective behavior is provided by showing beta-coefficients as well as effect sizes.

### The basic predictors of self-protectiveness

As a first step to studying self-protective behavior, in the first study (reported in chapter 2) and the second two studies (reported in chapter 3) my co-authors and I focused on testing well-known predictors of health risk behavior – risk perception, self-efficacy and response-efficacy – in the safety domain. In both a laboratory setting (reported in chapter 3) and within the field (reported in chapter 2), we tested whether these factors predict the intention of individuals to take risk-mitigating options regarding safety risks as well as their information seeking behavior.

In line with Rogers (1975) and Witte (1992) I endorse the idea that high levels of risk perception and efficacy beliefs are essential conditions for encouraging self-protectiveness. As can be seen in table 7.1, risk communication can be effective in stimulating self-protective behavioral intentions. Results show that higher levels of induced risk perception and efficacy beliefs result in significantly higher levels of the intention to engage in self-protective behavior. As can be seen in table 7.1, the efficacy beliefs are key predictors of self-protectiveness. High

levels of perceived efficacy lead to more self-protectiveness. Also, high levels of risk perception prove to be a vital element needed in order to increase self-protectiveness. Only under the condition that respondents perceive a risk as threatening and feel that risk mitigating options are feasible and useful in mitigating the threat, they will engage in risk mitigating behaviors. These results were found in the field study (chapter 2) as well as in the controlled laboratory studies (chapter 3), adding to the generalizability of the results and showing that both research methods are useful when studying individuals' risk behaviors.

### **Additional predictors of self-protective behavior**

In the fire safety studies (chapter 3), external safety study (chapter 4) and the emergency situations study (chapter 5) I added predictors of risk behavior in order to better understand self-protective behavior of at-risk citizens. Involvement, personal responsibility and social norm were added as predictors of self-protective behavior. The intention to take risk-mitigating actions, information seeking behavior and actual self-protective behavior were studied as dependent variables. Overall, the results in this thesis indicate that response efficacy is the strongest predictor of self-protective behavior (table 7.1). Involvement, social norm and personal responsibility prove to be important additional predictors of self-protectiveness (table 7.1).

*Involvement and information seeking* - In the fire safety and terrorism studies (chapter 3), involvement was added as an additional predictor of self-protective behavior. High levels of involvement prove to be important for both risk information seeking as well as the intention to engage in other risk-mitigating behaviors. Participants that felt high instead of low personal involvement with a certain risk, showed higher levels of self-protectiveness. They also indicated higher intentions to engage in risk-mitigating behaviors and searched more often for relevant risk information. This is novel because, as far as we know, this has not been reported with respect to risk communication. These results indicate that the personal involvement of individuals can be regarded as an important stepping stone in order to enhance self-protectiveness. Risk communication might take this into account by stressing the personal relevance of certain risks and threats for citizens in order to motivate them to take adequate risk related action. Furthermore, the studies show that individuals who actively gather relevant risk information have higher intentions to take preventive measures when compared to low information seekers (table 7.1).

In line with Ter Huurne (2008), I underline the importance of stimulating information seeking behavior as a form of self-protectiveness, since this ultimately leads to more risk mitigating behavior among citizens. Enhancing information seeking behavior positively influences the intention of citizens to take preventive actions, indicating that risk communication should not solely focus on stimulating the adoption of risk mitigating behaviors. Stimulating individuals' information seeking will positively affect their self-protectiveness, making this an important focus point of future risk communication efforts (table 7.1).



*Personal responsibility* - In the external safety study (chapter 4), personal responsibility was added as a predictor of self-protective behavior. Research shows that individuals who believe that protection against risks is their personal responsibility, will perceive risk mitigating options as more useful and feasible and will be more willing to engage in self-protectiveness (Nouwen et al., 2009). The results of the study reported in chapter 4 provided support for the idea that personal responsibility is a vital element in enhancing self-protectiveness of citizens. Although not being the strongest predictor of self-protective behavior, feeling personally responsible to prepare yourself for risks and threats has a positive effect on self-protective behavior (table 7.1). Respondents experiencing high levels of personal responsibility were significantly more willing to take risk mitigating actions in order to increase their safety than respondents not feeling responsible for preparing themselves against risks. Feeling personally responsible for taking self-protective actions leads to higher levels of self-efficacy and response-efficacy, subsequently leading to a stronger tendency to take protective actions.

*Social norm* - In the emergency situation study (chapter 5), social norm was added as a predictor of self-protective behavior. Although the concept of social norm is a well-known predictor of behavior (Ajzen, 1991; Godin & Kok, 1996; Hampson, Andrew & Barckley, 2007), it has not been studied intensively within the safety domain. The study reported in chapter 5 shows that social norm – together with self-efficacy and response-efficacy – is an important and strong predictor of self-protective behavior regarding safety risks (table 7.1). These results indicate that when preparing individuals for a disaster or crisis by means of risk communication, one ideally should also take the social context of recipients into account. When a crisis or disaster occurs, the perceived social norm regarding safe behavior – people’s judgment of the perception of significant others towards the risk at hand and possible risk mitigating options – proves to significantly predict people’s own behavior above and beyond well-known predictors such as efficacy beliefs (table 7.1). Al together, this study demonstrated the importance of focusing on the social context of citizens as an addition to providing risk mitigating options that are both useful and feasible in order to increase actual self-protective behaviors. Therefore, social norm can be seen as an important additional predictor of safe behavior of citizens.



**Table 7.1. The influence of predictors of self-protectiveness on self-protective behaviors per studied risk type**

Chapter	Population	Risk type	Dependent variables	Risk perception	Self-efficacy	Response-efficacy	Intended information seeking	Intended risk mitigating behavior	Personal responsibility	Social norm
2	Adults prone to the risk of flooding	Flood risks	Intended information seeking Actual information seeking Intended risk mitigating behavior	$r = .46^{**}$ $\eta^2 = .04^{**}$ $r = .18^{**}$ $\beta = .47^{**}$ $\eta^2 = .08^{**}$ $r = .44^{**}$ $\beta = .45^{**}$ $\eta^2 = .05^{**}$	$r = .54^{**}$ $\eta^2 = .11$ $R = .11^{**}$ $\beta = .53^{**}$ $\eta^2 = .04^{**}$ $r = .71^{**}$ $\beta = .71^{**}$ $\eta^2 = .13^{**}$	(studied together) (studied together) (studied together) (studied together) (studied together) (studied together)	- $r = .50^{**}$ $r = .78^{**}$ $\eta^2 = .03^{**}$	- $r = .11^{**}$ - -	- - - -	- - - -
3	Students from the University of Twente	Fire safety & Terrorism	Intended information seeking Actual information seeking	- -	- -	- -	- $r = .30^{**}$ $r = .35^{**}$	$r = .42^{**}$ $r = .26^{**}$	- -	- -
4	Adults prone to external safety risks	External safety	Actual risk mitigating behavior	$r = -.03$	$r = .06$ $\beta = -.01$	$r = .16^{**}$ $\beta = .04^{**}$	-	-	$r = .11^{**}$ $\beta = .01^*$	-
5	Children (age 9 - 13)	Fire safety Emergency situations	Intended risk mitigating behavior Intended risk mitigating behavior	$r = .31^{**}$ $\eta^2 = .04^{**}$ $r = .27^{**}$ $\eta^2 = .03^{**}$	$r = .49^{**}$ $\beta = .38^{**}$ $r = .57^{**}$ $\beta = .10^{**}$	$r = .34^{**}$ $\beta = .20^{**}$ $r = .76^{**}$ $\beta = .67^{**}$	- -	- -	- -	$r = .37^{**}$ $\beta = .17^{**}$ $\eta^2 = .05^{**}$ $r = .71^{**}$ $\beta = .23^{**}$ $\eta^2 = .21^{**}$

\*\* significant at .01 level. **bold text** = strongest predictor in every study based on correlations, beta's and effect sizes.

- = no correlations, beta's nor effect sizes were measured for the relationship between the variables.

## The role of delivery mode in stimulating self-protectiveness

Another addition to the current risk communication literature in this thesis, is the focus on the delivery mode of risk information. I focused on the way in which risk communication can most optimally serve as a means used to enhance self-protective behavior. In the studies reported in chapter 4, 5 and 6, my co-authors and I particularly focused on studying the effect of different delivery modes of risk information on (actual) self-protective behavior. I proposed that actively processing relevant risk information might be key in optimally stimulating individuals' self-protective behavior. In most studies on self-protective behavior, the results are based on responses of respondents after receiving mere information only (e.g. Terpstra & Gutteling, 2008; Lindell & Perry, 2012). Previous research in different safety domains shows that self-protective behavior can be more effectively trained through highly engaging measures such as behavioral trainings (Burke et al., 2011). Not only will the level of procedural knowledge increase making the behavior a routine activity, the behavioral training will also increase levels of perceived feasibility and usefulness of risk mitigating behavior (Sitzman, 2011).

*Instructional method* - In the studies reported in chapter 4 and 5 my co-authors and I proposed that behavioral training (an active way of processing information) is a key element in enhancing citizens' procedural knowledge as well as their perceived levels of self-efficacy and response-efficacy and, subsequently, their (actual) self-protective behavior. These studies focused on measuring (actual) self-protectiveness in the public domain. The results show that actively informing citizens (by means of a behavioral training) increases levels of efficacy beliefs and self-protectiveness to a significantly larger extent than the passive approach in which individuals are merely informed (table 7.2). Furthermore, the study in chapter 5 further contributes to our understanding of effective risk communication by showing that an active approach in risk communication also stimulates a positive social norm regarding safe behavior. This more positive social norm subsequently enhances actual self-protectiveness, providing even more evidence for the effectiveness of active forms of risk communication. Together, the studies reported in chapter 4 and 5 thus indicate that an active approach is more effective in increasing the self-protectiveness of the population with regard to both external safety risks (chapter 4) and emergency situations (chapter 5).

*Risk message repetition* - The final study reported in chapter 6 goes one step further in identifying effective ways of communicating risks by testing the added value of repetitive risk messages on (predictors of) self-protective behavior in both the short- and long-term. While a large amount of literature in advertising and persuasion try to explain the influence of message repetition on attitudes and behavior (Zajonc, 1968; Berlyne, 1971; Cacioppo & Petty, 1989), within the risk communication literature the effect of message repetition on self-protectiveness has not been studied intensively (Witte, 1992, 1994; Shi & Smith, 2016). My co-authors and I studied the added effect of risk message repetition on actual self-protectiveness over and above the effect of behavioral training. The results show that risk message repetition positively influences actual self-protective behavior in both the short- and long-term. Individuals participating in a behavioral training and that receive a risk message repetition, engage in significantly more self-protective behaviors than respondents who do

not receive a risk message repetition in both the short- and long-term.

The results described above provide new insights in the effect of the delivery mode of risk information on efficacy beliefs and self-protectiveness in the safety domain. The behavioral trainings developed and used in this thesis with state-of-the-art risk mitigating behaviors are unique and the results are promising, showing that its usage positively influences self-protectiveness. Furthermore, this thesis provides some first evidence that repeating such risk messages over time enhances short- and long-term self-protective behavior. All together, these studies provide evidence for the effectiveness of a more active, two-way approach in risk communication repeating risk messages aimed at enhancing self-protectiveness in the long-term.

## **Behavioral intentions as well as actual risk behavior**

The research reported in this thesis focuses on studying intentions as well as actual self-protective behaviors. Until now, most studies on self-protective behaviors of at-risk populations focused on intentions instead of actual behavior, whereas research shows that the intention of someone to behave in a certain manner does not necessarily lead to actual behavior (Ajzen & Cote, 2008). The results found provide some first insight in the relationship between intentions and actual self-protective behavior of citizens.

This thesis provides some proof for the assumption that intention and actual behavior intertwine. That is, in the studies focusing on intentions as well as actual self-protective behavior (reported in chapter 2 and 3), results show that the intention to take risk mitigating behaviors is positively associated with actual self-protective behavior (table 7.1). Also, risk perception and efficacy beliefs are significant predictors of both intentions as well as actual behavior. The effect of risk perception and efficacy beliefs on the intention of citizens to engage in self-protective behaviors is stronger than the effect of these factors regarding actual behavior, but is nonetheless highly significant in both cases. This provides support for the idea that citizens' actual self-protective behavior corresponds with their intentions.

However, some results reported in this thesis do not support the idea that intentions and actual self-protective behavior always coincide. Differences in the effect of risk perception and efficacy beliefs on intentions and actual self-protective behavior were found. Whereas risk perception and efficacy beliefs significantly predict intentions of individuals to take risk-mitigating behavior (chapter 5), this is not the case for actual self-protective behavior (chapter 4). The question that arises is whether these differences are due to differences in the measured behavior (intentions vs. actual self-protectiveness). Although our current results do not allow us to draw conclusions on this matter, it is possible that risk perception and self-efficacy are stronger predictors of intentions to take risk mitigating behavior than of actual self-protectiveness. Possibly, it is difficult for individuals to imagine how they would react in a sudden unsafe situation. When time pressure is absent, certain constructs – such as the perceived feasibility of risk mitigating behaviors – might be decisive for individuals in

**Table 7.2. The effect of delivery mode on self-protective behavior per studied risk type in the short- and long-term**

Chapter	Population	Risk type	Time	Dependent variable	Instructional method	Risk message repetition
4	Adults prone to external safety risks	External safety	Short term	Actual risk mitigating behavior <sup>a</sup>	Active vs. no information: $\beta = -.31^{**}$ Active vs. passive: $\beta = -.23^{**}$	-
5	Children (age 9 - 13)	Fire safety Emergency situations	Short term Short term	Intended risk mitigating behavior	$\eta^2 = .04^{**}$	-
				Intended risk mitigation	$\eta^2 = .34^{**}$	-
6	Children (age 9 -13)	Emergency situations / calling 112 and internet safety	Short term	Intended risk mitigating behavior emergency	-	$\eta^2 = .29^{**}$
				Intended risk mitigating behavior calling 112	-	$\eta^2 = .10^{**}$
				Intended risk mitigating behavior internet safety	-	n.s.
				Actual risk mitigation (calling 112 scenario)	-	$\eta^2 = .03^{**}$
			Long term	Intended risk mitigating behavior emergency	-	$\eta^2 = .14^{**}$
				Intended risk mitigating behavior calling 112	-	n.s.
				Intended risk mitigating behavior internet safety	-	n.s.
				Actual risk mitigation (calling 112 scenario)	-	$\eta^2 = .03^{**}$

\*\* significant at .01 level. n.s. = not significant. - = no effectsizes or beta's were measured for the relationship between the variables.

<sup>a</sup> Instructional method consisted of different conditions. We constructed two dummy variables in order to calculate betas (Hayes & Preacher). Since the behaviorally trained condition was coded 0 and the informed and control conditions were coded 1, the negative betas imply that more elaborate instruction leads to higher levels of self-protectiveness.

determining how to act. However, under time pressure, other constructs – for instance the perceived usefulness of risk mitigating behavior at that specific moment - might become more important. Further research is needed in order to gain more insight in possible differences in predictors of intentions and actual self-protective behavior.

In the study reported in chapter 6, some further contradictions between intentions and actual behavior were found. The results indicate that in the short-term, risk message repetition leads to an increase in both the intention of individuals to take risk mitigating behaviors as well as actual self-protective behavior in the “calling 112” scenario (table 7.2). However, in the long-term, the results indicate that no effect was found with regard to individuals’ intention to take risk-mitigating behavior whereas a significant effect regarding actual behavior still existed. Respondents indicated that they would not act self-protectively during a crisis situation but they did behave self-protective by installing an ICE-contact on their mobile phones. Whereas this contradiction might be due to the fact that some respondents already installed an ICE-contact on their mobile phones prior to or during the study, more insight in the effect of instructional method on both intentions and actual behavior is needed.

Although some results reported in this thesis indicate that citizens’ intentions and actual behavior coincide, other results indicate that - in line with Ajzen and Cote (2008) - there is a difference in individuals’ intentions and their actual behavior. These differences ask for future research on the relationship between intentions and actual self-protective behavior of citizens regarding safety risks in order to gain a better understanding of the generalizability of individuals’ intentions to their actual behavior.

## The role of risk topic and different populations

Finally, this thesis adds to current risk communication literature by studying different risk types as well as different populations.

*Risk topics* - I studied several risks topics differing in newness, the number of people exposed to the risk, the dreadfulness of certain hazards and we incorporated both man-made risks as well as natural hazards. When comparing the results found in this thesis between risk type, differences can be observed. When focusing on the more familiar, well-known risk types such as flood risks and fire safety (reported in chapter 2, 3 and 5), the “basic predictors” of self-protectiveness all seem to have a significant effect on self-protective behavior (table 7.1). However, when focusing on less familiar, novel risk types such as external safety (reported in chapter 4), risk perception and self-efficacy do not significantly predict adequate risk behavior. This might be due to the fact that it is more difficult for individuals to imagine how severe the consequences of unfamiliar and novel risks are. Furthermore, individuals might struggle with determining whether they think they are capable to mitigate these unfamiliar and novel risks. These findings ask for a better understanding of the psychological processes underlying people’s decisions to engage in self-protective behavior regarding different safety risks.

In this thesis, I deliberately studied multiple risk types together in one study (which was the case in the studies reported in chapter 5 and 6), in order to be able to compare the effect of different delivery modes on behavior between risk types. First of all, differences between risk type in the effect of delivery mode (active vs. passive risk communication) on self-protectiveness was found in the study reported in chapter 5. Whereas for emergency situations the delivery mode (active vs. passive) significantly predicted the self-protective behavior of respondents in this study, no differences between delivery modes in the level of self-protectiveness was found with regard to fire safety. This indicates that “risk type” might also be an important factor with respect to the effect of delivery mode of risk information on self-protectiveness. I speculate that active forms of risk communication might be specifically beneficial with regard to risks that are novel and fairly unknown (such as emergency situations). Actively practicing risk mitigating options with regard to such unknown risks might lead to a stronger increase in self-protectiveness when compared to passive forms of risk communication, since actively practicing adequate risk behaviors might lead to a better understanding of the usefulness of risk mitigating behaviors regarding these type of risks. For risks that are familiar and well-known (such as fire safety), actively practicing risk behaviors might not lead to a better and more comprehensive understanding of adequate risk behaviors when compared to standard-passive techniques, since these risk mitigating options are already well-known and well-understood.

With regard to the effect of risk message repetition on self-protectiveness, differences between risks types were also found (chapter 6). Whereas with regard to “calling 112” and emergency situations strong effects of message repetition on behavior were found, no significant effect of risk message repetition on behavior was found for the internet safety scenario. This discrepancy might be due to the way in which we measured self-protective behavior regarding internet safety. The pop-up we used to measure self-protective behavior might have been too obvious instigating socially desirable behavior, stressing the need to further look into the effect of risk type on the relationship between delivery mode and self-protectiveness using less transparent ways of measuring actual behavior. Since differences in results were found between different risk types, more research is needed to get a better understanding of the influence of the type of risk on the relationship between delivery mode and (predictors of) self-protective behavior.

*Populations* - in order to gain knowledge on self-protectiveness among a broader variety of individuals in our society, I deliberately chose adult populations as well as populations of primary school children (age: 9 – 13) as research populations in this thesis. The studies in chapter 2, 3 and 4 focused on an adult population and the studies in chapter 5 and 6 focused on a population of primary school children (age: 9 – 13). Our results indicate that for different populations similar constructs predict self-protectiveness. Also, in both an adult population (chapter 4) and a population of children (chapter 5), an active approach of communicating risks proves to be beneficial in enhancing safe behaviors (table 7.2). In line with Witte and Allen (2000), the results in the current thesis provide some evidence that age does not affect the processing of risk information.

## Limitations and recommendations for future research

Although the results of our studies are promising and provide new insights into the keys to effective risk communication, there are also some limitations that need to be addressed. A first important limitation of the studies reported in this thesis, is the focus on solely Dutch citizens as our research population. Research on differences in social behavior between different cultures shows that social behavior varies dramatically across human populations (Henrich, 2005). Especially with regard to the effect of efficacy beliefs on behavior, differences between cultures are found. For instance, citizens of more collectivistic countries such as China have an overall lower self-efficacy and this factor does not strongly predict behavior (Early & Christopher, 1994; Schwarzer et al., 1997; Hofstede, 2001). In individualistic countries such as the countries in Western Europe, higher levels of self-efficacy are observed with this variable strongly influencing behavior (Early & Christopher, 1994; Schwarzer et al., 1997; Hofstede, 2001). More research is needed in order to see whether the predictors of self-protective behavior found in the studies reported in this thesis are generalizable over other populations, nationalities and cultures.

Another limitation of the current thesis concerns the way in which we measured our independent and dependent variables. Firstly, this thesis provides a first attempt to measure actual self-protective behavior for real-life safety risks. Although we tried to measure self-protectiveness as realistic as possible, the question remains whether citizens will behave in a similar manner during a real incident when stress, time pressure and possible other emotions may also affect their behavior. Secondly, we measured our independent and dependent variables mainly by means of a survey. However, new technological developments provide opportunities to more adequately test interventions and measure actual behavior for instance by means of virtual reality or by logging the behavior of individuals during real-life incidents. Although we included a serious game as an intervention in our last study and measured behavior online using pop-ups (chapter 6), using more technological developments in order to test interventions and measure behavior is advisable for future research. The main use of surveys in this thesis has led to some more limitations. For example, in the studies reported in chapter 2, 3 and 5, we measured risk-mitigating behavior by means of a questionnaire asking respondents about their intention to adopt recommendations. As the intention a person has to adopt certain behaviors does not always correspond to their actual behavior, this may give a biased view of the preventive actions taken among respondents. In the study reported in chapter 4, we measured actual self-protective behavior by asking respondents which risk mitigating behaviors they had already carried out. Again, a survey was used for this measurement and the question arises whether the self-reported self-protectiveness is a full and valid representation of respondents' actual self-protectiveness. Thirdly, in the studies reported in chapter 2 and 3 actual information-seeking behavior was measured using only one item. This seems not ideal in that the results of only one item can result in drawing biased conclusions about the information seeking behavior among respondents. Also, since our measure allowed respondents to make a rather effortless or costless choice, immediately after

being confronted with the possibility to choose, this raises the question whether this type of response is representative of information-seeking processes outside an experimental reality. These points all ask for more research on actual risk behavior more elaborately measuring actual self-protective behavior in realistic safety situations.

A final limitation of the studies incorporated in this thesis refers to the settings in which data was collected and the way in which respondents were selected. Several studies we conducted, were conducted in real-life safety settings. Although this provides us with the opportunity to study actual behavior in a realistic environment, these research settings also face some challenges and possible limitations. For instance, in chapter 4 we describe research conducted in the municipality of Borne among the local population regarding the risks related to the transportation of dangerous chemical substances by train. From an academic point of view, the nature of this study leads to some remaining questions that need to be addressed. First of all, due to ethical constraints, the selection of participants for the behavioral training was not conducted randomly. Instead, participants of the behavioral training signed up for the training voluntarily. This might have led to self-selection bias and therefore this group may differ from the other respondents in characteristics that might be potentially relevant for the training's success (e.g. some specific interest in the risk). Secondly, although we did randomly select participants for our main study (reported in chapter 4) and the number of participants was fairly high, they were assigned to a condition based on their self-reported received instructional method (behavioral training vs. information vs. no information). The question that thus remains is whether these results would be replicated in a more controlled setting randomly assigning respondents to a condition. Therefore, further research in both controlled settings as well as real-life scenario's is necessary in order to increase our understanding of self-protective behavior.

The results found in this thesis ask for future research on several aspects. Most importantly, and as discussed above, our results are not fully consistent with regard to the predictive value of self-efficacy. Whether self-efficacy has an effect on self-protectiveness or not, remains an open question. Although few of our studies (f.i. the study reported in chapter 5) show support for a positive relationship between self-efficacy and self-protectiveness, the study reported in chapter 4, in line with other research (f.i. Gutteling & de Vries, 2016), did not find a significant effect of self-efficacy on self-protectiveness. Further research is necessary in order to look further into the relationship between self-efficacy and self-protective behavior and whether the type of risk could possibly explain differences in the found relationship between these two variables.

Also, the results found in our two Risk Factory studies (chapter 5 and chapter 6) stress the importance to further look into possible differences between risk types in the effect of delivery mode on self-protectiveness. That is, in our first Risk Factory study (chapter 5), different results were found between the two different risk topics in this study (fire safety and emergency situation) in the effect of delivery mode on social norm and self-protectiveness. In our second Risk Factory study (chapter 6), results on the effect of repeating risk messages on self-protectiveness were also inconsistent between the different risk scenarios. The question



remains whether the type of risk is of importance when determining the delivery mode used to communicate about a certain risk or threat. More insight in the influence of different delivery modes of risk information on these concepts as well as self-protectiveness regarding different safety risks, may lead to more knowledge on effective ways to tailor risk communication in order to increase the resilience of the population.

Furthermore, the studies conducted in the Risk Factory (chapter 5 and 6) show that the predictors of self-protectiveness among adults also apply to a population of children. Although this finding is corroborated by a previous meta-analysis showing that age does not affect the processing of risk messages (Witte & Allen, 2000), more research is needed in order to be able to generalize results over different populations.

Finally, our final study (reported in chapter 6) is one of the first studies aiming at testing the effect of risk message repetition on long-term self-protectiveness. Although our results clearly indicate that risk message repetition might be beneficial in enhancing self-protective behavior, the predictive value of risk message repetition as an addition to single active risk messages was not as apparent for all variables measured. Furthermore, our results are not entirely in line with other recent studies on the effect of risk message repetition (Lu et al. 2015; Shi & Smith 2016), stressing the importance of further research on the effect of repeating risk messages on long-term self-protectiveness of citizens.

## Practical recommendations

With the increase of safety risks in our modern day society, the necessity of preparing citizens for possible risks and crisis in their environment becomes more evident (Rickard et al., 2014). Since expectations are that the number of crisis and disasters in our contemporary society increases over the next few years and the government is aware that it cannot guarantee full calamity protection to its citizens (Ministry of Infrastructure and Environment, 2014), the government is stressing the importance of individual citizens' responsibilities in taking risk-preparation activities. In order to protect the public and encourage them to take self-protective measures, governmental institutions are faced with the task to communicate with citizens about risks and threats in their environment. The risk communication developed by governmental institutions should be effective and increase the self-protectiveness of the public in order to increase their personal safety.

The results of this thesis show that risk communication is most effective when recommended risk-mitigating actions are actually viewed by the public as effective in mitigating the threat. Therefore, risk communication efforts need to focus on communicating risk-mitigating options that the target audience perceives as useful, with efforts preferably tailored to the needs of the specific audience (Collins McLaughlin & Mayhorn, 2014). Providing citizens with the opportunity to practice these behaviors as well as emphasizing their own personal responsibility are two options that might positively influence this perceived usefulness of risk mitigating options. Also, this thesis shows that citizens who have a positive social norm

regarding safe behaviors, are more willing to engage in self-protectiveness. This stresses the need to incorporate social norm in current risk communication campaigns. It also provides new opportunities by using peers and significant others as role models when communicating about risks. Finally, since results show that citizens who receive multiple similar risk messages are more willing to engage in risk mitigating behavior in the short- and long-term, risk message repetition can be used in order to increase the self-protectiveness of the population.

*Key recommendations for risk communication based on this thesis:*

- 1. Recognize the importance of crafting risk messages along the lines of behavioral actions that are seen as efficacious by large numbers of people. Risk messages aimed at promoting self-protectiveness are effective under the conditions that the advised actions are perceived by the public as useful. Stressing the usefulness of risk mitigating options – and thus increasing the perceived response-efficacy of the population regarding the advised risk mitigating options – is necessary in order to increase citizens' self-protectiveness.*
- 2. Recognize the need to use an active two-way approach in which adequate behavior is actively trained, in which people feel they are personally responsible for taking preparatory measures and in which risk messages are repeated when communicating with the public about risks and threats.*
- 3. Incorporate social norm in current risk communication efforts by for instance using peers and significant others as role models when communicating about risks. The social context of individuals is of the utmost importance when determining on how to act in case of a crisis or disaster. Citizens that have a positive social norm regarding safe behaviors, are more willing to engage in self-protectiveness.*
- 4. Recognize the need to develop evidence based risk communication through multidisciplinary collaboration. Risk communication cannot be developed solely by communication experts. In order to develop successful risk communication efforts, communication experts, risk experts, researchers and operational services need to disseminate knowledge and work together. Intensive collaboration between experts in these fields is necessary in order to develop adequate risk mitigating options and subsequently effective risk communication.*

## Conclusions

This thesis shows under which conditions citizens are willing to engage in actual self-protective behavior regarding safety risks and how risk communication can contribute as a means to enhance self-protective behavior. It adds to the current literature on risk communication by looking at important and additional predictors of self-protective behavior as well as focusing on the way in which risk communication is most effective in enhancing the self-protectiveness of the general population. Based on the evidence from this thesis, risk communicators can no longer suffice to take their own perception of message effectiveness as a sole guideline. However, an active two-way approach in which adequate risk behavior is actively trained and in which risk messages are provided that stress the usefulness of risk mitigating options should be the new consensus.

## REFERENCES

- Ajzen, I. & Fishbein, M. (1980). Understanding attitudes and predicting social behavior. Englewood Cliffs, NJ: Prentice-Hall.
- Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational behavior and human decision processes*, 50 (2), 179 – 211.
- Ajzen, I. & Cote. N.G. (2008). Attitudes and the prediction of behavior. In W.D. Crano & R. Prislin (red.), *Attitudes and attitude change*, (pp. 289-311). New York: Psychology Press.
- Anderson, J.R. (1982). Acquisition of cognitive skill. *Psychological Review*, 89, 369 – 406.
- Anderson, T., Howe, C., Soden, R., Halliday, J. & Low, J. (2001). Peer interaction and the learning of critical thinking skills in further education students. *Instructional Science*, 29(1 ), 1 – 32.
- Andrews, J.C., Durvasula, S. & Akhter, S.H. (1990). A framework for conceptualizing and measuring the involvement construct in advertising research. *Journal of Advertising* 19 (4), 27–40.
- Andrews, C., Fichet, E., Ding, Y., Spiro, E.S. & Starbird, K. (2016). Keeping up with the Tweet-dashians: the impact of official accounts on online rumoring. CSCW 16, San Francisco, CA, USA.
- Apsler, R. & Sears, D.O. (1968). Warning, personal involvement, and attitude change. *Journal of Personality and Social Psychology*, 9 (2), 162–6.
- Armitage, C.J. & Conner, M. (2001). Efficacy of the theory of planned behavior: a meta analytic review. *British journal of social psychology*, 40 (4), 471 – 499.
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, 84 (2), 191 – 215.
- Bandura, A. (1986). The Explanatory and Predictive Scope of Self-Efficacy Theory. *Journal of Social Clinical Psychology*, 1991; Special Issue: Self-Efficacy Theory in Contemporary Psychology. 4, 359-373.
- Bandura, A. (1991). Social Cognitive Theory of Self-Regulation. *Organizational Behavior and Human Decision Processes*, 50(2), 248 – 287.
- Bandura, A. (1997). Self-efficacy: the exercise of control. Freeman, New York
- Bandura, A. (2004). Health promotion by social cognitive means. *Health education and behavior*, 31 (2), 143 – 164.
- Baron, R.M. & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 6, 1173-1182
- Beck, K.H. & Frankel, A. (1981). A conceptualization of threat communications and protective health behavior. *Social psychology quarterly*, 44, 2014 – 2017.

- Beck, U. (2002). The terrorist threat: World risk society revisited. *Theory, Culture & Society*, 19 (4), 39-55.
- Bell, B.S. & Kozlowski, S.W.J. (2008). Active learning: Effects of core training design elements on self-regulatory processes, learning, and adaptability. *Journal of Applied Psychology*, 93, 296 - 316.
- Beirens, T.M.J., Brug, J., van Beeck, E.F. Dekker, R., den Hertog, P. & Raat, H. (2007). Assessing psychosocial correlates of parental safety behaviour using Protection Motivation Theory: Stair gate presence and use among parents of toddlers. *Health Education Research*, 23 (4), 723-31.
- Berk, R. A. (2009). Multimedia teaching with video clips: TV, movies, YouTube, and mtvU in the college classroom. *International Journal of Technology in Teaching and Learning*, 5 (1), 1-21.
- Berlyne, D. E. (1970). "Novelty, complexity, and hedonic value." *Perception & Psychophysics*, 8 279 - 286.
- Berlyne, D. E. (1971). *Aesthetics and psychobiology*. New York, NY: Apple-ton-Century Crofts.
- Brandweer Twente. (2017). Risk Factory. Retrieved on February 5th from <http://www.troned.nl/>.
- Brashers, D.E., Goldsmith, D.J. & Hsteh, E. (2002). Information seeking and avoiding in health contexts. *Human Communication Research* 28 (2), 258-71.
- Broström, S., Johansson, I., Sandberg, A. & Frøkjær, T. (2014). Preschool teachers' view on learning in preschool in Sweden and Denmark. *European Early Childhood Education Research Journal*, 22(5), 590 - 603.
- Burke, L.A. & Hutchins H.M. (2007). Training transfer: An integrative literature review. *Human Resource Development Review*, 6, 263 - 296.
- Burke, M.J., Salvador, R.O., Smith-Crowe, K., Chan-Serafin, S., Smith, A. & Sonesh, S. (2011) "The dread factor: How hazards and safety training influence learning and performance." *Journal of applied psychology*, 96, 46 - 70.
- Cacioppo, J. T. & Petty, R.E. (1979). Effect of message repetition and position on cognitive response, recall and persuasion. *Journal of personality and social psychology*, 37 (1), 97 -109.
- Cacioppo, J. T. & Petty, R.E. (1989). "Effects of message repetition on argument processing, recall, and persuasion." *Basic and Applied Social Psychology*, 10, 3 - 12.
- Campell, M.C. & Keller, K.L. (2003). Brand familiarity and advertisement repetition. *Journal of consumer research*, 30 (2), 292 - 304.
- Celsi, R.L., & Olson, J.C. (1988). The role of involvement in attention and comprehension processes. *Journal of Consumer Research*, 15, 210-44.
- Centraal Bureau voor de Statistiek, 2015. Kerncijfers [Internet]. [The Hague]: Statistics

Netherlands. Available from: [http://statline.cbs.nl/Statweb/publication/?DM=SLNL\\_PA=7004ned&D1=331&D2=21122113,2115,2123-2125,1257312575,16854,16857&D3=1&VW=T](http://statline.cbs.nl/Statweb/publication/?DM=SLNL_PA=7004ned&D1=331&D2=21122113,2115,2123-2125,1257312575,16854,16857&D3=1&VW=T) (updated 2015 Jan 1; Cited 2015 July 15).

- Carter, P.M., Bingham, C.R., Zakrajsek, J.S., Shope, J.T. & Sayer, T.B. (2014). Social norms and risk perception: predictors of distracted driving behavior among novice adolescent drivers. *Journal of adolescent health, 54* (2), S32 – S41.
- Case, D.O., Andrews, J.E., Johnson, D.E. & Allard, S.L. (2005). Avoiding versus seeking: the relationship of information seeking to avoidance, blunting, coping, dissonance, and related concepts. *Journal of the Medical Libery Association, 93*, 353-362
- Chaffee, S.H. & Roser, C. (1986). Involvement and the consistency of knowledge, attitudes, and behaviors. *Communication Research 13* (3), 373-399.
- Cho, H., & Boster, F.J. (2005). Development and validation of value-, outcome-, and impression relevant Involvement scales. *Communication Research 32* (2), 235-64.
- Cho, H., & Witte, K. (2005). Managing fear in public health campaigns: A theory-based formative evaluation process. *Health Promotion Practice, 6* (4), 482-90.
- Collins Mc Laughlin, A. & Mayhorn, C.B. (2014). Designing effective risk communications for older adults. *Safety Science, 61*, 59 – 65.
- Commissie Onderzoek Vuurwerkkramp (februari 2001). De vuurwerkkramp: eindrapport. Opgehaald op 26 april 2017 van: [http://www.minbzk.nl/contents/pages/3166/eindrapport\\_oosting\\_2-01.pdf](http://www.minbzk.nl/contents/pages/3166/eindrapport_oosting_2-01.pdf)
- Connolly, T. M., Boyle, E.A., MacArthur, E., Hainey, T. & J.M. Boyle. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education, 59*(2), 661-686.
- Cross, J.E. & Peisner, W. (2009). Recognize: A social norms campaign to reduce rumor spreading in a junior high school. *Professional School Counseling, 12*(5), 365-377.
- Cuite, C.L., Weinstein, N.D., Emmons, K. & Colditz, G. (2008). A test of numeric formats for communicating risk probabilities. *Medical Decision Making, 28* (3) 377-84.
- Danieli, Y., Brom D. & Sills, J. (2004). The trauma of terrorism: Contextual considerations. *Journal of Aggression, Maltreatment and Trauma, 9* (1), 1-17.
- De Leonardis, D., Robinson, E., Huey, R. & Atkins, R.. (2004). Threshold effects of speed monitoring devices in the speeding behavior of drivers. *Transportation Research Record: Journal of Transportation Research Board*. DOI: 10.3141/2425-03
- De Wit, M.S., van der Most, H., Gutteling, J.M., Bockarjova, M. (2008) Governance of flood risks in the Netherlands: interdisciplinary research into and meaning of risk perception. In: Martorell S et al (eds) *Safety, reliability and risk analysis: theories, methods and applications*. Taylor & Francis group, London, 1585-1593
- De Quervain, D.J.F., Roozendaal, B. & McGaugh J.L. (1998). Stress and glucocorticoids impair

retrieval of long-term spatial memory. *Nature*, 394, 787 – 790.

- De Young, R. (1993). Changing behavior and making it stick the conceptualization and management of conservative behavior. *Environmental Behavior*, 25(3), 485 – 505.
- Earley, P. & Christopher, N. (1994). Cultural effects & training on self-efficacy and performance. *Administrative Science Quarterly*, 39(1), 89-117.
- Easterling, D.V. & Leventhal, H. (1989). Contribution of concrete cognition to emotion: Neutral symptoms as elicitors of worry about cancer. *Journal of Applied Psychology* 74, 787-96.
- Engelberg, M., Flora, J.A. & Nass, C.A. (1995). AIDS knowledge: Effects of channel involvement and interpersonal communication. *Health Communication*, 7 (2), 73-91.
- Eurostat. (2013). Eurostat European Statistics on Accidents at Work. European Commission.
- Fink, A, Ulbrich, U. & Engel, H. (1996). Aspects of the January 1995 flood in Germany. *Weather*, 51, 34-39
- Fischhoff, B. (1995). "Risk perception and communication unplugged: Twenty years of process." *Risk Analysis*, 15, pp. 137 – 145.
- Garcia-Marques, T. & Mackie, D.M. (2001). The feeling of familiarity as a regulator of persuasive processing. *Social cognition*, 19 (1), 9 – 34.
- Glendon, I., Clarke, S.G. & McKenna, E.F. (2006). *Human safety and risk management*. Boca Raton, FL: Taylor & Francis.
- Godin, G. & Kok, G. (1996). The Theory of Planned Behaviour: A review of its application to health related behavior. *American Journal of Health Promotion* 11(2), 87 – 98.
- Gore, T. & Bracken, C.C. (2005). "Testing the Theoretical Design of a Health Risk Message: Reexamining the Major Tenets of the Extended Parallel Process Model." *Health Education Behavior*, 32 (1): 27 – 41.
- Griffin, R. J., Dunwoody, S., & Neuwirth, K. (1999). Proposed Model of the Relationship of Information Seeking and Processing to the Development of Preventive Behaviors. *Environmental Research*, 80, S230-245.
- Griffin, R.J., Yang, J., Ter Huurne E.F.J., Boerner, F., Ortiz, S. & Dunwoody, S. (2008). After the flood: Anger, attribution and the seeking of information. *Science Communication*, 29 (3), 285-315.
- Grothmann, T., Reusswig, F. (2006). People at risk of flooding: why some residents take precautionary action while others do not. *Natural Hazards*, 38, 101-120
- Gurabardhi, Z., Gutteling, J.M. & Kuttschreuter, M. (2004). The development of risk communication. *Science Communication*, 25 (4), 323-49.
- Gutteling, J.M. & Wiegman, O. (1996). Exploring risk communication. Dordrecht: Kluwer Academic.
- Gutteling, J.M., Baan, M., Kievik, M. & Stone, K. (2010). Risicocommunicatie in de ogen van de burger: 'Geen paniek!'. In: van der Most, H., de Wit, S., Broekhand, B. & Roos, W. (eds).

Kijk op waterveiligheid. Eburon, Delft

- Gutteling, J.M. (2015). Risk Communication. The International Encyclopedia of Political Communication, Editor(s): Gianpietro Mazzoleni (Editor-in-Chief), Kevin C. Barnhurst (Associate Editor), Ken'ichi Ikeda (Associate Editor), Rousiley C. M. Maia (Associate Editor), Hartmut Wessler (Associate Editor). pages 1435-1439; Wiley-Blackwell. ISBN 978-1-118-29075-0.
- Gutteling, J.M. & de Vries, P.W. (2016). Determinants of seeking and avoiding risk-related information in times of crisis. *Risk Analysis*. DOI: 10.1111/risa.12632.
- Hampson, S. E., Andrews, J. A., Barckley, M. (2007). Predictors of the development of elementary school children's intentions to smoke cigarettes: Hostility, prototypes, and subjective norms. *Nicotine & Tobacco Research*, 9(7), 751-760.
- Hayes, A.F. & Preacher, K.J. (2014). Statistical Mediation Analysis with a Multicategorical Independent Variable. *British Journal of Mathematical and Statistical Psychology*, 67 (3), 451 - 470.
- Heath, R.L., Liao, S.H. & Douglas, W. (1995). Effects of perceived economic harms and benefits on issue involvement, use of information sources, and actions: A study in risk communication. *Journal of Public Relations Research*, 7 (2), 87-109.
- Henrich, J. (2015). Culture and social behavior. *Current opinion in behavioral sciences*, 3, 84 - 89.
- Helsloot, I. & Groenendaal, J. (2013). Twitter: An underutilized potential during sudden crises? *Journal of contingencies and crisis management*, 21 (3), 178 - 183.
- Hill, M. & Tisdall, K. (2014). *Children and society*. Routledge: Taylor and Francis.
- Hofstede, G. (2001) Culture's Consequences - Second Edition: Comparing Values, *Behaviors, Institutions and Organizations Across Nations*. London: Sage.
- Huang, J.L. & Ford, J.K. (2012). Driving locus of control and driving behaviours: Inducing chance through driver training. *Transportation Research Part F: Traffic Psychology and Behavior*, 15, 358 - 368.
- Hubbell, A.P., Mitchell, M.M. & Gee, J.C. (2001). The relative effects of timing of suspicion and outcome involvement on biased message processing. *Communication Monographs*, 68 (2), 115-32.
- IOOV; Inspectie Openbare Orde en Veiligheid (2011). Brand Chemie-Pack Moerdijk. Een onderzoek naar de bestrijding van (de effecten van) het grootschalig incident. Den Haag: Inspectie Openbare Orde en Veiligheid (IOOV), Ministerie van Veiligheid en Justitie.
- Jacob, C., Mathiasen, L. & Powell, D. (2010). Designing effective messages for microbial food safety hazards. *Food control*, 21 (1), 1 - 6.
- Jongejan, R. B., Jonkman, S.N. & Vrijling, J.K. (2012). The safety chain: a delusive concept. *Safety*



*Science*, 50(5), 1299-1303

- Johnston, A.C. & Warkentin, M. (2010). Fear appeals and information security behaviors: An empirical study. *MIS Quarterly*, 34(3), 549-566.
- Kahlor, L.A. (2007). An Augmented Risk Information Seeking Model: The Case of Global Warming Media Psychology, 10, 414-435.
- Kapferer, J.N. & Laurent, G. (1985). Consumer involvement profiles: A new practical approach to consumer involvement. *Journal of Advertising Research*, 25 (6), 48-56.
- Keller, C. & Siegrist, M. (2009). Effect of risk communication formats on risk perception depending on numeracy. *Medical Decision Making* 29(4), 483-90.
- Keller, C., Siegrist, M. & Visschers, V. (2009). Effect of risk ladder format on risk perception in high- and low-numerate individuals. *Risk Analysis* 29(9), 1255-64.
- Kievik, M., Ter Huurne, E.F.J. & Gutteling, J.M. (2009). The action suited to the word. Use of the framework of risk information seeking to understand risk-related behaviors. Paper presented at the annual meeting of the Society of Risk Analysis, Baltimore, USA
- Kievik, M. & Gutteling, J.M. (2011). Yes we can: motivate Dutch citizens to engage in self-protective behavior. *Natural Hazards*, 59(3), 1475 - 1490.
- Kievik, M., Ter Huurne, E.F.J., Gutteling, J.M. (2012). The action suited to word: Use of the framework of risk information seeking to understand risk-related behaviors. *Journal of Risk Research*, 15(2), 131 - 147.
- Kievik, M., Misana - ter Huurne, E.F.J., Gutteling, J.M. & Giebels, E. Accepted pending minor revisions. Making it stick: exploring the effect of information and behavioral training on self-protectiveness of citizens in a real-life safety setting. *Safety Science*.
- Kievik, M., Giebels, E., Domrose, J. & Gutteling, J.M. Under review. No man is an island: social norm as a predictor of self-protective behavior of primary school children regarding real-life safety risks. *Journal of Contingencies and Crisis Management*.
- Kinateder, M., Pauli, P., Muller, M., Krieger, J., Heimbecher, F., Ronnau, I., Bergerhausen, U., Vollmann, G., Vogt, P. & Muhlberger, A. (2013). Human behavior in severe tunnel accidents: Effect of information and behavioral training. *Transportation Research Part F*, 17, 20 - 32.
- Koch, T. & Zerback, T. (2013). Helpful or harmful? How frequent repetition affects perceived statement credibility. *Journal of Communication*, 63(6), 993-1010.
- Krasovskaia, I. (2005). Perception of flood hazard in countries of the north sea region of Europe (No. FLOWS WP2A-1). Norwegian Water Resources and Energy Directorate, Oslo.
- Kuhlmann, S., Piel, M. & Wolf, O.T. (2005). Impaired memory retrieval after psychosocial stress in healthy young men. *Journal of Neuroscience*, 25, 2977 - 2982.
- Larsman, P., Eklof, M. & Torner, M. (2012). Adolescents' risk perception in relation to risk behavior with long-term health consequences; antecedents and outcomes: A literature

review. *Safety science*, 50 (9), 1740 – 1748.

- Latkin, C.A., Forman, V., Knowlton, A. & Sherman, S. (2003). Norms, social networks and HIV-related behaviors among urban disadvantages drug users. *Social science & medicine*, 56 (3), 465 – 476.
- Levin, I.P., Huneke, M.E. & Jasper, J.D. (2000). Information processing at successive stages of decision making: Need for cognition and inclusion-exclusion effects. *Organizational Behavior and Human Decision Processes*, 82 (2), 171–93.
- Lindell, M.K. & Perry, R.W. (2000). Household adjustment to earthquake hazard: a review of research. *Environment & Behavior*, 32, 590–630
- Lindell, M.K. & Perry, R.W. (2012). The Protective Action Decision Model: Theoretical modifications and additional evidence. *Risk Analysis*, 32 (4), 616 – 632.
- Livingstone, S., Haddon, L., Görzig, A. & Ólafsson, K. (2010). Risk and safety on the internet: the perspective of European children: full findings and policy implications from the EU Kids Online survey of 9 – 16 years old and their parents in 25 countries. EU Kids Online, Deliverable D4. EU Kids Online Network, London, UK.
- Lu, X., Xie, X. & Liu, L. (2015). Inverted U-shaped model: How frequent repetition affects perceived risk. *Judgment and Decision Making*, 10(3), 219-224.
- Maaskant, B., Jonkman, S.N., Bouwer, L.M. (2009). Future risk of flooding: an analysis of changes in potential loss of life in South Holland (the Netherlands). *Environmental Science & Policy*, 12, 157-169
- Malony, E.K., Lapinsky, M.K. & Witte, K. (2011). Fear appeals and persuasion: a review and update of the Extended Parallel Process Model. *Social and personality psychological compass*, 5 (4), 206 – 219.
- Mayer, I., Bekebrede, G., Hartevelde, C., Warmelink, H., Zhou, Q., Ruijven, T., ... & I. Wenzler. (2014). The research and evaluation of serious games: Toward a comprehensive methodology. *British Journal of Educational Technology*, 45(3), 502-527.
- McComas, K.A. (2006). Defining moments in risk communication: 1996–2005. *Journal of Health Communication* 11, 75–91.
- McEachen, R.R.C., Conner, M., Taylor, N.J. & Lawton, R.J. (2012). Prospective prediction of health related behaviors with the Theory of Planned Behaviour: a meta-analysis. *Health Psychology review*, 5 (2), 97 – 144.
- McQuarrie, E.F. & Munson, J.M. (1992). A revised product involvement inventory: Improved usability and validity. *Advances in Consumer Research* 19, 108-15.
- Messemaker, M., Wolbers, J., Treurniet, W. & Boersma, K. (2013). Shaping societal impact: between control and cooperation. Proceedings of the 10th International ISCRAM Conference – Baden-Baden, Germany, May 2013 Ministry of Infrastructure and Environment. Rail freight transport. The Hague: Government of the Netherlands, 2014.

<https://www.government.nl/topics/freighttransportation/contents/frigttransport-by-rail> (updated 2014 Mar 20; cited 2015 Aug.10).

- Miceli, R, Sotgiu, I & Settanni, M. (2007). Disaster preparedness and perception of flood risk: a study in an alpine valley in Italy. *Journal of Environmental Psychology*, 28, 164-173
- Mileti, D.S. & Peek, L. (2000). The social psychology of public response to warnings of a nuclear power plant accident. *Journal of hazardous materials*, 75 (2-3), 181 - 194.
- Miller, S.M. (1987). Monitoring and blunting: validation of a questionnaire to assess styles of information seeking under threat. *Journal of Personality and Social Psychology*, 52, 345-353.
- Ministry of Transport, Public Works and Water Management. (2006). Kabinetsstandpunt Rampenbeheersing Overstromingen DGW/WV 2006/1306
- Ministry of Infrastructure and Environment. Rail freight transport. The Hague: Government of the Netherlands, 2014. <https://www.government.nl/topics/freight-transportation/contents/freight-transport-by-rail> (updated 2014 Mar 20; cited 2015 Aug. 10).
- Neighbors, C., Lee, C.M., Lewis, M.A., Fossos, N. & Larimer, M.E. (2007). Are social norms the best predictor of outcomes among heavy-drinking college students? *Journal of studies on alcohol and drugs*, 68 (4), 556 - 565.
- Noar, S.M., Clark, A., Cole, C. & Lustria, M.L.A. (2006). Review of interactive safer sex web sites: Practice and potential. *Health Communication* 20(3), 233-41.
- Nordhielm, C.L. (2002). The influence of level of processing on advertising repetition effects. *Journal of consumer research*, 29 (3), 371 - 382.
- NOS, 2014. Fout op fout bij treinongeluk Wetteren [Hilversum]: Nederlandse Omroep Stichting. Available from: <http://nos.nl/artikel/2007382-fout-op-fout-bij-treinongeluk-wetteren.html> (updated 2014 Dec 5; Cited 2015 Aug 21).
- Nouwen, A., Uruquhart Law, G., Hussain, S., Mc Govern, S. & Napier, H. (2009). Comparison of the role of self-efficacy and illness representations in relation to dietary self-care and diabetes distress in adolescents with type 1 diabetes. *Psychology and Health*, 24 (9), 1071 - 1084.
- Oblinger, D. (2004). The next generation of educational engagement. *Journal of Interactive Media in Education*, 8, 1-18.
- Ostrom, E. (2014). Collective action and the evolution of social norms. *Journal of natural resources policy journal*, 6 (4), 235 - 252.
- Paton, D. (2003). Disaster Preparedness: a Social Cognitive Perspective. *Disaster Prevention Management: An International Journal*, 12 (3), 210 - 216.
- Pechmann, C. & Stewart, D.W. (1988). Advertising repetition: A critical review of wearin and wearout. *Current Issues and Research in Advertising*, 11, 285-329.
- Perse, E.M. (1990). Audience selectivity and involvement in the newer media environment.

*Communication Research*, 17(5), 675–97.

- Petty, R.E. & Cacioppo, J.T. (1986). *Communication and persuasion: Central and peripheral routes to attitude change*. New York: Springer.
- Pin, R.R., & Gutteling, J.M. (2009). The development of public perception research in the genomics field: An empirical analysis of the literature in the field. *Science Communication*, 31, 57–83.
- Pongiglione, F. (2011). *Climate change and individual decision making: an examination of knowledge, risk perception, self-interest and their interplay*. Nota di Lavoro. University of Bologna.
- Redmond, E.C. & Griffith, C.J. (2006). Assessment of consumer food safety education provided by local authorities in the UK. *British food journal*, 108 (9), 732 – 752.
- Rickard, L.N., Yang, Z.J., Seo, M., & Harrison, T.M. (2014). The “I” in Climate: The Role of Individual Responsibility in Systematic Processing of Climate Change Information. *Global Environmental Change*, 26, 39 – 52.
- Rijksoverheid (2011). *Nationaal Waterplan*. The Hague: Government of the Netherlands, 2017. <https://www.rijksoverheid.nl/documenten/brochures/2011/03/28/nationaalwaterplan> (updated 2011 Mar 28; cited 2017 May 31).
- Rimal, R.N. (2001). Perceived risk and self efficacy as motivators: understanding Individuals' long term use of health information. *Journal of Communication*, 51, 634–654
- Rimal, R.N. & Real, K. (2003). Perceived Risk and Efficacy Beliefs as Motivators of Change. Use of the Risk Perception Attitude (RPA) Framework to Understand Health Behaviors. *Human Communication Research*, 29 (3), 370-399.
- Rimal, R.N. (2008). Modeling the relationship between descriptive norms and behaviors: A test and extension of the theory of normative social behavior (TNSB). *Health Communication* 23(2), 103–16.
- Rogers, R.W. (1975). A Protection Motivation Theory of Fear Appeals. *The Journal of Psychology*, 91 (1), 93 – 114.
- Rogers, R.W. (1983). *Cognitive and physiological processes in fear appeal and attitude change: A revised theory of protection motivation*. In *Social psychophysiology: A sourcebook*, ed. J.T. Cacioppo, and R.E. Petty, 153–76. London: Guilford.
- Romoser, M.R. & Fisher, D.L. (2009). The effect of active versus passive training strategies on improving older drivers' scanning in intersections. *Human Factors*, 51, 652 – 668.
- Rosenstock, I.M., Strecher, V.J. & Becker, M.H. (1994). The health belief model and HIV risk behavior change. Pp. 5–24 in DiClemente, R.J., Peterson, J.L. (eds). *Preventing AIDS: Theories and Methods of Behavioral Intentions*. New York: Plenum Press.
- Ruiter, R. A. C., Abraham, C. & Kok, G.J. (2001). Scary warnings and rational precautions: A review of the psychology of fear appeals. *Psychology & Health*, 16, 613–630.

- Schotzko, C.M., Richardson, L.M. & Kiragu, A.W. (2006). Adolescent perspective on safety. *Journal of Trauma - Injury, Infection and Critical Care*, 60 (6), 1386-7.
- Schumann, D.W., Petty, R.E. & Clemons, D.S. (1990). Predicting the effectiveness of different strategies of advertising variation: A test of the repetition-variation hypotheses. *Journal of consumer research*, 17 (2), 192 - 202.
- Schwarzer, R., Bäßler, J., Kwiatek, P. & Schröder, K. (1997). The assessment of optimistic self-beliefs: Comparison of the German, Spanish, and Chinese version of the General self-efficacy scale. *Applied psychology: an international review*, 46 (1), 69 - 88.
- Schwebel, D.C. & McClure, L.A. (2010). Using virtual reality to train children in safe street-crossing skills. *Injury prevention*, 16 (1).
- Sheeran, P., Harris, P. R., & Epton, T. (2013, June 3). Does Heightening Risk Appraisals Change People's Intentions and Behavior? A Meta-Analysis of Experimental Studies. *Psychological Bulletin*. Advance online publication.
- Shi, J. & Smith, S.W. (2016). "The effects of fear appeal message repetition on perceived threat, perceived efficacy, and behavioral intention in the extended parallel process model." *Health communication* 31(3), 275-286.
- Silva, S., Carvalho, H., Jao Oliveira, M., Fialho, T., Guedes Soares, C. & Jacinto, C. (2017). Organizational practices for learning with work accidents throughout their information cycle. *Safety Science*. <https://doi.org/10.1016/j.ssci.2016.12.016>
- Sitzman, T. (2011). A meta-analytic examination of the instructional effectiveness of computer-based simulation games. *Personality Psychology*, 64, 489 - 538.
- Sjoberg, L. (2002) Risk communication between experts and the public: perceptions and Intentions. *Quest de Communication* 2, 19-35
- Slater, M.D., Karan, D.N., Rouner, D. & Walter, D. (2002). Effects of threatening visuals and announcer differences on responses to televised alcohol warnings. *Journal of Applied Communication Research* 30 (1), 27-49.
- Slovic, P. (2000). *The Perception of Risk*. Earthscan, London.
- Simons-Morton, B.G., Quimet, M.C. & Catalano, R.F.(2008). Parenting and the young driver problem. *American journal of preventive medicine*, 35(3), S294 - S303.
- Smith, R.A., Ferrara, M. & Witte, K. (2007). Social sides of health risks: stigma and collective efficacy. *Health Communication*, 21, 55-64
- Stone, E.R, Yates, J.F. & Parker, A.M. (1997). Effects of numerical and graphical displays on professed risk-taking behavior. *Journal of experimental psychology: Applied* 3, 243 - 256.
- Sunstein, C.R. (1996). Social norms and social roles. *Columbia law review*, 96 (4), 903 - 968.
- Ter Huurne, E.F.J. (2008). Information seeking in a risky World. The theoretical and empirical development of FRIS: a framework of risk information seeking. Dissertation.

Enschede: University of Twente. 174 p.

- Ter Huurne, E.F.J., Gutteling, J.M. (2008). Information needs and risk perception as predictors of risk information seeking. *Journal of Risk Research*, 11(7), 847 – 862.
- Ter Huurne, E.F.J. & Gutteling, J.M. (2009). How to trust? The importance of self efficacy and social trust in public responses to industrial risks. *Journal of Risk Research*, 12 (6), 809–24.
- Ter Huurne, E.F.J., Griffin, R.J. & Gutteling, J.M. (2009). Risk information seeking among U.S. and Dutch residents: An application of the model of risk information seeking and processing. *Science Communication*, 31, 215–37.
- Terpstra, T., Gutteling, J.M. (2008). Households' perceived responsibilities in flood risk management in the Netherlands. *International Journal of Water Resources*, 24, 555–565.
- Terpstra, T., Lindell, M.K. & Gutteling, J.M. (2009). Does communicating (flood) risk affect (flood) risk perceptions? Results of a quasi-experimental study. *Risk Analysis*, 29, 1141–1155
- Terpstra, T. (2010). Flood preparedness. Thoughts, feelings and intentions of the Dutch public. Dissertation. Enschede: University of Twente. 98 p.
- Timmermans, D.R.M., Ockhuysen-Vermeij, C.F. & Henneman, L. (2008). Presenting health risk information in different formats: The effect on participants' cognitive and emotional evaluation and decisions. *Patient Education and Counseling*, 73 (3), 443–7.
- Trettin, L. & Musham, C. (2000). Is trust a realistic goal of environmental risk communication? *Environment and behavior*, 32 (3), pp. 410 – 426.
- Tugade, M.M., Fredrickson, B.L. & Feldman Barret, L. (2004). Psychological resilience and positive emotional granularity: examining the benefits of positive emotions on coping and health. *Journal of personality*, 72 (6), 1161 – 1190.
- Tulving, E. (1983). *Elements of episodic memory*. New York: Oxford University Press.
- Turner, M., Rimal, R., Morrison, D., & Kim, H. (2006). The Role of Anxiety in Seeking and Retaining Risk Information: Testing the Risk Perception Attitude Framework in Two Studies. *Human Communication Research*, 32, 130-156.
- Van Buuren, A., Ellen, G.J. & Warner, J.F. (2016). Path-dependency and policy learning in the Dutch delta: toward more resilient flood risk management in the Netherlands? *Ecology and Society* 21(4):43.
- Van Leeuwen, F. (2012). Het motiveren van burgers tot zelfredzaam gedrag in geval van een weeralarm. Master's thesis. Enschede, University of Twente.
- Verroen, S., Gutteling, J.M. & de Vries, P.W. (2013). Enhancing self-protective behavior: efficacy beliefs and peer feedback in risk communication. *Risk Analysis*, 33 (7), 1252 – 1264.
- Vieweg S, Hughes AN, Starbird K. & Palen L. (2010). Microblogging during two natural hazards events: What Twitter may contribute to situational awareness. P.p. 1079–1088 in

- Conference on Human Factors in Computing Systems, Proceedings, 2, Atlanta, GA.
- Vincent, A.M. & Dubinsky, A.J. (2004). Impact of fear appeals in a cross-cultural context. *Journal of Euromarketing*, 14 (1-2), 145-67.
- Visscher, V.H.M., Meertens, R.M., Passchier, W.W.F. & de Vries, N.N.K. (2009). Probability information in risk communication: A review of research literature. *Risk Analysis*, 29 (2), 267 - 287.
- Wade, C.R., Molony, S.T., Durbin, M.E., Klein, S.H., & Wahl, L.E. (1992). Communicating with the Public about Risk. U.S. Department of Energy, Los Alamos.
- Wang, P., Patrick Rau, P. & Salvendy, G. (2015). Effect of information sharing and communication on driver's risk taking. *Safety Science*, 77, 123 - 132.
- Webb, N.M. (1989). Peer interaction and learning in small groups. *International journal of educational research*, 13(1), 21 - 39.
- Weinstein, N. (1999). What does it mean to understand a risk? Evaluating risk comprehension. *Journal of the national cancer institute monograph*, 25, 15 - 20.
- Westerman, D., Spence, P.R. & van der Heide, B. (2013). Social media as information source: Recency of updates and credibility of information. *Journal of computer mediated communication*, 19 (2), 171 - 183.
- Windle, M. (1999). Critical conceptual and measurement issues in the study of resilience. *International Journal of Occupational Safety and Ergonomics*: 163.
- Witte, K. (1992). Putting the fear back into fear appeal: The extended parallel process model. *Communication Monographs*, 59(4), 329 - 349.
- Witte, K., Cameron, K.A., McKeon, J. & Berkowitz, J. (1996). Predicting risk behaviors: Development and validation of a diagnostic scale. *Journal of health communication*, 1, 317 - 341.
- Witte, K., & Allen, M. (2000). A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health Education & Behavior* 27(5), 591-615.
- Witte, K., Cameron, K. A., McKeon, J., & Berkowitz, J. (1996). Predicting risk behaviors: Development and validation of a diagnostic scale. *Journal of Health Communication*, 1, 317-341
- Yang, Z.J., Aloe, A.M. & Feeley, T.H. (2014). Risk information seeking and processing model: a meta-analysis. *Journal of Communication*, 64 (1), 20 - 41.
- Youssef, C.M. & Luthans, F. (2007). Positive organizational behavior in the workplace. *The impact of hope, optimism, and resilience. Journal of management*, 33 (5). 777 - 800.
- Zaalberg, R., Midden, C., Meijnders, A & McCalley, T. (2009). Prevention, adaptation, and threat denial: flooding experiences in the Netherlands. *Risk Analysis*, 29, 1759 - 1778
- Zajonc, R. B. (1968). "Attitudinal effects of mere exposure." *Journal of Personality and Social Psychology* 9(2), 1-27.

**SUMMARY**

**SAMENVATTING**



## SUMMARY

The aim of this thesis is to gain an in-depth understanding of self-protective behavior of citizens regarding real-life safety risks. With the increase of safety risks in our modern day society, the necessity of preparing citizens for possible risks and crises in their environment becomes more evident (Rickard et al., 2014). Insight in the conditions under which citizens are inclined to take self-protective measures is therefore needed. Since risk communication is a powerful tool used to increase self-protectiveness of citizens, this thesis also focuses on studying the way in which risk communication can be used as a means to enhance the self-protective behavior of at-risk populations. The main research question is: Which variables predict the self-protectiveness of citizens with regard to real-life safety risks and under which conditions is risk communication most effective in enhancing self-protective behavior?

This thesis goes beyond previous studies in five ways. One, I test the basic assumptions of the Extended Parallel Process Model (EPPM) (Witte, 1992) – a prominent model in risk communication research - in a controlled laboratory setting as well as in field studies with regard to safety risks. Two, I add variables to the basic assumptions of the EPPM, namely involvement, social norm and personal responsibility. Three, I study the effect of different risk communication efforts - differing in the number of risk message repetitions and the instructional method (active vs. passive) used - on self-protectiveness in both the short- and long-term. Four, I study actual behavior instead of intentions only. Five, I focus on various risk topics - varying in level of familiarity, novelty and dreadfulness, and variations in man-made and natural hazards - and populations, namely primary school children (age: 9 - 13) and adults. These variations allow us to study human behavior regarding safety risks in general and to generalize our results to a broad population.

Together, the findings discussed address both the predictors of actual self-protectiveness as well as the way in which risk communication can most optimally stimulate self-protective behavior - the so called "delivery mode". One may conclude that insight in both the predictors of self-protective behavior in real-life safety settings and the delivery mode that is most effective in increasing self-protectiveness contributes to a better understanding of self-protective behavior of citizens.

In chapter 2, an empirical study on the effect of risk perception and efficacy beliefs on self-protectiveness regarding flood risks is reported. Based on the Extended Parallel Process Model (Witte, 1992), my co-authors and I examine what the effect of risk messages is - differing in level of risk perception and perceived efficacy - on the intention of citizens prone to the risks of flooding to take risk mitigating options. Moreover, we examine their information seeking behavior concerning flood risks. In the study reported in chapter 2 (n = 726) a quasi-experimental field study is conducted among adults prone to flood risks, by manipulating the levels of perceived

risk and efficacy beliefs in multiple risk messages. Results show that higher levels of induced risk perception and efficacy beliefs result in significantly higher levels of both information seeking behavior and the intention to engage in self-protective behavior. The efficacy beliefs proved to be key predictors of self-protectiveness. Also, high levels of risk perception prove to be a vital element in increasing self-protectiveness. Only under the condition that respondents perceive a risk as threatening and feel that risk mitigating options are feasible and useful in mitigating the threat, they will engage in risk mitigating behaviors.

In chapter 3, two empirical studies are reported on the effect of risk information seeking on risk behavior regarding fire safety and terrorism. Although a growing body of risk communication research focuses on how people process risk information, one question often overlooked is how the seeking of information contributes to behavioral adaptation toward the risk issue (Ter Huurne, 2008). In the first empirical study (n = 92), several of the basic assumptions of the Framework for Risk Information Seeking (Ter Huurne, 2008) are tested in a laboratory setting. This study focuses on the effect of personal involvement and risk perception on the intention for risk information seeking. In the second empirical study (n = 168), the effect of risk perception, involvement and efficacy on self-protectiveness is tested. Also, the relationship between risk information seeking and the intention to take other preventive or risk-mitigating behaviors is studied. Results show that high levels of involvement proves to be an additional important predictor of both risk information seeking as well as the intention to engage in other risk related behaviors. Participants that felt that they are personally involved with a certain risk, showed higher levels of self-protective behavior. Also, respondents engaging in the gathering of relevant risk information are more intended to take preventive measures than low risk information seekers. This stresses the need to actively motivate citizens to seek for risk information as an addition to merely encouraging them to engage in risk mitigating behavior.

In chapter 4 two empirical studies are reported focusing on the way in which risk communication efforts are most effective in enhancing self-protectiveness of individuals concerning external safety risks. I propose that the psychological elements underlying people's judgment whether to take self-protective behaviors can be influenced by the way in which risk communication is provided – the so called delivery mode. Personal responsibility is added as a predictor of self-protective behavior in this study. The first study of chapter 4 consists of a behavioral-training-effectiveness study (n = 47), exploring whether a behavioral training (an active form of risk communication) increases participants' efficacy beliefs and self-protectiveness. In the second study of chapter 4 – using a random sample of the population of Borne prone to the risks related to the transportation of chemical substances by train (n = 614) – my co-authors and I test if the delivery mode used when communication about risks (behavioral training vs. information only vs. no information) is a predictor of efficacy beliefs and self-protectiveness. Results show that actively informing citizens (by means of a behavioral training) increases levels of efficacy beliefs and self-protectiveness to a significantly larger extent than the passive approach

in which individuals are merely informed. The results show that an active approach in risk communication is more effective in increasing the self-protectiveness of the population with regard to external safety risks. Furthermore, personal responsibility proves to be an important additional predictor of self-protectiveness.

In chapter 5, social norm is added as an additional predictor of self-protectiveness. Although the concept of social norm is a well-known predictor of behavior in social psychological theoretical models such as the Theory of Planned Behavior (Ajzen, 1991), it has not been studied intensively within the safety domain. According to Verroen, Gutteling and de Vries (2013), people's behavior in preparing for a crisis as well as their behavior during a crisis is partly predicted by their perceived social norm regarding safe behavior. I propose that social norm, together with perceived feasibility (self-efficacy) and the expected usefulness (response-efficacy) of risk-mitigating options, might predict self-protectiveness. Furthermore, I take the perspective that a behavioral training (active risk communication) in which peer interaction is stimulated, leads to a more positive social norm and subsequently higher levels of self-protective behavior than passive risk communication. This study is conducted in the Risk Factory – a state-of-the-art education-center in which children (age: 9 – 13) experience real-life risks first hand and learn how to deal with dangerous situations. This study focused on fire safety and emergency situations as research topics. A sample of children from 14 primary schools (n = 365) randomly assigned to one of three conditions (behavioral training vs. passive information vs. no information) is used. Results show that social norm – together with self-efficacy and response-efficacy – are important predictors of self-protective behavior regarding safety risks among children. These results indicate that when preparing individuals for a disaster or crisis by means of risk communication, one ideally should also take the social context of recipients into account. Citizens that have a positive social norm and perceive risk mitigating options as both feasible (high levels of self-efficacy) and useful (high levels of response-efficacy) are most likely to engage in adequate risk behaviors. Also, this study shows that an active way of communicating about risks is more effective in increasing self-protective behavior of individuals when compared to standard-passive forms of risk communication.

In chapter 6, the effect of risk message repetition on self-protectiveness in the short- and long-term is examined more closely. This study focuses on emergency situation and internet safety as risk topics. I assume that risk message repetition increases the level of self-protective behavior to a larger extent than providing only one single risk message or than providing no risk message at all. My co-authors and I chose a behavioral training (active risk-communication) as the delivery mode since research indicates that this form is more effective in increasing self-protectiveness than standard-passive techniques of risk communication. While a large amount of literature in advertising and persuasion try to explain the influence of message repetition on attitudes and behavior (Zajonc, 1968; Berlyne, 1970; Cacioppo & Petty 1989), within the risk communication literature the effect of message repetition on self-protectiveness has not been studied intensively (Witte 1992, 1994; Shi & Smith 2016). This study provides crucial

additional information on the effect of message repetition in a real-life safety setting, answering the question: does message repetition increase the actual self-protective behavior of individuals in both the short- and long-term?

The study is again conducted in the Risk Factory among primary school children (age 9 - 13) randomly assigned to one of three conditions (behavioral training repetition vs. behavioral training vs. no information (n = 265). Results show that risk message repetition positively influences actual self-protective behavior in both the short- and long-term. Individuals participating in a behavioral training and that receive a risk message repetition, engage in significantly more self-protective behaviors than respondents who do not receive a risk message repetition in both the short- and long-term.

Overall, the results show that risk communication is most effective when recommended risk mitigating actions can be viewed by the public as effective in mitigating the threat. Therefore, risk communication efforts need to focus primarily on communicating risk-mitigating options that the target audience perceives as useful. Providing citizens with the opportunity to practice these behaviors as well as emphasizing their own personal responsibility, are two options that might positively influence this perceived usefulness of risk mitigating options. Also, this thesis shows that citizens that have a positive social norm regarding safe behaviors, are more willing to engage in self-protectiveness. This stresses the need to incorporate social norm in current risk communication campaigns. Finally, since results show that citizens who receive multiple similar risk messages are more willing to engage in risk mitigating behavior in the short- and long-term, risk message repetition can be used in order to increase the self-protectiveness of the population.

The similarities in results found between our research populations (children vs. adults), provide a first indication that comparable constructs predict self-protectiveness for different populations in our society. The different results found between risk topics in this thesis ask for a better understanding of the influence of the type of risk on the relationship between delivery mode and (predictors of) self-protective behavior.

## SAMENVATTING

Het doel van dit proefschrift is om diepgaande kennis te verkrijgen in de zelfredzaamheid van burgers bij levensechte veiligheidsrisico's. Met de toename van veiligheidsrisico's in onze moderne samenleving, neemt ook de noodzaak toe om burgers goed voor te bereiden op mogelijke risico's en crises (Richard et al., 2014). Inzicht in de condities waaronder burgers geneigd zijn zelfredzaam gedrag te vertonen is dan ook cruciaal. Aangezien risicocommunicatie een krachtig middel is om de zelfredzaamheid te vergroten, richt dit proefschrift zich ook op de manier waarop risicocommunicatie gebruikt kan worden als middel om de zelfredzaamheid te verhogen bij populaties met een verhoogd risico. De hoofdvraag van dit proefschrift luidt dan ook: Welke variabelen voorspellen de zelfredzaamheid van burgers bij levensechte veiligheidsrisico's en onder welke condities is risicocommunicatie het meest effectief in het vergroten van de zelfredzaamheid?

Dit proefschrift gaat verder dan eerdere studies op vijf verschillende manieren. Allereerst worden de basis uitgangspunten van de Extended Parallel Process Model (EPPM) (Witte, 1992) getest - het meest vooraanstaande model gebruikt in dit proefschrift - in zowel een gecontroleerde laboratorium opstelling als een veldexperiment wat betreft veiligheidsrisico's. Ten tweede worden variabelen toegevoegd aan de basis uitgangspunten van EPPM, te weten persoonlijke betrokkenheid, sociale norm en eigen verantwoordelijkheid. Ten derde wordt het effect van verschillende vormen van risicocommunicatie getest - variërend in de instructiemethode en variërend in het aantal herhalingen van de risico boodschap - op zelfredzaamheid op de korte- en de lange-termijn. Ten vierde wordt daadwerkelijk gedrag gemeten, en niet slechts intentie tot gedrag. Ten vijfde worden verschillende risico-onderwerpen - variërend in mate van bekendheid, nieuwigheid en afschrikwekkendheid en in menselijke en natuurlijke risico's - en populaties bestudeerd, te weten basisschool kinderen (leeftijd 9 - 13) en volwassenen. Deze variaties stellen ons in staat om menselijk gedrag te bestuderen betreffende algemene veiligheidsrisico's en onze resultaten te generaliseren naar een brede populatie.

Gezamenlijk adresseren de resultaten van dit proefschrift de voorspellers van daadwerkelijk zelfredzaam gedrag en de manier waarop risicocommunicatie optimaal kan worden ingezet om de zelfredzaamheid te verhogen - de zogenoemde vorm van risicocommunicatie ("delivery mode"). Inzicht in zowel de voorspellers van zelfredzaamheid in levensechte veiligheidsrisico' als in de meest effectieve vorm van risicocommunicatie om zelfredzaamheid te verhogen, dragen bij aan een beter begrip van de zelfredzaamheid van burgers.

In **hoofdstuk 2** wordt onderzoek beschreven naar het effect van risicoperceptie en effectiviteitsinschatting (efficacy beliefs) op zelfredzaamheid ten aanzien van overstromingsgevaar. Gebaseerd op het Extended Parallel Process Model (EPPM) (Witte, 1992), wordt onderzocht wat het effect van een risicoboodschap is - variërend in mate van risicoperceptie en effectiviteitsinschatting - op de intentie van burgers om zich zelfredzaam te gedragen.

Bovendien wordt hun informatie-zoekgedrag onderzocht betreffende overstromingsgevaar. In het onderzoek van hoofdstuk 2 (n = 726) is een quasi-experimentele veldstudie gedaan bij volwassenen, blootgesteld aan overstromingsgevaar, door de mate van gepercipieerd risico en effectiviteitsinschatting in verschillende risico boodschappen te manipuleren. De resultaten laten zien dat een hogere mate van risicoperceptie en effectiviteitsinschatting resulteren in een significant hogere mate van informatie-zoekgedrag en intentie tot zelfredzaamheid. Bovendien, een hogere mate van risicoperceptie blijkt een cruciaal element in het verhogen van zelfredzaamheid. Alleen wanneer respondenten een risico als dreigend ervaren en het gevoel hebben dat de handelingsperspectieven haalbaar en bruikbaar zijn om het risico te verlagen, zullen zij zelfredzaam gedrag vertonen.

In **hoofdstuk 3** worden twee empirische studies beschreven over het effect van risico-informatie zoeken op risico gedrag in het geval van brandveiligheid en terrorisme. Hoewel steeds meer risicocommunicatie onderzoek zich richt op hoe mensen risico informatie verwerken, wordt 1 vraag vaak over het hoofd gezien, namelijk hoe het zoeken van informatie bijdraagt aan het aanpassen van gedrag ten aanzien van het risico (Ter Huurne, 2008). In de eerste empirische studie (n = 92) worden verschillende basis assumpties van het Framework for Risk Information Seeking (Ter Huurne, 2008) getest in een laboratorium setting. Deze studie richt zich op het effect van persoonlijke betrokkenheid en risico perceptie op de intentie tot risico-informatie zoeken. In de tweede empirische studie (n = 186) wordt het effect van risico perceptie, betrokkenheid en effectiviteitsinschatting op zelfredzaamheid getest. Ook wordt de relatie tussen informatie zoeken en de intentie tot het nemen van risico-reducerend gedrag (risicomitigating behavior) bestudeerd. De resultaten laten zien dat een hoge mate van betrokkenheid een belangrijke additionele voorspeller is van zowel risico-informatie zoeken als de intentie om ander adequaat risico gerelateerd gedrag te laten zien. Participanten die zich persoonlijk betrokken voelden bij een bepaald risico lieten een hogere mate van zelfredzaamheid zien. Bovendien waren respondenten die risico-informatie zochten meer geneigd om preventieve maatregelen te nemen dan respondenten die dat minder deden. Dit benadrukt de noodzaak van het actief motiveren van burgers om risico informatie te zoeken, naast het aansporen tot ander zelfredzaam gedrag.

In **hoofdstuk 4** worden twee empirische studies beschreven gericht op de manier waarop risicocommunicatie het meest effectief is in het verhogen van zelfredzaamheid van individuen bij externe veiligheidsrisico's. Er wordt verondersteld dat de onderliggende psychologische elementen bij het inschatten van het al dan niet vertonen van zelfredzaam gedrag beïnvloed kunnen worden door de manier waarop de risicocommunicatie wordt aangeboden - de zogeheten vorm van risicocommunicatie. In deze studie is persoonlijke verantwoordelijkheid toegevoegd als voorspeller van zelfredzaamheid. De eerste studie in hoofdstuk 4 bestaat uit een gedragstraining effectiviteitsstudie (n = 47), waarin onderzocht wordt of een gedragstraining (een actieve vorm van risicocommunicatie) de effectiviteitsinschatting en de zelfredzaamheid van deelnemers beïnvloedt. In de tweede studie van hoofdstuk 4 - bij een willekeurige

steekproef van de populatie van Borne blootgesteld aan risico's ten aanzien van het transporten van chemische stoffen per trein (n = 614) – wordt getest of de vorm van risicocommunicatie bij het communiceren over de risico's (gedragstraining vs. alleen informatie vs. geen informatie) een voorspeller is van de effectiviteitsinschatting en zelfredzaamheid. De resultaten laten zien dat het actief informeren van burgers (door middel van een gedragstraining) de mate van effectiviteitsinschatting en zelfredzaamheid significant meer doen toenemen dan een passieve aanpak waarin individuen alleen geïnformeerd worden. De resultaten laten zien dat een actieve aanpak in risicocommunicatie meer effectief is in het verhogen van de zelfredzaamheid van de populatie bij externe veiligheidsrisico's. Bovendien blijkt persoonlijke verantwoordelijkheid een belangrijke additionele voorspeller van zelfredzaamheid.

In **hoofdstuk 5** is sociale norm toegevoegd als additionele voorspeller van zelfredzaamheid. Hoewel het concept sociale norm een bekende voorspeller van gedrag is in sociaal psychologische theoretische modellen zoals de Theory of Planned Behavior (Ajzen, 1991) is het nog niet eerder intensief bestudeerd binnen het veiligheidsdomein. Volgens Verroen, Gutteling en de Vries (2013) wordt het gedrag van mensen in zowel het voorbereiden op een crisis als tijdens een crisis deels voorspeld door hun waargenomen sociale norm ten aanzien van veilig gedrag. In dit proefschrift wordt verondersteld dat sociale norm, samen met waargenomen haalbaarheid (self-efficacy) en het verwachte nut (response-efficacy) van handelingsperspectieven, zelfredzaamheid zou kunnen voorspellen. Bovendien wordt verondersteld dat een gedragstraining (actieve risicocommunicatie) waarin interactie met leeftijdsgenoten (peer interaction) wordt gestimuleerd, meer leidt tot een positieve sociale norm en dat dat vervolgens leidt tot meer zelfredzaamheid, dan passieve risicocommunicatie. Deze studie is uitgevoerd in de Risk Factory – een zeer modern onderwijscentrum waarbinnen basisschoolkinderen (leeftijd: 9 – 13) levensechte risico's zelf kunnen ervaren en kunnen leren hoe ze met gevaarlijke situaties moeten omgaan. Deze studie richt zich op brandveiligheid en noodsituaties als onderzoeksonderwerpen. Een steekproef van kinderen van 14 basisscholen (n = 265) is willekeurig toegewezen aan een van drie condities (gedragstraining vs. passieve informatie vs. geen informatie). De resultaten laten zien dat sociale norm – samen met waargenomen haalbaarheid en het verwachte nut – belangrijke voorspellers zijn van zelfredzaamheid. Deze resultaten suggereren dat bij het voorbereiden van een individu op een ramp of crisis door middel van risicocommunicatie, idealiter de sociale context van de ontvangers wordt meegenomen. Burgers die een positieve sociale norm hebben en handelingsperspectieven als zowel haalbaar en nuttig ervaren, zullen meer geneigd zijn adequaat risico gedrag te vertonen. Daarnaast laat deze studie zien dat een actieve manier van risicocommunicatie effectiever is in het verhogen van zelfredzaamheid vergeleken met meer standaard passieve vormen van risicocommunicatie.

In **hoofdstuk 6** wordt het effect van het herhalen van een risicoboodschap op zelfredzaamheid op de korte- en lange-termijn nader onderzocht. Deze studie richt zich op noodsituaties

en internetveiligheid als risico onderwerpen. Verondersteld wordt dat herhaling van risicoboodschappen de mate van zelfredzaamheid meer verhoogt dan het aanbieden van een enkele boodschap of helemaal geen risicoboodschap. Er is een gedragstraining gekozen (actieve vorm van risicocommunicatie) als de vorm van risicocommunicatie aangezien onderzoek laat zien dat deze vorm meer effectief is dan passieve vormen van risicocommunicatie in het verhogen van zelfredzaamheid. Hoewel veel literatuur op het gebied van adverteren en overreding (persuasion) uitleg geeft over het effect van boodschap herhaling op attitudes en gedrag (Zajonc, 1968; Berlyne, 1970; Cacioppo & Petty, 1989), is het effect van boodschap herhaling op zelfredzaamheid niet intensief bestudeerd binnen de risicocommunicatie literatuur (Witte, 1992, 1994; Shi & Smith, 2016). Deze studie geeft cruciale additionele informatie over het effect van boodschap herhaling in levensechte veiligheidssituaties en geeft antwoord op de vraag: verhoogt boodschap herhaling de zelfredzaamheid van individuen op de korte- en de lange-termijn? Deze studie is wederom uitgevoerd in de Risk Factory met basisschool kinderen (leeftijd 9 - 13) die willekeurig zijn toegewezen aan een van drie condities (gedragstraining herhaling vs. gedragstraining vs. geen informatie (n = 265)). De resultaten laten zien dat risicoboodschap herhaling een positieve invloed heeft op zelfredzaamheid op zowel de korte- als de lange-termijn. Individuen die deelnemen aan de gedragstraining en boodschap herhaling ontvangen, vertonen significant meer zelfredzaam gedrag dan respondenten die geen herhaling van de risicoboodschap ontvangen.

De resultaten van dit proefschrift laten zien dat risicocommunicatie het meest effectief is wanneer de aanbeloven handelingsperspectieven gezien worden door het publiek als effectief in het ondervangen van de dreiging. Daarom zou risicocommunicatie primair gericht moeten zijn op het communiceren van handelingsperspectieven die door de doelgroep als nuttig worden ervaren. Burgers voorzien van mogelijkheden om te oefenen met dit gedrag en het benadrukken van hun eigen persoonlijke verantwoordelijkheid, zijn twee opties die een positieve invloed kunnen hebben op het waargenomen nut van handelingsperspectieven. Ook laat dit proefschrift zien dat burgers die een positieve sociale norm hebben ten aanzien van veilig gedrag, meer geneigd zijn om zelfredzaam gedrag te vertonen. Dit benadrukt de noodzaak om sociale norm mee te nemen in huidige risicocommunicatie campagnes. Ten slotte zouden risicoboodschappen herhaald moeten worden, aangezien de resultaten laten zien dat burgers die meerdere keren dezelfde risicoboodschap ontvangen meer geneigd zijn tot zelfredzaamheid op zowel korte- als lange-termijn.

De overeenkomsten tussen de resultaten in verschillende populaties (kinderen vs. volwassenen), geven een eerste indicatie dat vergelijkbare constructen zelfredzaamheid voorspellen voor verschillende populaties in onze samenleving. De verschillende resultaten die werden gevonden tussen risico-onderwerpen in dit proefschrift suggereren dat er meer inzicht moet komen in de invloed van het type risico op de relatie tussen vorm van risicocommunicatie en (voorspellers van) zelfredzaamheid.





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