Individual Disaster Preparedness: Explaining disaster-related Information Seeking and Preparedness Behavior in Switzerland

Report

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Individual Disaster Preparedness: Explaining disaster-related information seeking and preparedness behavior in Switzerland

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Content

Executive Summary

Individual disaster preparedness is shaped by a broad variety of psychological, socio-economic and cultural factors which interact in complex ways. The present study makes a preliminary effort to understand the drivers of information seeking and preparedness behavior in the German and French speaking parts of Switzerland. It analyzes the important driving factors behind individual information seeking about hazard preparedness and seeks to generate the basis for a discussion on how well-designed disaster management and risk communication practices can contribute to advances in the field.

Preparatory measures for disasters can take on a variety of concrete forms. Generally speaking, they refer to actions that prevent or reduce the risk of injuries and damage caused by, or associated with, hazard events. In practice, academic researchers and emergency practitioners have widely agreed on a conception of individual disaster preparedness that is composed of two elements: emergency supplies on the one hand and emergency plans on the other hand. While emergency supplies include the sufficient storage of water and food, for example, emergency plans refer to the development of clearly defined procedures and capabilities to respond to specific emergencies before they arise (such as the identification of escape routes, communication and reunion strategies, etc.).

In a previous study, the CSS examined the hazard information needs of the Swiss population using a panel survey. The work established descriptive and comparative differences between 2011 (when the same survey was last completed) and 2017, which are detailed by Maduz et al. (2018). The present study more deeply explores this data to understand the explanatory relationships between key influential factors and information seeking behavior.

Based on the analyses conducted in this study, four important conclusions can be drawn from the work:

1. While people seem to be seeking more information about risks, and demonstrated higher levels of risk perception, these factors don't necessarily correlate with increased knowledge about potential preparations, or actual preparation.

2. As highlighted by previous work by the CSS (Prior and Herzog, 2015a), considering several key elements when developing risk information will likely improve the ability of the public to translate risk information into action.

3. Focusing on demographic factors as drivers of information assimilation and action when developing risk communication messages and process is insufficient. An understanding of the way demographic characteristics affect information seeking, preparedness knowledge, and preparedness behavior must be mixed with a consideration of the way socio-cognitive factors affect peoples' decisions. By combining both, risk communicators can reasonably develop effective and efficient risk communication resources.

4. Proper preparedness requires planning. The study demonstrated that people who develop an emergency plan generally demonstrate higher levels of preparedness knowledge than people who report having an emergency supply of food and water.

Utilising the 2011 information seeking survey as the basis of the 2017 survey permitted a comparison in the Swiss public's information seeking behavior between 2011 and 2017. However, this survey construction limited the ability of the research team to add psychometrically tested question-sets to the survey that would have covered some important socio-psychological factors that are known to influence both information seeking and preparedness behavior. Using this study as the basis for further analyses that specifically examine the dual influence of demographic and socio-cognitive factors on preparedness will yield a more coherent picture of the publics' preparedness decision making, and bring this work in line with international efforts to continually improve the meaningfulness and public understanding of risk messages.

1 Introduction

1.2 Aim of the study

Individual disaster preparedness has been found to be shaped by a broad variety of psychological, socio-economic and cultural factors, which interact in complex ways (Prior and Eriksen 2013; Paton et al. 2008). From the perspective of the disaster management and risk communication authorities, it is essential to know the public's standard of knowledge about hazards, its information needs, and the way these factors, in particular, shape individual preparedness behavior.

Internationally, research of this nature has been widely used by authorities to improve risk communication practices, and significant methodological and practical advances have been made with respect to how risk communication is used as a tool to encourage personal preparedness behavior. However, just as disasters have a strong local component, also disaster preparedness differs from one context to the other. Therefore, findings how to foster preparedness are not easily transferrable.

To date, little research has been conducted on the topic in German speaking parts of Europe. The present study makes a preliminary effort to understand the drivers of information seeking and preparedness behavior in the German and French speaking parts of Switzerland. It analyzes the important driving factors behind individual information seeking about hazards, local risks, and possible protective measures and seeks to generate the basis for a discussion on how well-designed disaster management and risk communication practices can contribute to advances in the field.

1.2 Previous CSS work

The CSS has published a large volume of work on risk communication and risk messaging (Hagmann and Cavelty, 2012; Roth and Brönnimann, 2012; Giroux, Roth and Herzog, 2013; Roth, Giroux and Herzog, 2013, 2015), and individual preparedness (Prior and Herzog, 2015b).

In 2018, the CSS examined the hazard information needs of the Swiss population using a panel survey. The work established descriptive and comparative differences between 2011 (when the same survey was first completed) and 2017, which are detailed by Maduz et al. (2018). It showed how the perceptions of hazards and risks have changed in Switzerland over a rather short period of time. It also demonstrated how citizens' information seeking relevant to risks and mitigation measures has shifted over the survey period. The present study more deeply explores this data to understand the explanatory relationships between key influential factors and information seeking behavior.

1.3 Scope of the Study

The study utilizes data from the 2017 survey, first analyzed in Maduz et al., 2018. It considers a broad range of factors that are suspected to influence behavior related to disaster risks, including demographic characteristics, general hazard perceptions, and individual risk perception. Several socio-cognitive factors are also examined, even though the survey's construction limited the ability of the research team to add psychometrically tested question-sets. Consequently, the survey did not cover some important socio-psychological factors that are known to influence both information seeking and preparedness behavior. Important factors like 'sense of community', critical awareness', outcome expectancy', action coping', and 'self-efficacy', etc., were not included in the survey for reasons of survey length and because their exploration was not the primary goal of the 2018 study. Nevertheless, because the survey collected information on respondents' knowledge of preparedness behavior, and information seeking behavior, these two variables are the focus of this analysis.

Overall, the study examines preparedness towards a broad range of hazard scenarios (for details, see: Maduz et al., 2018). In particular, a focus was placed on public preparedness towards pandemic risks, which are considered to be one of the most serious risks that Switzerland is faces, and at which authorities have focused a good part of their recent public communication efforts (see section 3.1).

1.4 Outline of the study

After this introduction, Chapter 2 provides some background information to the study. Among other things, it summarizes the results of the previous study upon which the present study is built. Chapter 3 describes the dataset and the methods used. The two subsequent chapters detail the results of the study. They include a presentation of results of the empirical analyses as well as a discussion of these results. In a broad analysis, Chapter 4, first, examines if and how well-known predictors, such as individu-

als' structural characteristics, basic socio-cognitive factors, and behavioral variables impact individual disaster preparedness. Chapter 5, then, takes a closer look at the complex interplay among hazard-specific variables relevant to individuals' preparedness. The study concludes with a synthesis including some thoughts on policy implications (Chapter 6).

2 Background

2.1 Studying individual disaster preparedness

Although 'disaster preparedness' has had a long history of discussion in research and practice, and been found to be a key element of individuals' disaster resilience, no formal nor universally established definition of the term exists. In addition, Kohn et al. (2012) highlight "inconsistencies between governmental and academic definitions."

Preparatory measures for disasters can take on a variety of concrete forms. Generally speaking, they refer to actions that prevent or reduce the risk of injuries and damage caused by, or associated with, hazard events (Paton, 2003). In practice, academic researchers and emergency practitioners have widely agreed on a conception of individual disaster preparedness that is composed of two elements: emergency supplies on the one hand and emergency plans on the other hand. While emergency supplies include the sufficient storage of water and food, for example, emergency plans refer to the development of clearly defined processes and capabilities to respond to specific emergencies before they arise (such as the identification of escape routes, communication and reunion strategies, etc.).

Such preparatory actions may vary in terms of both their value added to individuals' preparedness as well as the difficulties involved in taking certain actions (Prior, 2010). A conceptual distinction that helps capture such difficulty is the one between "weak" and "hard" preparations. 'Weak' preparations refer to activities that generally do not require any specific disaster-orientated thinking, which can easily be embedded and incorporated in everyday life activities. A typical example would be food and water supplies: The storage of these goods can be maintained as a part of the usual household purchases without involving any particular hazard preparedness thinking. They will still be extremely helpful in case of a disaster. By contrast, 'hard' preparations require previous considerations of disaster risk, possible preparedness measures, and specific behaviors, etc. An example for such 'hard' preparation activity would be the creation of an emergency plan, as this requires specific considerations about possible disaster risks and concrete ways to deal with them, before an event occurs.

To date, research has failed to capture the qualitative difference between these two manifestations of personal preparedness (supplies and plans). One of the differentiations that can be drawn qualitatively refers to psychological thinking processes involved with, and required to achieve, certain preparedness (hard) activities. In this context, we would expect an emergency plan to pose greater obstacles to actual preparedness activity than storing sufficient food supplies, for example.

2.2 Social cognition and hazard preparedness

In the last 50 years, decision researchers have invested significant effort in understanding why people do, or do not, behave in predictable or advised ways. This work has especially focused on health risks and consumer behavior, but also on relationships between people and the environment. During this period, research has demonstrated the significant role of socio-cognitive factors in peoples' decision making with respect to protective behavior, like hazard preparedness.

It developed on the basis of early findings that people often do not accept, or necessarily act on, risk information provided to them by expert risk managers. Supposedly 'irrational' public decision making cannot simply be explained by structural demographic factors, and decision scientists have identified that socio-cognitive factors play an important mediating role in peoples' decisions, especially in the context of risk.

Social cognitive theories have spurred the development of social cognitive models (SCMs), which have been used to describe how different aspects of cognition (thinking), and the inter-relationships between these cognitions, can ultimately determine behavior (Hardeman et al., 2002). The Theory of Planned Behavior (TPB) (Ajzen, 1991), the Health Belief Model (HBM) (Rosenstock, 1974), the Protection Motivation Theory (PMT) (Rogers and Prentice-Dunn, 1997), and the Person-Relative-to-Event Model (PrE) (Duval and Mulilis, 1999) are four particularly important SCMs that have been applied in the psychological literature to firstly understand peoples' behavior in

relation to risk, and secondly to provide mechanisms that help influence behavior change through interventions like the dissemination of risk communication information.

These four key SCMs have been used variously in the environmental hazards preparedness literature, and provide generic mechanisms to understand and predict behavior from individual and social points of view. They have also been used to develop techniques by which "undesirable" behavior may be changed.

Social cognitive models describing human cognition help researchers to understand how people think about issues, but more importantly, how the interacting cognitions concerning those issues determine the way people behave. SCMs are consequently very useful tools for understanding why people don't behave in the ways we think they might or should. What has become clear over the past few decades is that while people may form accurate perceptions of their risk from natural hazards, there is no direct link between this and the adoption of actions that can ameliorate this risk. A crucial issue here is how people (individually and collectively) reason about their relationship with their environment.

The factors that influence how people reason about the hazardous aspects of their environment are diverse. Previous experience with a natural hazard or understanding of the hazard; interaction with hazard management agencies; interaction with the environment in which they live; relationships within the community; and media, can all contribute to decision-making by building cognitive, affective and behavioral attitudes towards risk at a personal level.

2.3 Disaster risks and individual preparedness in Switzerland

Over many centuries, Switzerland has learned to live with hazards connected to its specific geography. Specifically in the mountainous areas of the country, many settlements are exposed natural hazards, including avalanches, landslides, and floods. Only because of extensive protective measures and governance mechanisms at the local, cantonal and national levels, do these hazards pose only a very limited risk to the Swiss population today. These include, for instance, strict building codes, refined early-warning systems for gravitational hazards, and an efficient emergency management system. Similarly, Switzerland has been historically eager to set off its geostrategic vulnerabilities with an extensive civil defense system.

Mitigating the risks to the Swiss population, both stemming from natural and man-made hazards, is the mission of civil protection authorities. Their responsibility is to "protect the population and its vital resources in the event of disasters, emergencies and armed conflict". Among their core tasks, we find[1]:

- Ensuring that the public is informed about hazards, protection options and measures
- Warning and alerting the population, and issuing instructions on how it should act

A peculiarity of Swiss policy-making, including in the field of civil protection, is the pronounced federalist and subsidiary character of the system. As a consequence, diversity exists with regard to the organization of the civil protection system at the sub-national level. As such, efforts must be coordinated not only across the three political levels, but also among authorities and emergency response forces, such as with the police and fire services.

Based on the recent record of disaster events, Switzerland's civil protection system appears to be effective. Although comprehensive data on disaster losses is currently not available (UNISDR, 2017), research indicates that over the last decades, mortality due to natural disasters has been rather low in Switzerland by international comparison (Badoux et al., 2016, see Figure 1). Nonetheless, like many other countries, Switzerland will likely face considerable challenges in the foreseeable future, due to ecological, technological and social changes. For instance, Switzerland is particularly affected by the effects of climate change, with more frequent and extreme whether events to be expected. Further, the country's economy and society is globally interlinked, and also increasingly dependent on critical infrastructure systems. Various events of the last years, such as the widespread floods in 2005, the influenza pandemic of 2009, cyber-attacks on defense company RUAG in 2016, or the heat waves of 2015, 2017 and 2018, can be considered stark warnings in this regard (Bundesamt für Bevölkerungsschutz BABS, 2015).

To strengthen the resilience of the Swiss society in the face of these trends, significant effort has been invested in disaster management and to ensure efficient and effective government actions, including a complete revision of the national civil protection law aimed at stronger leadership and coordination of all actors involved (Schweizerishe Eidgenossenschaft, 2017). At the same time, authorities have begun to realize that an effective civil protection system fundamentally relies on the preparedness of the population, and that public preparedness cannot be taken for granted, but has to be enabled and supported to be operational (Roth, 2018). To foster the knowledge and capabilities of the population in

1 http://www.babs.admin.ch/en/verbund/auftrag.html

terms of individual preparedness, Swiss authorities are increasingly making use of online information and communication technologies, such as online information platforms, mobile apps, and social media. In 2015, Alertswiss.ch was launched as a central communication, information, and alerting platform (since October 2018). Amongst others, the platform provides for twelve selected hazards specific government recommendations on how to react in case of an emergency.

2.4 Key results of the 2017 survey

The present study uses data collected in a survey conducted in 2017 (Maduz et al., 2018). Initial analyses of the data produced some interesting results, but remained at a purely descriptive level. The study demonstrated that, since 2011, there was a rise in both peoples' risk perception and their information-seeking interest. At the same time people living in Switzerland became more actively engaged in information seeking-behavior. No clear trend was found with respect to peoples' knowledge about preparedness measures. Generally speaking, peoples' information levels were rather low with regard to technical and certain social risks, such as cyber and terror attacks. At the same time, these were the risks that people felt most threatened by, and for which the information seeking interest and behavior was the highest, or most active. Generally, more people reported having been affected by hazards in 2017.

The present study seeks to address a series of research questions that are relevant for refining and advancing current communication practices: How does risk perception influence information seeking-interest and behavior? What is the relationship between peoples' knowledge about preparedness and their information seeking-interest and behavior? How does experience influence information seeking-interest and behavior?

Perhaps unsurprisingly, results from this study also demonstrated that the Internet has gained in importance as an information platform since 2011. However, especially during a disaster, traditional information channels, such as the radio, sirens or the TV remain important. How does the existing communication and information structure affect peoples' information seeking interest and behavior? How can individual preparedness be encouraged using existing risk communication tools?

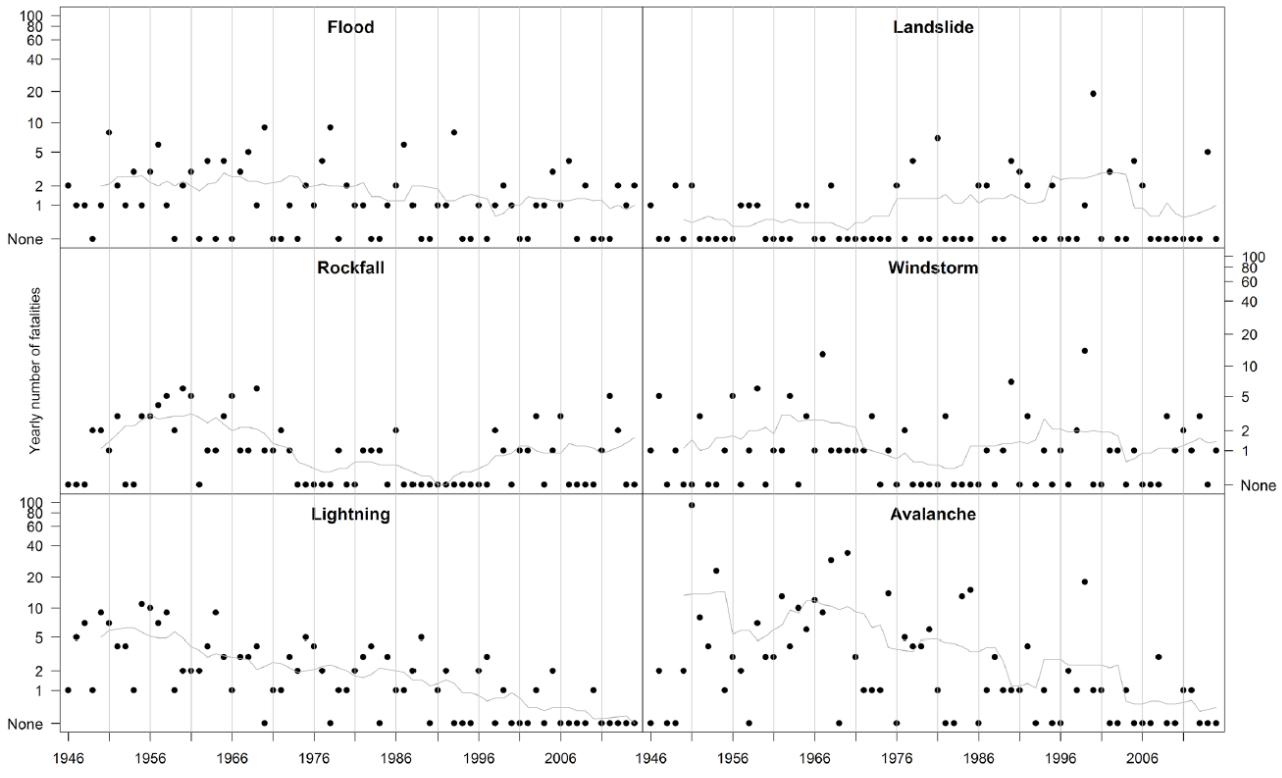


Figure 1: Annual frequency of fatalities in Switzerland for the different natural hazard categories (Badoux et al., 2016, 2753)

3 Methodology

3.1 Data collection

The survey data first presented in Maduz et al. (2018), provide the empirical basis for the present study. The data were collected by drawing on an existing internet panel of the LINK survey institute, which was also involved in questionnaire development, online questionnaire programming and data processing. The panel is representative of the Swiss population aged between 15 and 79 using the Internet at least once a month for private purposes. The sample was quoted by region (German-speaking Switzerland / Western Switzerland), sex and age. From 28th August to 7th September 2017, a total of 758 online surveys were conducted. On average, respondents needed 17 minutes to complete the questionnaire.

3.2 Data analysis

To examine the explanatory power of the factors said to predict individuals' preparedness (see Chapter 4), a multivariate logistic regression analysis was conducted, with "individual preparedness" as the dependent variable. The statistical software used for the logistic regressions was STATA (version 15). For an overview of the data and variables used in the regression models, some descriptive statistics were carried out. Descriptions of variables used in all analyses are given in the following sections.

In a further step (Chapter 5), structural equation modelling (SEM) was used, in addition, to determine the structure of the relations between all hazard-specific variables relevant to individual preparedness. The statistical software used for SEM was SPSS. SEM provides us with a statistical means for testing the fit of a suggested model, i.e. path structure, to the data, indicating how the defined variables interact and affect each other.

3.3 Measuring general and hazard-specific disaster preparedness

Three dependent variables were used to measure our main concept of interest, i.e. individual disaster preparedness: emergency plan and emergency supply. These variables have been widely used in disaster preparedness research (Table 1). In addition to this, as a more specific measure, we further examined preparedness particularly towards pandemic scenarios. According to Switzerland's national risk analysis, pandemic risk is ranked as one of the most likely and most disastrous risks (Bundesamt für Bevölkerungsschutz BABS, 2015). In a globalized, densely interconnected world, the risks of pandemics are likely to increase further in the future (Roth et al., 2014). Due to the high pandemic risks, but also because public preparedness and prevention measures can make an effective contribution to mitigate this risk, Swiss authorities have recently undertaken considerable efforts to communicate the risks of pandemics to the population, and to provide advice for protective measures. Based on survey question F320 (see Maduz et al., 2018), emergency plan specifies whether (1) or not (0) respondents have a predefined, personalized emergency plan. By contrast, emergency supply (based on F330) defines whether respon-

Table 1: Overview of literature: commonly used preparedness measures

Case Studies	Ablah et al., 2009	Basolo et al., 2009	Page et al., 2008	Kapucu, 2008	Eisenman et al., 2006	Murphy et al., 2009	Paton et al., 2008	Hausman et al., 2007	Kirschenbaum, 2006	Eisenman et al., 2009
Outcome measures for individual disaster preparedness										
Emergency Supplies										
Genereal level of Supplies								x	x	
Water	x	x		x	x	x	x			x
Food	x	x		x	x	x				x
Medical Kit	x		x	x		x				x
Technical Items	x	x	x			x				x
Emergency Plan	x	x	x	x	x	x	x	x	x	x
Perceived Prepardness		x	x							

dents have a sufficient food and water supply at home for cases of emergency. The supply-variable takes on the value 1 when respondents indicated the availability of a 3-day supply of water and a 7-day supply of food – and 0 otherwise. Pandemic preparedness was measured using three questions, where respondents were asked if they had hygiene masks (F340) and disposable gloves (F350) at home, and if they had received an annual flu vaccination (F360). If responses to two of the three questions were positive the variable pandemic preparedness was coded as 1 – and 0 otherwise.

3.4 Structural, socio-cognitive, and behavioral predictors

Independent variables included in this study were selected based on their presence in the existing body of disaster preparedness literature, as well as their availability in the data retrieved from the survey. These variables can be broadly classified into three categories: structural, socio-cognitive and behavioral factors. Structural factors include socio-demographic characteristics, such as sex, age or education as well as further characteristics associated with preparedness (e.g. respondents' household size and the size of the city they live in). Socio-cognitive factors refer to hazard-specific variables, measuring respondents' risk perception, subjective levels of information, direct and indirect hazard experience, preparedness knowledge, etc. The third category consists of variables measuring respondents' reported information seeking behavior including the specific information sources they consulted when seeking information (workplace, private surroundings etc.).

3.4.1 Structural factors

Gender: The first demographic variable included in our model is gender (survey question S01) i.e. male (0) or female (1). While scholars generally agree that gender is a relevant predictor of preparedness, views and empirical findings concerning the direction of its effect vary considerably in the literature (Kohn et al., 2012). Ablah et al. (2009) found men more likely to prepare, whereas Russell et al. (1995) and Murphy et al. (2009) identified that women were more likely to be prepared. In this respect, Hausman et al. (2007) state, that female gender is associated with higher risk perception, which in turn could influence disaster preparedness, though the relationship between risk perception and behavior is often strongly mediated by socio-cognitive factors (Paton, Bürgelt and Prior, 2008).

Age: In addition to gender, respondents' age was taken into account (S02). While some scholars expected older age to have a positive effect on preparedness (Ablah et al. 2009, Eisenman et al., 2006), more recent work put these expectations into perspective by presenting more ambiguous empirical results about the relationship between age and disaster preparedness (Basolo et al. 2017). The authors identified age as a statistically significant predictor for perceived but not for actual household preparedness.

Education: A more uniform pattern exists with regard to education (F500); higher education levels are associated by many researchers in the field with increased levels of disaster preparedness (Hoffmann and Muttarak 2015, Mishra and Suar 2005 or, more differentiated, Eisenman et al. (2009).

Locality: Some previous studies consider region (varying in terms of their hazard susceptibility), city size and ethnicity to be important explanatory variables. A number of variables for the Swiss context were identified with regard to the places respondents live in and how they are (politically) related to them. Depending on the Swiss (language) region, factors, such as state-citizen relations and the media landscape are likely to vary. Hence, to account for Switzerland's strong political federalism as well as its fragmented multilingual composition, the regional identity variable german (based on S03) was added to our models, indicating whether a respondent lives in the German-speaking part (Deutschschweiz) of Switzerland (1) or in the French-speaking part (Romandie) of the country (0). To capture the urban-rural divide, the variable citysize indicates whether respondents live in places with less (0) or more (1) than 10'000 inhabitants (based on S03). According to previous research, larger city (or community) size is expected to be negatively correlated with disaster preparedness (Eng and Rhein, 2016).

Nationality: Furthermore, the variable for Swiss nationality (swiss) captures whether respondents are holders of a Swiss passport (1) or not (0). The variable was constructed based on variable b08q1310 in the dataset[2]. Findings on peoples' ethnic background, as often examined in the Anglo-Saxon context, may contain some interesting suggestions for the potential impact of nationality on individual preparedness in Switzerland. Although not consistent, foreign ethnicity and minority status is often expected to have a positive impact on disaster preparedness (Page et al. 2008, Eisenman et al. 2009). Ablah et al. (2009) challenges these noting that white ethnic (majority) groups tended to be better prepared than minorities.

2 This information does not stem from our 2017-survey. It was provided by the LINK institute, which asks is panelists once a year to respond to a number of questions including regarding their nationality.

Foreigners, i.e. non-Swiss passport holders, may tend to be better prepared as a consequence of their experience or knowledge of hazards outside Switzerland. Conversely, they, especially if new immigrants, may lack local (hazard-specific) knowledge necessary to be well prepared for disasters.

Household specifics: Further variables considered in the present analysis are respondents' household size, coded as 1 if more than two people lived in a household and 0 otherwise, and medical vulnerability. Household size (based on variable b08c1200c2 in the dataset[3]) is generally found to have a negative effect on preparedness (Onuma et al. 2017, Eng and Rhein 2016). On the contrary, medical vulnerability (coded as 1 if respondents rely on medicine on a daily basis – and 0 otherwise, see survey question F361) is generally thought to foster peoples' disaster preparedness (AFAC 2005, Ablah et al. 2009, Eng and Rhein 2016).

3.4.2 Socio-cognitive factors: perceptions, attitudes, experience

Socio-cognitive factors were found in previous research to be of particular relevance in the context of individual disaster preparedness (Paton, 2003). Natural hazard and health scholars identify risk perception, critical awareness and hazard anxiety as important antecedents for preparedness (D Paton, Smith and Johnston, 2005). Two of our survey questions (F200 and F290) are particularly relevant with regard to these aspects. Based on the responses to these questions, we constructed a variable for individual risk perception, a variable for general risk perception at home/at workplace as well as a general risk perception at frequently visited places. Factor analysis revealed that these variables capture a single generic risk perception dimension, which is why they were then collapsed into one variable riskperc (details are explained below).

Other variables expected to have an impact on preparedness behavior include individuals' perceived levels of information on disaster preparedness (F210) and their perceived need for (more) information, i.e. more information on how to prepare for disasters for preventive purposes (F230) and/or on how to react in the event of a disaster (F240). Some studies consider experience with disasters to be a key explanatory factor. Based on survey question F295, we built variables for direct experience and indirect experience respectively. In addition to respondents subjective information levels (see F210 above) the dataset contains information on their objective information levels: panelists were asked if they were familiar with official government recommendations for three key disasters, i.e. pandemic (F311), earthquake (F312), and blackout (F313). Two recommendations were considered per disaster. Adding +1 for each correct answer, the newly created variable for preparedness knowledge (prepknow) takes on values between 0 and 6.

Most of the data on the socio-cognitive dimensions of disaster preparedness are hazard-specific, i.e. panelists were asked for each hazard considered in the survey if they specifically felt threatened, informed, etc. The same applies to the experience variables. In the first step of data preparation, hazard-specific binary variables were created. In a following step, summary variables were created to capture socio-cognitive factors across all hazards. For the multivariate analysis, additive summary variables were created. Variables values approached zero if a balance existed between the hazards, by which a panelist, for example, feels threatened (+1), and hazards, by which the panelist does not feel threatened (-1) – and take on more extreme values, i.e. between -17 and +17 if not. The same procedure was applied in creating the other socio-cognitive variables.[4] For the bivariate analysis (Table 3), dichotomized (summary) variables were used: They take on the value 1 if a panelist feels threatened/informed/feels the need for more information by/for any hazard – or 0 otherwise.

3.4.3 Perceptions about using new technologies

Since a focus of the present study is citizens' information and communication behavior in view of disaster preparedness, we constructed a variable to measure peoples' preference for new technologies. This allowed us to inquire into the growing role of the Internet in risk communication from a citizen's perspective. The variable newtec2 (based on survey question F420) indicates whether, in the case of a disaster, respondents prefer to receive official risk information rather through new technologies (Internet, apps etc.) or through more traditional information channels, such as radio, TV or sirens.[5] In the survey, a list of possible information channels were presented to the panelists, from which they could choose. Every selected traditional information channel was counted as -1 and every selected information channel based on new technologies was counted as +1. The variable ranges from -5 to +4 with +4 indicating a strong preference for new technologies.

3 This information does not stem from our 2017-survey. It was provided by the LINK institute, which asks is panelists once a year to respond to a number of questions including regarding their household size.

4 These additive variables gave a more differentiated picture as to how socio-cognitive factors influence preparedness behavior.

5

3.4.4 Behavioral factors

Information-seeking behavior is another factor that has been singled out by previous research as relevant in explaining preparedness behavior. While one would presume that people who have sought information are more likely to take concrete preparedness measures, previous research suggests a more complicated relationship between information seeking and preparedness. Specifically, research across a range of hazards has demonstrated that intention strongly determines behavioral action (Paton et al., 2005; Adhikari et al., 2018). This research shows that people who develop an intention to seek more information about risk are less likely to convert that intention into action. By contrast, people who intend to prepare, and who may perceive themselves to have sufficient information to do so, are more likely to actually prepare.

A basic distinction was made (F250) between those respondents who reported to have sought information on hazard-specific disaster preparedness (1) and those who had not (0). To get a more differentiated picture of peoples' information-seeking behavior we established what information channels they consulted when searching for information (F260 and F270). If respondents used official information channels, such as those provided by the federal, cantonal or municipal governments or by professional emergency response forces, such as the police or fire services or health authorities, the variable official was coded as 1 – and 0 otherwise. People were also asked whether (1) or not (0) they consulted their professional surroundings (variable work), their private surroundings (variable private) or local associations and community groups (variable group).

All respondents, who indicated having sought information online, were, in addition, asked if they consulted online information platforms provided by Swiss authorities. Of particular interest was alertswiss.ch as the central platform for public risk communication in Switzerland, which is administered by the Federal Office for Civil Protection in cooperation with cantonal partners. The variable alertch was coded as 1 if people reported to have consulted alertswiss.ch – and 0 otherwise.

4 Explaining disaster preparedness behavior

4.1 Bivariate and multivariate analyses

To summarize and compare differences in bivariate relationships between factors, we compared means of the outcome measures emergency plan, emergency supply, and pandemic preparedness by predictors. Table 3 presents these descriptive statistics for the three outcome variables by structural, socio-cognitive, and behavioral predictors. The below presentation of the results of the bivariate analyses focuses on the statistically significant relationships.

As to the multivariate analyses (Table 4), we estimated six logistic regression models for each of the three preparedness measures. The first model contains

Table 2: Overview of literature: commonly used predictors for preparedness

Case Studies	Ablah et al., 2009	Basolo et al., 2009	Page et al., 2008	Kapucu, 2008	Eisenman et al., 2006	Murphy et al., 2009	Paton et al., 2008	Hausman et al., 2007	Kirschenbaum, 2006	Eisenman et al., 2009
Predictors for individual disaster preparedness										
Demographics										
Age	x	x		x	x	x		x		x
Income	x	x		x	x	x		x		x
Gender	x	x	x	x		x		x	x	x
Race	x	x	x	x	x	x		x		x
Education	x	x			x	x		x		x
Hazard Experience	x	x						x		
Risk Perception	x		x		x	x		x		

the basic structural predictors, i.e. age, education, region (German-speaking or not) and city size. In the second model, additional structural variables are added, i.e. household size, nationality, and medical vulnerability. The third model then includes all structural variables plus the socio-cognitive variables as predictors. These are perceived risk threat, perceived levels of information (well informed vs. not well informed), perceived information needs, direct or indirect hazard experience, objective preparedness knowledge, and preference for new technologies in risk communication. The forth model contains, in addition, some basic information on information-seeking behavior (sought information vs. not sought). In model five then, a breakdown of possible and relevant information channels through which information could be sought by people living in Switzerland is provided, i.e. official information channels, work or private surroundings, and community groups. Model six adds alertswiss.ch, an online platform, as an additional information channel.

Our goodness of fit-measure, the pseudo-R2, suggests that the models fit best in explaining variance in emergency planning and a little less in explaining variance in emergency supply. Again, the models do less well in explaining variance in pandemic preparedness. Starting with some structural variables, the goodness-of-fit increases with the inclusion of socio-cognitive variables. This is particularly true for the models that have emergency plan as a dependent variable. For emergency supply and pandemic preparedness both the addition of socio-cognitive variables as well as of behavioral variables considerably improved the goodness-of-fit of the models.

4.1.1 Explaining individual emergency planning

The bivariate analysis (Table 3) shows that the likelihood of having a predefined emergency plan is higher for men, people living in a big household, and foreigners. Like for the other outcome measures, emergency planning is positively related to the feeling of being well-informed and having high preparedness knowledge. Indirect hazard experience also seems to matter for the likelihood of having an emergency plan in place: the relationship between the factors is positive and statistically significant. Unlike for the other outcome measures, information-seeking behavior did not seem to play the same significant role for emergency planning. Interestingly, however, a positive association exists between having consulted alertswiss.ch and having an emergency plan set up. This is also true for having consulted community groups when seeking disaster preparedness information.

How do the results from the multivariate analysis (Table 4) complete the picture? Among the structural variables, household size and nationality stand out as predictors for emergency planning. They are robust across the various models. As the bivariate analyses already suggested, larger household size as well as being a foreigner increase the likelihood of having an emergency plan in place. When only structural variables are considered (models 1 and 2), being male increases the likelihood of having an emergency plan. When taking into account the other variable categories this relationship is insignificant, though.

With respect to the socio-cognitive variables, three predictors are worth highlighting (also see bivariate analysis): Individuals' subjective and objective levels of information (the latter is referred to as preparedness knowledge), as well as indirect experience with hazards increase the likelihood of them having an emergency plan. With regard to behavioral variables, only the consultation of alertswiss.ch seems to positively impact the development of a household emergency plan. When considering all other factors (i.e. holding them constant) in the multivariate analysis, the consultation of community groups was not a significant predictor, contradicting what was found in the bivariate analyses.

4.1.2 Explaining individual emergency supply

The bivariate analysis (Table 3) suggests that the likelihood of having an emergency supply at home tends to increase as a function of rising age. Being male and living in the German-speaking part of Switzerland are also positively associated with emergency supply. Education and city size are, by contrast, negatively related with the preparedness measure. As to the socio-cognitive factors, the mean of emergency supply is significantly higher for people who feel well informed and have a high preparedness knowledge – and lower for people who prefer new technologies in risk communication. People who respectively consulted official information channels, the work environment, and private surroundings when seeking information on disaster preparedness, are more likely to have an emergency supply at home than those who did not.

Table 3: Descriptive statistics (breakdown of means of emergency plan, supply, and pandemic preparedness by predictors)

			N (%)	Means: Plan (0 – 1)	Means: Supply (0 – 1)	Means: Pandemic Prep. (0 – 1)
	total		758 (100)			
Structural variables	sex	male	379 (50)	0.14 b	0.52	0.28 a
		female	379 (50)	0.10 a	0.49	0.35 b
	age, y	15 – 29	171 (22.6)	0.11	0.40 a	0.25 a
		30 – 44	203 (26.8)	0.12	0.40 a, b	0.30
		45 – 59	208 (27.4)	0.13	0.58 b, c	0.29
		60 – 79	176 (23.2)	0.11	0.64 c	0.41 b
	education (educ)	primary	52 (6.9)	0.17	0.52	0.29
		secondary	363 (47.9)	0.13	0.54 b	0.32
		tertiary	343 (45.3)	0.10	0.46 a	0.31
	region (german)	French-sp.	225 (29.7)	0.13	0.40 a	0.30
		German-sp.	533 (70.3)	0.11	0.55 b	0.32
	city size (citysize)	<10'000 inh.	421 (55.5)	0.11	0.55 b	0.35 b
		>10'000 inh.	337 (44.5)	0.13	0.45 a	0.26 a
	household size (hhsiz)	1 – 2 pers.	407 (53.7)	0.10 a	0.49	0.31
		> 2 pers	351 (46.3)	0.14 b	0.52	0.31
	nationality (swiss)	non-swiss	46 (6.1)	0.24 b	0.39	0.20 a
		swiss	709 (93.9)	0.11 a	0.51	0.32 b
	medical vul. (medvul)	not vulnerable	486 (64.1)	0.12	0.49	0.27 a
		vulnerable	272 (35.9)	0.12	0.54	0.39 b
Socio-cognitive variables	perceived risk threat (riskperc, dummy)	non existent	41 (5.4)	0.10	0.51	0.20 a
		existent	717 (94.6)	0.12	0.50	0.32 b
	perceived info level (suminfo, dummy)	not well informed	132 (21.1)$	0.07 a	0.43 a	0.19 a
		well informed	626 (82.6)	0.13 b	0.52 b	0.34 b
	more information (sumneed_p, dummy)	not interested	43 (5.7)	0.19	0.58	0.30
		interested	715 (94.3)	0.12	0.50	0.31
	direct hazard exp. (direct, dummy)	no experience	206 (27.2)	0.14	0.47	0.28
		experience	552 (72.8)	0.11	0.52	0.32
	indirect hazard exp. (indirect, dummy)	no experience	258 (34.0)	0.09 a	0.49	0.26 a
		experience	500 (66.0)	0.14 b	0.51	0.34 b
	prep. knowledge (prepknow, dummy)	low	388 (51.2)	0.06 a	0.50 a	0.25 a
		high	370 (48.8)	0.19 b	0.61 b	0.38 b
	new technologies (newtec2, dummy)	not preferred	516 (68.1)	0.12	0.54 b	0.34 b
		preferred	242 (31.9)	0.12	0.43 a	0.26 a
Behavioural variables	information seeking (sought)	not active	196 (34.9)	0.12	0.48	0.21 a
		active	562 (74.1)	0.12	0.51	0.35 b
	official information channels (official)	not consulted	79 (14.1)	0.08	0.41 a	0.22 a
		consulted	483 (85.9)	0.13	0.53 b	0.37 b
	work environment (work)	not consulted	287 (51.1)	0.11	0.44 a	0.30 a
		consulted	275 (48.9)	0.13	0.59 b	0.39 b
	private surroundings (private)	not consulted	158 (39.1)	0.11	0.41 a	0.31
		consulted	404 (71.9)	0.13	0.56 b	0.36
	community groups (group)	not consulted	456 (81.1)	0.11 a	0.50	0.33 a
		consulted	106 (18.9)	0.17 b	0.58	0.42 b
	alertswiss.ch (alertch)	not consulted	452 (85.6)	0.10 a	0.51	0.34
		consulted	76 (14.4)	0.26 b	0.55	0.41

The estimated multivariate models (Table 4) for emergency supply show a couple of patterns that we have not found for the emergency plan. This is particularly true for structural variables as has already been revealed in the bivariate analyses: The older and the less educated people are, the more likely they are to have an emergency supply. The place of residence also matters: People living in smaller places and those living in the German-speaking part of Switzerland are more likely to have an emergency supply at home than residents in bigger cities and in the Romandie. The results for socio-cognitive predictors are similar to the results from the models for emergency plan: a significant positive association exists between having an emergency supply on one hand and being well informed (both subjective feeling and objective preparedness knowledge), and having indirectly experienced hazards on the other hand. Among the behavioral predictors, having consulted the work environment is the only factor that remains significant when considering all other variables (in the bivariate analysis, official information channels and private surroundings have also been found to be significant predictors of emergency supply).

4.1.3 Explaining individual pandemic preparedness

The relationships between predictors and preparedness seem somewhat confusing when pandemic preparedness is examined. The bivariate analyses already indicate this situation. Table 3 shows, for example, that being female, being Swiss, and having sought information on disaster preparedness increase the likelihood of being prepared. Many of the socio-cognitive as well as the behavioral factors are found to be relevant, i.e. significantly related to pandemic preparedness. Unlike for the two other preparedness measures, perceived risk threat is found to be a statistically significant predictor, and its relationship with pandemic preparedness is positive. Like for emergency supply, being old, living in small places, having consulted official information channels, and having consulted the work environment are all factors that are positively associated with preparedness. In the same vein, the relationship is negative for people who prefer new technologies in risk communication. Like for emergency planning (binary analysis only), the consultation of community groups when seeking information seems to matter. This activity is positively related to pandemic preparedness. The same is true for being well informed and having a high preparedness knowledge (as is the case for the two other preparedness measures).

Contradicting the results for the two other preparedness measures, women were more likely to be prepared for pandemics. This was confirmed by the multivariate analysis (Table 4). Like for emergency supply, older people and residents of smaller places are more likely to have taken pandemic preparedness measures. Not surprisingly, daily reliance on medication (captured by the variable medical vulnerability) has a positive impact on preparedness when measured as pandemic preparedness. The positive association between pandemic preparedness and Swiss nationality is not statistically significant in the multivariate analysis – as opposed to the bivariate analysis.

As to the socio-cognitive variables, it is worth highlighting that results are similar to those for the other preparedness measures with some interesting exceptions. Particularly interesting is the finding that people interested in receiving more information on how to prepare for disasters are more likely to take pandemic preparedness measures. This effect is only revealed in the multivariate analysis, and contradicts research that has examined the negative relationship between information seeking and preparedness in the past. For the other two preparedness measures this predictor was not significant, being confused by the effects of the perceived information level variable. Actually, factor analysis highlighted that the two variables capture the same generic dimension.

In the context of the behavior variables, information source did not have a significant effect on pandemic preparedness (although the official information channels, the work environment, and the community groups were positively associated with preparedness in the bivariate analysis). However, having actively sought information (as opposed to not having sought information at all) makes a (statistically significant) difference.

4.2 Discussion of the results

Our analysis showed that the relationship between sex and preparedness varies depending on how preparedness was measured. Being female increases the likelihood of individuals' pandemic preparedness. This finding was robust across all multivariate models estimated. By contrast, men are more likely to have emergency plans (statistically significant for models only considering structural variables) and emergency supplies (not statistically significant). These mixed findings are in line with the literature. Ablah et al. (2009) suggest a positive relationship between male gender and preparedness whereas Russell et al. (1995) and Murphy et al. (2009) propose the opposite. The theoretical argument by Hausman et al. (2007) that female gender is related to higher risk perception cannot be confirmed by our data. Thus, other mechanisms must

Table 4: Logistic regression analysis for preparedness

	Emergency Plan							Emergency Supply			
	Model	1	2	3	4	5	6	Model	1	2	3
	plan							supply			
Structural variables	sex	-0.414*	-0.409*	-0.192	-0.191	0.0911	0.0146	sex	-0.232	-0.263*	-0.157
		(-1.80)	(-1.76)	(-0.77)	(-0.76)	-0.31	-0.05		(-1.52)	(-1.70)	(-0.97)
	age	-0.000726	0.00689	-0.001	-0.000878	0.00489	0.00743	age	0.0227***	0.0293***	0.0261***
		(-0.11)	-0.84	(-0.11)	(-0.09)	-0.44	-0.65		-4.93	-5.32	-4.32
	educ	-0.35	-0.36	-0.264	-0.231	-0.18	-0.326	educ	-0.316**	-0.299*	-0.284*
		(-1.50)	(-1.53)	(-1.03)	(-0.89)	(-0.61)	(-1.07)		(-2.05)	(-1.92)	(-1.74)
	german	-0.211	-0.153	-0.27	-0.259	0.135	0.293	german	0.573***	0.592***	0.541***
		(-0.87)	(-0.62)	(-0.98)	(-0.94)	-0.4	-0.83		-3.44	-3.49	-2.99
	citysize	0.17	0.178	0.383	0.401	0.429	0.409	citysize	-0.449***	-0.380**	-0.352**
		-0.76	-0.78	-1.55	-1.61	-1.47	-1.35		(-2.95)	(-2.45)	(-2.19)
	hhsiz		0.499*	0.612**	0.616**	0.711**	0.484	hhsiz		0.563***	0.593***
			-1.93	-2.18	-2.19	-2.11	-1.41			-3.23	-3.27
	swiss		-0.857**	-1.006**	-0.999**	-1.055**	-1.027**	swiss		0.251	0.17
			(-2.27)	(-2.39)	(-2.37)	(-2.06)	(-1.98)			-0.77	-0.49
	medvul		-0.00978	-0.0837	-0.0848	0.0805	0.0121	medvul		0.0367	0.00814
			(-0.04)	(-0.30)	(-0.31)	-0.25	-0.04			-0.21	-0.04
Socio-cognitive variables	riskperc			-0.0343	-0.03	0.0011	0.00282	riskperc			-0.00727
				(-1.28)	(-1.11)	-0.04	-0.09				(-0.42)
	suminfo			0.0742***	0.0750***	0.0834***	0.0804***	suminfo			0.0581***
				-3.51	-3.55	-3.33	-3.07				-3.96
	sumneed_p			0.00131	0.0042	0.0384	0.0365	sumneed_p			0.0185
				-0.06	-0.2	-1.5	-1.36				-1.27
	direct			0.0232	0.0246	0.0143	0.0209	direct			0.0273
				-0.91	-0.96	-0.47	-0.67				-1.5
	indirect			0.0957***	0.100***	0.0935***	0.0831***	indirect			0.0439**
				-4.23	-4.32	-3.58	-3.14				-2.51
	prepknow			0.675***	0.685***	0.661***	0.620***	prepknow			0.247***
				-5.02	-5.08	-4.14	-3.8				-3.31
	newtec2			-0.0108	-0.00549	-0.0141	-0.0299	newtec2			-0.0589
				(-0.14)	(-0.07)	(-0.15)	(-0.29)				(-1.16)
Behavioural variables	sought				-0.344			sought			
					(-1.14)						
	official					0.194	-0.0895	official			
						-0.39	(-0.18)				
	work					-0.268	-0.263	work			
						(-0.90)	(-0.85)				
	private					-0.257	-0.333	private			
						(-0.73)	(-0.93)				
	group					0.404	0.398	group			
						-1.16	-1.1				
	alertch						0.979***	alertch			
							-2.77				
	_cons	-1.550***	-1.393**	-3.118***	-2.839***	-3.876***	-3.595***	_cons	-0.964***	-1.804***	-1.872***
		(-3.98)	(-2.38)	(-3.30)	(-2.93)	(-3.18)	(-2.91)		(-3.50)	(-4.04)	(-2.95)
	N	758	755	755	755	559	526	N	758	755	755
	pseudo R2	0.011	0.026	0.16	0.162	0.155	0.167	pseudo R2	0.05	0.061	0.108

			Pandemic Preparedness						
4	5	6	Model	1	2	3	4	5	6
			medprep						
-0.158	-0.0646	-0.0248	sex	0.295*	0.269*	0.366**	0.366**	0.533***	0.561***
(-0.97)	(-0.33)	(-0.12)		-1.83	-1.65	-2.14	-2.14	-2.68	-2.73
0.0261***	0.0298***	0.0305***	age	0.0165***	0.0153***	0.0123*	0.0121*	0.0145*	0.0167**
-4.32	-4.03	-3.98		-3.4	-2.64	-1.92	-1.87	-1.94	-2.16
-0.276*	-0.283	-0.289	educ	-0.007	0.0143	0.0441	0.00833	0.173	0.084
(-1.68)	(-1.44)	(-1.42)		(-0.04)	-0.09	-0.26	-0.05	-0.88	-0.41
0.545***	0.778***	0.832***	german	0.0253	0.0614	0.0592	0.0463	0.0945	0.207
-3.01	-3.52	-3.6		-0.14	-0.34	-0.31	-0.24	-0.42	-0.89
-0.349**	-0.323*	-0.387*	citysize	-0.407**	-0.387**	-0.358**	-0.367**	-0.360*	-0.229
(-2.17)	(-1.67)	(-1.93)		(-2.51)	(-2.34)	(-2.10)	(-2.14)	(-1.82)	(-1.13)
0.596***	0.618***	0.555**	hhsiz		0.313*	0.385**	0.375*	0.482**	0.492**
-3.29	-2.82	-2.49			-1.7	-2	-1.94	-2.14	-2.13
0.174	-0.184	-0.0797	swiss		0.536	0.446	0.433	0.227	0.157
-0.51	(-0.44)	(-0.19)			-1.37	-1.11	-1.07	-0.5	-0.34
0.00935	0.0462	-0.0177	medvul		0.442**	0.431**	0.435**	0.570***	0.565***
-0.05	-0.21	(-0.08)			-2.48	-2.33	-2.35	-2.7	-2.6
-0.00596	-0.0139	-0.00466	riskperc			0.0116	0.00601	0.0157	0.0164
(-0.34)	(-0.65)	(-0.21)				-0.64	-0.33	-0.74	-0.75
0.0590***	0.0657***	0.0639***	suminfo			0.0464***	0.0444***	0.0426**	0.0438**
-3.99	-3.69	-3.49				-3.07	-2.92	-2.4	-2.39
0.0194	0.00843	0.0115	sumneed_p			0.0411***	0.0381**	0.0447**	0.0506***
-1.32	-0.46	-0.6				-2.68	-2.46	-2.39	-2.6
0.0279	0.0409*	0.0315	direct			0.0112	0.00828	0.00272	-0.00845
-1.53	-1.85	-1.39				-0.59	-0.43	-0.13	(-0.38)
0.0450**	0.0353*	0.0311	indirect			0.0436**	0.0391**	0.0323	0.0287
-2.56	-1.72	-1.49				-2.53	-2.25	-1.63	-1.42
0.252***	0.272***	0.267***	prepknow			0.254***	0.239***	0.263***	0.260***
-3.35	-2.89	-2.71				-3.15	-2.94	-2.71	-2.58
-0.0579	-0.079	-0.0995	newtec2			-0.0647	-0.07	-0.087	-0.124*
(-1.13)	(-1.25)	(-1.50)				(-1.21)	(-1.30)	(-1.36)	(-1.84)
-0.104			sought				0.455**		
(-0.55)							-2.13		
	-0.051	-0.11	official					0.484	0.523
	(-0.18)	(-0.36)						-1.52	-1.53
	0.426**	0.504**	work					0.172	0.176
	-2.18	-2.48						-0.86	-0.85
	0.303	0.301	private					-0.231	-0.35
	-1.37	-1.3						(-1.00)	(-1.46)
	0.013	-0.0134	group					0.234	0.299
	-0.05	(-0.05)						-0.95	-1.17
		0.377	alertch						0.182
		-1.31							-0.64
-1.797***	-2.451***	-2.720***	_cons	-1.558***	-2.346***	-2.736***	-3.102***	-3.524***	-3.863***
(-2.77)	(-2.98)	(-3.18)		(-5.18)	(-4.56)	(-3.89)	(-4.24)	(-4.01)	(-4.23)
755	559	526	N	758	755	755	755	559	526
0.108	0.144	0.148	pseudo R2	0.023	0.034	0.08	0.085	0.1	0.102

be at work, and this is why a focus on socio-cognitive mediators has risen over the focus on demographic characteristics as predictors of preparedness.

Age: Furthermore, our results suggest that preparedness is positively associated with age when measured as emergency supply or pandemic preparedness. This finding supports established research in the field (Ablah et al. 2009, Eisenman et al. 2009). No clear relationship exists between age and emergency plan, though. One possible explanation might be that perceptions play a bigger role in explaining emergency planning as opposed to the other preparedness measures (see Basolo et a. 2017 on the distinction between perceived and actual preparedness). Departing from previous research (Hoffmann and Muttarak 2015, Mishra and Suar 2005, Eisenman et al. 2009), our analysis suggests a negative association between education levels and preparedness. Less educated people were found to be more likely to prepare for disasters. The association is statistically significant only in the context of ensuring an emergency supply is to hand, though.

City size: As to the city size, our finding that it is negatively correlated with preparedness supports previous studies on the topic (Eng and Rhein, 2016). This finding has been established based on the analyses for supply and pandemic preparedness. It seems to intuitively make sense that people living in rural areas have a more abundant water and food supply. It is interesting, though, that measures for pandemic preparedness are also more likely to be taken in these places rather than in more densely populated urban areas where pandemics would probably hit first.

Ethnicity: Our analysis confirms previous research on the positive connection between preparedness and foreign ethnicity (Page et al., 2008; Eisenman et al., 2009). In the Swiss context, being a foreigner increases the likelihood for setting up an emergency plan. Although Switzerland is a multi-ethnic country, research on ethnic minorities as conducted largely in the US do not apply well to Swiss minority language groups. This is particularly the case for the French-speaking population (not recently immigrated, etc.). The 'majority group', i.e. residents of German-speaking Switzerland, were been found in our analysis to be better prepared in terms of emergency supplies. However, it is difficult to say whether cultural differences rather than a specific majority-minority divide might be behind this difference in preparedness.

Socio-cognitive factors: As to socio-cognitive factors, we did not formulate any clear expectations. From previous research, we know that they interact in complex ways (Paton 2003; Douglas Paton, Smith and Johnston, 2005). It is worth highlighting that peoples' knowledge, i.e. their perceived levels of information as well as their objective preparedness knowledge are significant and robust predictors for preparedness. This result is established based on all three preparedness measures. People with higher preparedness knowledge (subjective and objective) are more likely to take preparedness actions. Our analysis reveals another important socio-cognitive predictor of preparedness, i.e. indirect experience of hazards. People with indirect hazard experience tend to be better prepared. Factor analysis (not shown here) suggested that direct experience and indirect experience would often capture the same generic experience dimension. By collapsing them into one variable, we would have lost quite a bit of the explanatory power of the models, though. For the same reason, perceived risk threat and information-seeking interest (i.e. information needs) might be less important predictors than we would expect them to be. Risk experience and perceived risk threat have been found to be difficult to separate (suggested by factor analysis not shown here).

Information-seeking behavior: Previous research suggests that information-seeking behavior and intention are important to understand when examining why people undertake preparedness measures. The results in our analysis are mixed, depending on the preparedness measure considered. Emergency plans are more likely to be taken by people who consulted alertswiss.ch, whereas ensuring the household has an emergency supply is a behavior more likely to be associated with people who consulted their work surroundings for information about disaster preparedness. Finally, for pandemic preparedness, it only mattered whether or not people sought information about preparedness at all; none of the more differentiated information-seeking variables were found to be significant. Interesting in this context are also the findings on peoples' preferences in risk communication. While (almost) never statistically significant, people who prefer new technologies seem to be less likely to take preparedness measures.

5 Explaining information-seeking behavior

Explaining Swiss peoples' general preparedness behavior was the aim of Chapter 4. We examined the relationships between three preparedness behavior measures and potentially relevant explanatory variables. None of the independent and dependent variables used in the analysis were hazard-specific, except for pandemic preparedness. In a further step, the study examined if and how relation-

ships between variables relevant to peoples' attitudes and behaviors towards disaster preparedness were hazard-specific. We assumed that clear hazard-specific patterns would have implications for recommendations regarding well-designed disaster management and risk communication practices. The analysis focuses on explaining information-seeking.

5.1 Disaster-related information-seeking behavior and other hazard-specific variables

The 2018 study, on which this study is built, has shown that hazard-specific patterns exist. Among the risks people in Switzerland feel most threatened by we found technical hazards, such as chemical spills, and social risks, such as cyber-attacks and terrorist attacks. At the same time, these were the risks people felt least informed about. Furthermore, the study showed a strong rise in peoples' risk perceptions since 2011. Individuals' information seeking activities were also found to have clearly increased during this period. However, no clear tendency could be seen in their perceived levels of information. Section 5 therefore analyses in more detail how hazard-specific variables are related to one another. In the end, these hazard-specific interactions will have an influence on whether or not people prepare for disasters.

The 2017-survey contains hazard-specific data on 17 hazards (see Appendix A). The first of seven hazard-specific questions explored to what extent people felt threatened by a specific hazard (see variables per*). Consecutive hazard-specific questions were asked: about peoples' perceived levels of information (variables inf*), their need for information (preventive - variables need*_p - and in the case of an event)[6], hazard experience (variables exp*_d and exp*_i), general hazard risk perception (at home/work or at frequently visited places: variables per*_h and per*_v respectively). For three hazards, i.e. pandemics, earthquakes, and blackouts, people were asked if they knew government recommendations on how to react to them (two recommendations each: variables know3*). For an overview of these hazard-specific variables for the three hazards, pandemics, earthquakes, and blackouts, see Table 5.

Constrained by the nature of the survey, it is difficult to determine how hazard-specific variables are individually and collectively – directly or indirectly – related to concrete preparedness measures (emergency planning etc.). The variables for risk perceptions, perceived levels of information, and information needs measure peoples' perceptions and assessments, and not their objective or subjective levels of preparedness. For the experience variables as well as for the information-seeking variable, people were asked whether they had actually experienced hazards/sought information. As such, the following empirical analyses focus on the behavioral variable, i.e. information-seeking activity, as the variable to be explained, and not on an estimate of planning or emergency supply preparedness.

It is interesting to study preparedness (chapter 4) and information-seeking behavior (present chapter) in the same analysis. Two reasons argue this necessity. First,

Table 5: Summary statistics of hazard-spec. variables

Pandemic					
Variable	Obs	Mean	Std. Dev.	Min	Max
seekpan	758	0.4261214	0.4948383	0	1
perpan	758	0.4076517	0.4917223	0	1
perpan_h	758	0.474934	0.499701	0	1
perpan_v	758	0.2137203	0.4102023	0	1
infpan	758	0.5356201	0.4990589	0	1
needpan_p	758	0.6240106	0.4846971	0	1
exppan_d	758	0.1437995	0.351118	0	1
exppan_i	758	0.1886544	0.3914921	0	1
know3pan	758	1.952507	0.2577472	0	2
Earthquake					
seekear	758	0.2770449	0.4478343	0	1
perear	758	0.3139842	0.4644165	0	1
perear_h	758	0.328496	0.4699764	0	1
perear_v	758	0.1886544	0.3914921	0	1
infear	758	0.3430079	0.4750276	0	1
needear_p	758	0.6332454	0.4822369	0	1
expear_d	758	0.1754617	0.3806127	0	1
expear_i	758	0.0989446	0.2987848	0	1
know3ear	758	1.783641	0.4718176	0	2
Blackout					
seekbla	758	0.2150396	0.4111211	0	1
perbla	758	0.4920844	0.5002674	0	1
perbla_h	758	0.5936675	0.4914723	0	1
perbla_v	758	0.2216359	0.4156216	0	1
infbla	758	0.2862797	0.4523202	0	1
needbla_p	758	0.7044855	0.456575	0	1
expbla_d	758	0.3271768	0.4694922	0	1
expbla_i	758	0.1424802	0.3497728	0	1
know3bla	758	0.8957784	0.8997038	0	2

6 Questions concerning perceived information levels and perceived information needs were only asked with regard to six selected hazards, considered to be particularly interesting in the Swiss context (blackouts, earthquakes, floods, nuclear incidents, pandemics, terrorist attacks). They were also asked with regard to additional hazards for all people who had indicated they felt threatened by these specific hazards (see questions F210, F230, and F240).

Table 6: Logistic regressions for information seeking

	Information-Seeking Behaviour: Pandemics					Information-Seeking Behaviour: Earthquakes				
	Model	1	2	3	4	Model	1	2	3	4
	pandemics					earthquakes				
Hazard-spec. soc.-cognitive variables	perpan	0.875***	0.874***	0.860***	0.863***	perear	0.505**	0.515**	0.548***	0.562***
		-5.19	-5.19	-4.99	-4.98		-2.54	-2.57	-2.68	-2.71
	perpan_h	0.342**	0.339**	0.349**	0.373**	perear_h	0.184	0.182	0.154	0.162
		-2.01	-1.99	-2	-2.13		-0.91	-0.9	-0.74	-0.78
	perpan_v	0.093	0.0912	0.155	0.173	perear_v	0.839***	0.895***	0.820***	0.822***
		-0.47	-0.46	-0.77	-0.85		-4.01	-4.22	-3.8	-3.77
	infpan	1.002***	1.000***	0.996***	0.970***	infear	1.196***	1.146***	1.190***	1.173***
		-6	-5.97	-5.9	-5.7		-6.52	-6.2	-6.35	-6.21
	needpan_p	0.703***	0.704***	0.703***	0.733***	needear_p	0.505**	0.526***	0.595***	0.600***
		-4.04	-4.04	-3.97	-4.11		-2.51	-2.61	-2.88	-2.89
	exppan_d	0.228	0.226	0.273	0.256	expear_d	0.526**	0.531**	0.530**	0.562**
		-0.98	-0.97	-1.16	-1.09		-2.38	-2.39	-2.33	-2.46
	exppan_i	0.650***	0.654***	0.693***	0.703***	expear_i	0.648**	0.678**	0.630**	0.619**
		-3.16	-3.17	-3.32	-3.36		-2.4	-2.49	-2.28	-2.22
	know3pan		0.0741	-0.0278	0.0278	know3ear		0.594***	0.613***	0.619***
			-0.23	(-0.08)	-0.08			-2.7	-2.74	-2.74
Structural variables	sex			0.261	0.234	sex			-0.218	-0.244
				-1.57	-1.4				(-1.19)	(-1.33)
	age			0.0114**	0.0149**	age			-0.00998*	-0.0022
				-2.29	-2.53				(-1.79)	(-0.34)
	educ			0.262	0.278*	educ			0.242	0.26
				-1.57	-1.65				-1.31	-1.4
	german			0.0257	0.0433	german			-0.092	-0.106
				-0.14	-0.24				(-0.46)	(-0.52)
	citysize			0.054	0.0747	citysize			-0.0228	0.0515
				-0.33	-0.45				(-0.13)	-0.28
	hhsiz				0.299	hhsiz				0.484**
					-1.61					-2.37
	swiss				-0.017	swiss				0.246
					(-0.05)					-0.61
	medvul				0.0608	medvul				-0.174
					-0.33					(-0.83)
	_cons	-2.018***	-2.160***	-2.804***	-3.254***	_cons	-2.371***	-3.461***	-3.017***	-3.817***
		(-9.64)	(-3.33)	(-3.87)	(-3.89)		(-11.41)	(-7.46)	(-5.59)	(-5.43)
	N	758	758	758	755	N	758	758	758	755
	pseudo R-sq	0.12	0.12	0.13	0.132	pseudo R-sq	0.123	0.132	0.14	0.147

	Information-Seeking Behaviour: Blackouts			
Model	1	2	3	4
blackouts				
perbla	0.951***	0.922***	0.983***	1.069***
	-4.79	-4.57	-4.66	-4.95
perbla_h	0.16	0.202	0.162	0.156
	-0.76	-0.95	-0.74	-0.71
perbla_v	0.0133	0.0715	-0.00698	0.0466
	-0.06	-0.32	(-0.03)	-0.2
infbla	0.614***	0.374*	0.412*	0.375*
	-3.01	-1.75	-1.91	-1.72
needbla_p	1.065***	1.087***	1.069***	1.098***
	-4.23	-4.28	-4.18	-4.23
expbla_d	0.680***	0.669***	0.704***	0.716***
	-3.42	-3.31	-3.39	-3.41
expbla_i	0.319	0.332	0.334	0.321
	-1.23	-1.26	-1.26	-1.2
know3bla		0.506***	0.507***	0.522***
		-4.59	-4.4	-4.48
sex			-0.275	-0.271
			(-1.40)	(-1.36)
age			-0.00543	-0.00349
			(-0.90)	(-0.48)
educ			0.301	0.288
			-1.52	-1.44
german			-0.0979	-0.0393
			(-0.43)	(-0.17)
citysize			0.0398	0.0246
			-0.21	-0.13
hhsiz				0.227
				-1.02
swiss				-0.978***
				(-2.65)
medvul				0.203
				-0.94
_cons	-3.257***	-3.727***	-3.440***	-2.919***
	(-10.61)	(-11.25)	(-7.52)	(-4.88)
N	758	758	758	755
pseudo R-sq	0.099	0.126	0.134	0.145

developing effective risk communication information requires a detailed understanding of the way in which information influences action, if at all, since this behavior change is the ultimate goal of risk communication. Second, existing research illustrates that our practical understanding of the influence of risk information on preparedness behavior is complex and confusing. The results from section 4, and from this section support this reasoning.

5.2 Regression analyses

In the empirical analyses of this chapter, we focus on three hazards, for which we have a form of hazard-specific data, including on preparedness knowledge. These are (see Table 5) pandemics, earthquakes, and blackouts. They represent social, natural, and technical hazards respectively. The first two models consider hazard-specific socio-cognitive factors only (Table 6). The third and fourth models include structural variables into the logistic regressions.

The results in Table 6 confirm some of the findings in chapter 4 and show at the same time a more differentiated picture of the relationships between socio-cognitive variables. People who are well informed (perceived levels of information and preparedness knowledge) were found to be more likely to take preparedness measures (see Table 4). The same is true for seeking information (Table 6). Feeling well informed and knowing government recommendations on how to react to disasters are positively associated with active information-seeking behavior. These relationships are statistically significant; the fact that the relationship between preparedness knowledge and information-seeking is not statistically significant in the case of pandemics is likely to be related to the limited variance of preparedness knowledge. Only a handful of people did not know the government recommendations with regard to pandemics.

A certain spatial dimension to hazards and/or the perception of the risk they pose to people seems to be important in understanding differences in how hazard-specific variables relate to one another. Having been indirectly affected by hazards was found to be a significant predictor for preparedness (Table 4). This can be confirmed for pandemics and earthquakes. For blackouts, however, it is direct experience with the hazard that matters. This hazard-specific difference most likely arises because people tend to have had some personal experience of a blackout or brown out.

It is interesting to see in this context that the only structural variable of statistical significance for information seeking on blackouts is nationality. Non-Swiss are more likely to have sought information on blackouts. Di-

rect experience with the hazard also matters in the models for information-seeking on earthquakes. Here, it is worth highlighting that risk perception with regard to places an individual visits is positively and statistically significantly associated with information seeking. This is not the case for the other two hazards. Place-specific risk perception was not relevant for blackouts. For pandemics, it was, on the contrary, where risk perception at home and/or at work was a significant predictor for information-seeking.

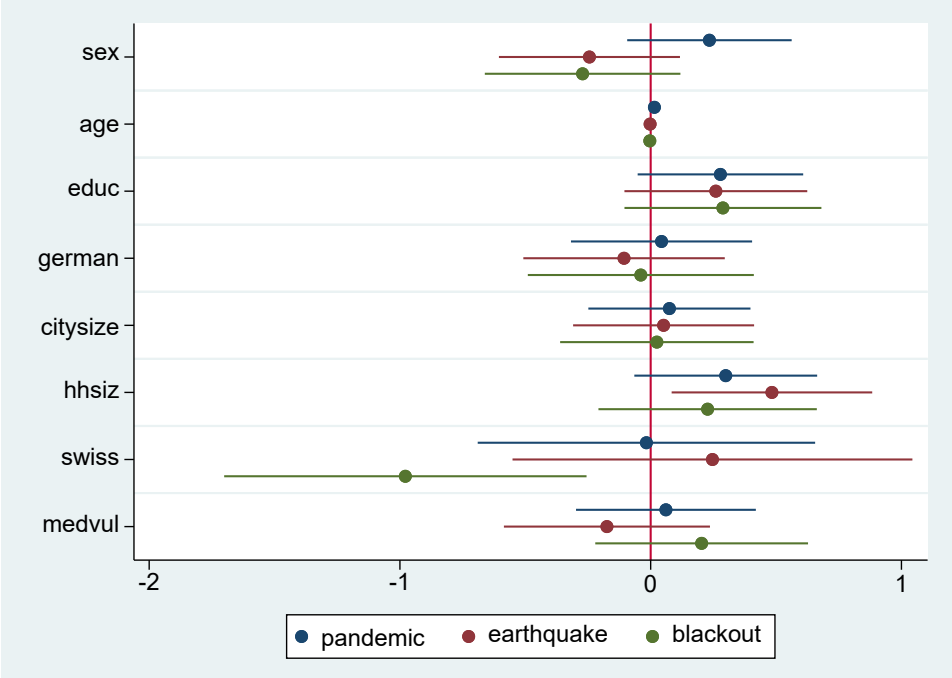
In contrast to the findings for preparedness, risk perception is a relevant predictor for information seeking. This is true for all three hazards considered. In a hazard-specific analysis it also seems to make sense to differentiate between the three measures of risk perception, i.e. per*, per*_h, and per*_v, as the above results show (whereas they were collapsed into one variable in Table 4). The 2018-study showed that both risk perception and information seeking has strongly increased across hazards in the period between 2011 and 2017. Our multivariate hazard-specific analysis confirms this positive relationship between the two factors. Also contrasting with the results for preparedness, the need for information is found to be a good predictor here (i.e. statistically significant for all three hazards and models). It was also one of the factors to have increased (across all hazards) between 2011 and 2017.

Based on these results, we could suggest that a high risk perception and a strong need for information will increase peoples' information-seeking activities, but not necessarily their preparedness behavior (emergency planning etc.). For the latter, the levels of information seem most relevant among the socio-cognitive variables. This finding also reflects previous research, and reinforces the need to conduct research in the Swiss context concerning to better understand the way people interpret and act on official risk information.

The inclusion of structural variables (models 3 and 4 in Table 6) provide us with some interesting additional information. Figure 1 is a visual presentation of the effects of structural variables on information seeking, by hazard (holding other factors shown in Table 6 constant). As could be expected, from our analysis of pandemic preparedness (Table 4), women are more likely to have sought information on pandemics (Table 6). For the other two hazards, men were more likely to seek information, but these relationships were not statistically significant. Not surprisingly and in line with what we have previously found (Table 4), age matters when it comes to explaining information seeking on pandemics, with older people more likely to seek information about pandemic risk. For the other hazards, earthquakes and blackouts, again, the opposite was the case: young people were more likely to seek information (not statistically significant, though). In the case of earthquakes, active information seeking behavior is positively associated with a bigger household size.

An interesting finding regarding the effects of structural variables concerns education. Even if relationships between the variable and information seeking is not statistically significant, results suggest that more educated people are more likely to seek information on how

Figure 2: Explaining information-seeking using structural variables



to react to hazards. This is the opposite from what we had found for preparedness where less educated people seemed more likely to take preparedness measures. These findings combined could be interpreted as follows: More educated people are likely to seek information on disaster preparedness, but not likely to take actual measures to prepare.

5.3 Models of hazard specific threat perception, information seeking, and preparedness knowledge.

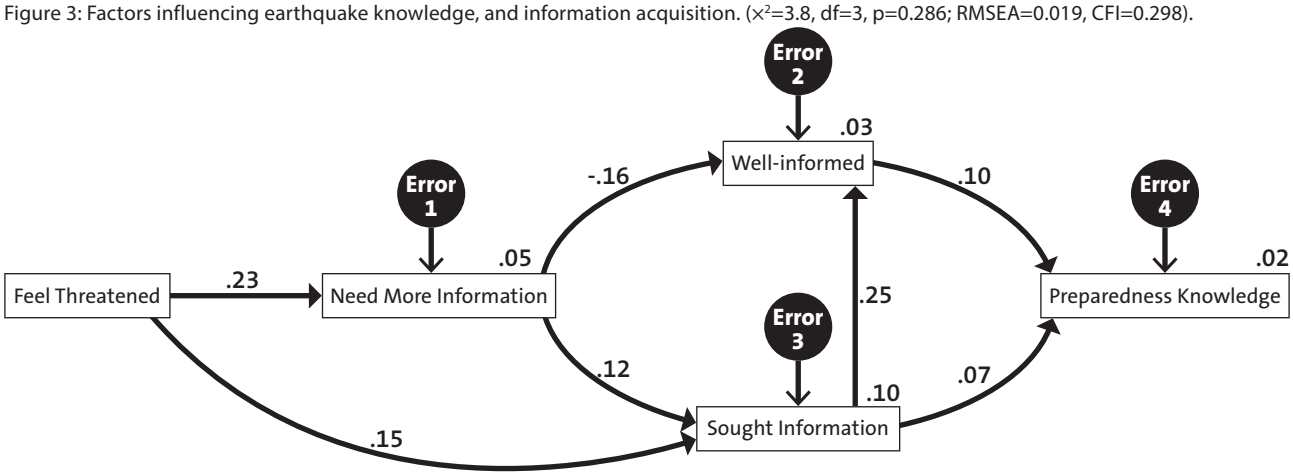
Relationships between socio-cognitive factors – and their impact on preparedness measures – are highly complex. Logistic regressions (as applied in 5.2) are only a crude way to capture those relationships. To analyze interdependencies and effects between these factors more systematically, we will use structural equation models (SEM) in the present sub-chapter. This will allow us to approach the complexity of the issue from a more detailed and theoretical perspective.

Traditional models of risk mitigating behavior illustrated that intentions tend to mediate peoples' preparedness motivation and their actual behavior. In these early models (Theory of Reasoned Action and Theory of Planned Behavior), motivating factors included beliefs about the outcomes of the behavior and for the individual, normative, and compliance beliefs, as well as subjective norms and perceptions about behavioral control. These motivation factors were seen to determine whether individuals facing a risk would form an intention to respond to that risk by changing their behavior.

In the 1990s Protection Motivation Theory highlighted the importance of perceptions about threat severity, a person's response efficacy, and about people appraisals of the threat and their ability to cope with that threat. These factors were seen as drivers of preparedness motivation. During the 2000s, elements of each of these three models of risk preparedness behavior were further informed by detailed qualitative and quantitative research across a broad range of natural and technical hazards. In particular, this work highlighted the importance of social capital, and that there was often a distinct disconnect between peoples' intention formation, and their preparedness, where those people simply seeking information about preparing were less likely to actually prepare.

Using these models as a basis, the project team applied Structural Equation Models to examine the relationships between threat perceptions, information needs, information seeking and hazard-specific preparedness knowledge. A substantive model of examining risk perception, information seeking and preparedness knowledge was developed based on the results detailed in section 4. Data were collected on survey participants' hazard-specific preparedness knowledge for three hazards only (earthquakes, blackout, and pandemic), and the analyses are reported here, with superficial interpretation. Interpretability of these models is limited by the fact that the survey questions used in 2017 were based on questions used in the previous study of 2011. A the time of writing, it was unclear whether questions used in the survey in 2011 were pychometrically contructed or tested, so the reliablility and validity of the results of the analysis cannot be assessed. Notwithstanding these limitations, these results offer a first insight into public preparedness in Switzerland and can serve as a basis for subsequent research.

Figure 3: Factors influencing earthquake knowledge, and information acquisition. (x^2=3.8, df=3, p=0.286; RMSEA=0.019, CFI=0.298).



5.3.1 Earthquake Information Seeking and Knowledge

The relationship between peoples' feelings about threat tend to positively influence repondents' desires to obtain more information about the hazard, as well as their actual information seeking behavior (Figure 3). Likewise, a desire for more information had a positive effect on peoples' information seeking behavior regarding earthquake hazards. Consistent with what would be expected, there was a negative relationship between desires for information, and perceptions of being well-informed – people who feel well-informed are unlikely to want more information on a hazard. Both information seeking and feelings about level of informedness positively affected knowledge about specific blackout preparedness behaviors (find cover and protect your head, leave the property if badly damaged).

Data fits the model well. While Beta coefficients describe a reasonable level of standard deviation change in the dependent variables, the overal variance predicted by the variables remains quite low.

5.3.2 Blackout Information Seeking and Knowledge

The same model fits data on blackouts slightly better than with the earthquakes (Figure 4). The same general patterns of influence between the variables can be observed, with those relationships describing slightly more (though still relatively little) variability in the variables themselves. Stronger relationships between feelings of being well informed and desire to seek information (than in the earthquake model) contribute to better describe variance in knowledge about two important blackout behaviors, though still quite low, even for social data (Sheeran, 2002).

5.3.3 Pandemic Information Seeking and Knowledge

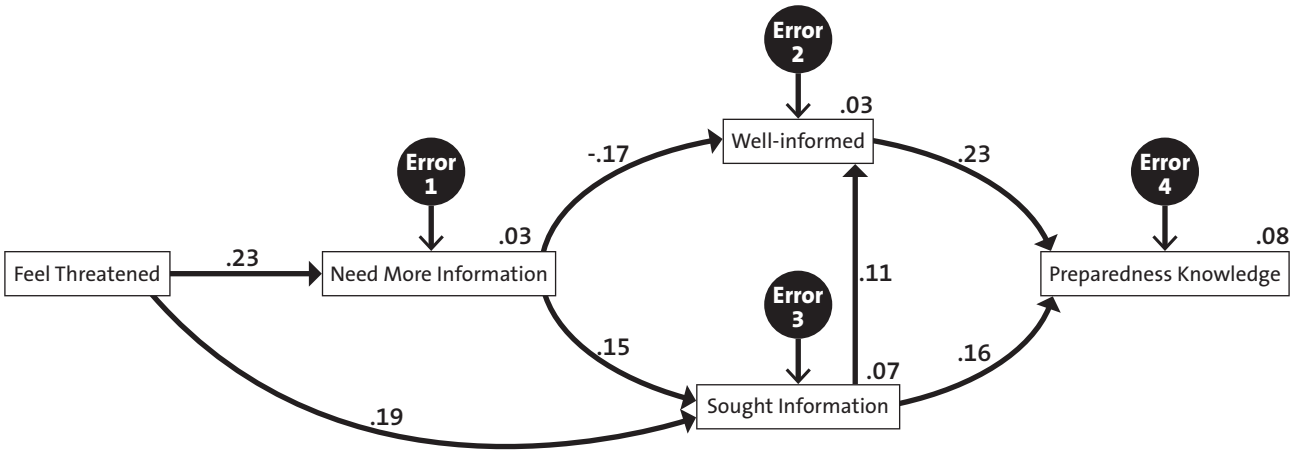
Of the three hazards, the model fits poorest to the pandemic data (Figure 5). Relationships between the variables are weak, particularly between knowing preparations (regular hand washing and disinfection, covering mouth when sneezing or coughing) and feelings of being well informed, and whether respondents had already sought information about pandemic threat (see Table 6). However, most similarity between pandemics and the previous two hazards lay in the relationship between a desire for more information and feeling of being well informed (negative), and whether they had already sought information (positive).

5.4 Discussion of results

This section sought to explore two aspects of information seeking important in the development of effective risk communication. First, the relationship between structural and socio-cognitive variables and Swiss peoples' information seeking. Second, how this relationship extended to influence peoples' hazard preparedness knowledge. Using data collected for three different hazards (earthquakes, blackouts, pandemics), representing the three basic types of hazards (natural, technical and social), some key findings were made with respect to communication from an all-hazards basis, the relationship between risk perception, information seeking and preparedness knowledge, and how experience influences information seeking.

Only risk perception was observed to positively influence information seeking across all three hazards ex-

Figure 4: Factors influencing blackout preparedness knowledge and information acquisition.
(x^2=2.88, df=2, p=0.237; RMSEA=0.024, CFI=0.995).



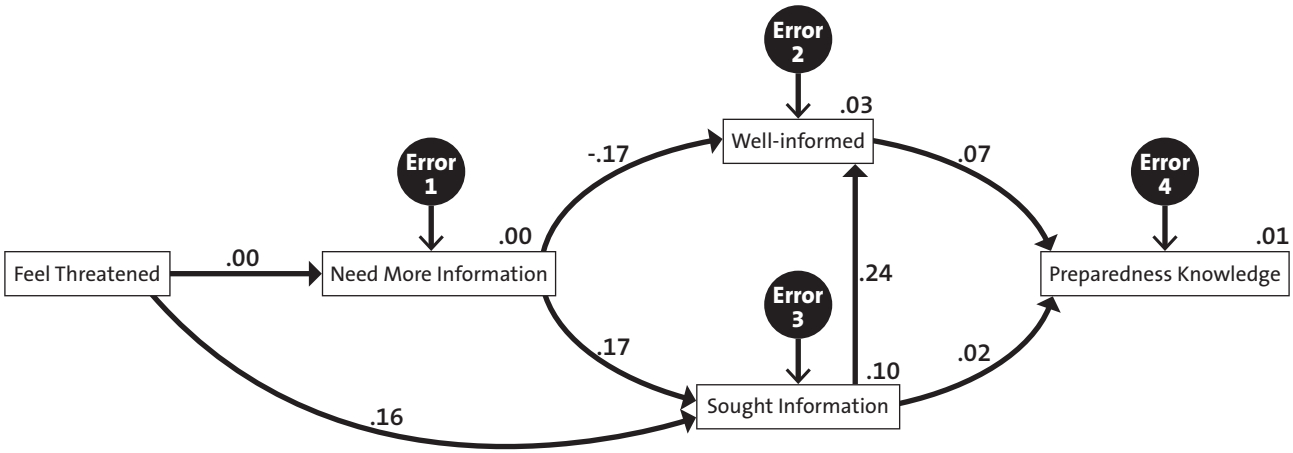
amined. This finding matches existing research that has demonstrated a strong link between risk perception and intention to seek information. Yet, while our results suggest that high risk perception drives peoples' needs for more information, there is no obvious relationship between these factors and peoples' preparedness, which also reflects existing research.

Direct (blackouts) or indirect (earthquake, pandemics) experience of hazards was a strong predictor of information seeking. The Swiss population (surveyed) level of risk perception was observed to have generically increased between 2011 and 2017, and these changes are likely (though exploratory SEM analyses could not substantiate this assumption) to be connected to direct or indirect experience of these hazards by the population. Direct experience was a strong predictor of blackout information seeking, and indeed the issue of a blackout in Switzerland has received considerable attention in the media (SRF Thementag, 2017, various articles in print media, popular fiction publications, etc.) in recent times. Indeed, the likelihood that Swiss people surveyed by the CSS had experienced a blackout in their homes (even if for a short duration only) is higher than the likelihood of them having experienced an earthquake or pandemic. For the latter hazards, indirect experience played a significant role in driving their information seeking actions.

The results demonstrated quite clearly that Swiss peoples' information seeking is influenced by the type of hazard at the focus of their activities. The results suggest that information seeking is generically influenced (either positively or negatively) by factors including survey respondents' perceptions about risk, their gender, education level, age, the size of the household or community in which they live, their direct and/or indirect experiences (or perceived experiences) of those hazards. However, influencing factors varied between the hazards. A case in point was the role of age in driving information seeking: older people were more likely to seek information on pandemics, while younger people were more likely to seek information about blackouts or earthquakes. Similar hazard-specific differences were observed with place-based risk perception.

The nature of the survey imposes limits on the ability of the research team to make strong conclusions about these differences in the hazard-specific drivers of information seeking. However, that such contrasts could be observed, at all, suggests that taking an all-hazards approach to risk communication about hazards in Switzerland might be counter-productive in some contexts. Indeed, these results support the notion that it is necessary to develop, where possible, targeted information about hazards and the necessary steps for preparedness.

Figure 5: Factors influencing pandemic preparedness knowledge and information acquisition.
(x^2=15.95, df=3, p=0.001; RMSEA= 0.076, CFI= 0.888).



6 Conclusions and implications

Connecting with the public through meaningful risk communication processes is likely to become increasingly important in Switzerland in the future. Simply because the urban population areas in the country are becoming more dense means that the consequences, if disaster does strike, will be more severe – where severity is measured in deaths and injuries, destroyed or damaged infrastructure, and disrupted services. Climate change predictions for Switzerland, which indicate more frequent and severe storms (resulting in flooding, landslides, liquefaction, etc) among other impacts, are cause for added concern – because disasters are social phenomena (caused by hazard activity), increased population density magnifies disaster severity. Under such circumstances it will become more necessary for the Swiss Federation, Cantons and Municipalities to share the burden of mitigating hazard impacts. Risk communication that considers (among other issues) the points explored in this report, can help to inform the development of effective risk communication.

Based on the analyses conducted in this study, three important conclusions can be drawn from the work. First, while people seem to be seeking more information about risks, and demonstrated higher levels of risk perception, these factors don't necessarily correlate with increased knowledge about potential preparations, or actual preparation. To better understand these relationships, the current study's methodological limitations must be overcome in the future. Second, as highlighted by previous work by the CSS (Prior and Herzog, 2015a), considering how influential factors interact when developing risk information and communication processes will likely improve the ability of the public to translate risk information into action. Last, proper preparedness requires planning. The study demonstrated that people who develop an emergency plan generally demonstrate higher levels of preparedness knowledge than people who report having an emergency supply of food and water. These three points are discussed in this section, along with commensurate implications for Swiss risk communication.

6.1 Key elements from 2011 – 2017 information needs comparison

6.1.1 More people seeking information

In 2018, the information needs study showed that people are seeking more information than in 2011 (Maduz et al., 2018). This mirrors findings in other places (UK Civil Contingencies Secreriat), which illustrates that the public is becoming more engaged in the provision of services that affect them – including in emergency management. Closer engagement translates to greater interest in dealing with the problem personally. In a society defined increasingly by access to information technology, this means obtaining the information that can help. In the era of 'Google solutions' peoples' access to information is higher, they seek information more.

Even so, it is not clear whether the public actually translating the results of their information seeking into the preparedness behaviors that authorities advise or desire. We demonstrated that although peoples' risk perceptions have increased, leading to stronger information seeking behavior, there was no consequent change in preparedness behavior (emergency planning etc.). For this reason, it's important to develop risk information sources that are meaningful and understandable – both in the context of the types of people searching (demographics), and with respect to the (socio-cognitive) drivers or inhibitors that influence the translation of information into action.

6.1.2 More people feeling affected by hazards, but preparation knowledge not increasing

More people reported feeling threatened by hazards in 2017 than in 2011. This is probably a reflection mostly of peoples' increased access to information, and particularly to reporting of hazard incidents locally, regionally, and globally. It also potentially reflects the emotional effects that reporting of hazards has on people – here the perception of personal impact may be as important as actual (indirect or direct) impact from a hazard.

Even though people reported being affected by hazards more in 2017, and that information seeking behavior increased during this time also, there was no commensurate trend in preparedness knowledge. This would indicate some disconnection between the perception of risk, information seeking, and the accumulation of knowl-

edge about preparation. The fact that higher risk perception does not influence preparedness knowledge reflects previous research finding that perceptions of risk may be antecedents of behavior change, but that other socio-cognitive factors drive actual risk mitigating behavior.

This issue highlights a limitation of the present study, which was unable to examine the broader influence of socio-cognitive factors on information seeking and information knowledge because of the comparative survey used to collect data from the public. The survey was structured in the same way, contained the same questions, and was administered in the same way as a previous survey in 2011. Future work should focus specifically on the collection and analysis of socio-cognitive information.

6.2 Established elements in effective risk communication

Globally, risk communication is increasingly being used as a tool to connect the public effectively with formal disaster management actions and processes as a way of sharing the burden of mitigating hazard impacts. However, simply providing 'targeted' risk information and relying on the receiver's perception of their risk as a means to increase preparedness for natural hazards does not yield sufficient public behavior or attitude change – and is therefore insufficient in a burden-sharing context. In 2015, the CSS suggested six recommendations that can improve the way people interpret and act on risk information (Prior and Herzog, 2015a). Each of these points remain relevant now, and are revisited with respect to the results from the present study.

6.2.1 Engaging with the at-risk public

Research in this study demonstrates how differently information seeking behavior is driven among diverse population across different hazards. These results seem to contradict the utility of an 'all-hazards' approach to risk communication, where generic communication styles and paths are employed across hazard types. Developing risk messages and information together with the target audience can be a useful way of identifying misunderstandings and misinterpretation of risk messages. 'Road-testing' risk messages and delivery channels before the dissemination of the information, and incorporating feedback from the information receivers can increase the efficacy of risk communication dramatically. Indeed, if risk communication seeks to elicit preparedness behavior, then road-testing messages may be an excellent means of understanding how to practically bridge the obvious divide between perceptions of risk (which the Swiss demonstrate) and actual preparedness action.

Structural variables were found to be better at explaining peoples' preparedness behavior as opposed to their information-seeking behavior. This highlights that the logic behind these behaviors differ, which is has important implications from the perspective of risk communicators. Especially for emergency supply, factors such as sex, age, education, region, city size and household size, matter. By contrast, our findings suggest that for emergency planning, socio-cognitive factors play a comparatively more important role. Here, the mental process leading to the decision to develop a household seems to be key. Becoming aware of risk, and acting to mitigate it, is a process of learning (Eriksen and Prior, 2011), and the learning process cannot be considered complete simply if risk information is passively transferred to an at-risk audience.

6.2.2 Risk information must be understandable and meaningful to the receiver.

Risk communicators should be aware that the risk information they distribute may not be acted on in the way it is intended. The 2018-study already indicated that especially for technical and social threats, a mismatch exists between peoples' perceived information levels and their risk perceptions. Among the risks they feel most threatened by, we found social and technical risks, such as terrorism, cyber-attacks, chemical spills and nuclear incidents. At the same time, these were risks they felt least informed about and for which, they showed an interest in more information. From the perspective of policy-makers the information landscape, as provided by authorities, is well developed in the case of natural disasters. The same is not true for social and technical disasters. For these risks, it would be particularly important to have understandable, and easily interpretable information at hand.

6.2.3 Not all people prepare

Risk communicators should expect that not all people will prepare for hazards that they might be threatened by. Our findings suggest that educated people are more likely to seek information on disaster preparedness, but they are less likely to take actual preparedness measures. The same is true for people with a high risk perception. While

they are more likely to actively engage in information-seeking, people who feel more threatened by disaster risks are not more likely to prepare in terms of emergency planning, emergency supply or pandemic preparedness.

6.2.4 Mixing active and passive risk messaging

By providing risk information using only one mode of dissemination, the risk communicator automatically limits the utility and uptake of that information. One of the panelists from the survey, summarizing other comments that were made, pointed out that a lot of disaster preparedness information was "out there", but that it was difficult finding the right information for themselves. The 2018-study has already shown that the Internet is becoming more important as an information source. Yet the present study suggests that preferences for information channels (new technologies vs. more traditional technologies) influences whether or not people are likely to prepare. People with a preference for more traditional information channels (consultation of work place) were more likely to take preparedness measures (emergency plan). Again, results for emergency planning somewhat differed from the result for emergency supply. Here, the consultation of the online platform alertswiss.ch was positively associated with taking preparedness action.

Presenting information regularly, through different media, and in different ways can be a useful way of increasing the salience of hazard risk as well as reaching a bigger part of the target group. Some people can incorporate mass communicated information seamlessly into their daily lives, while others require assistance contextualizing information and interpreting it in their own situations.

6.2.5 Complementing individuals' risk thinking

Risk managers should seek to gain an understanding of the way the public thinks and feels about risk, and develop risk information and messages that complements these thoughts and feelings. The present study highlights that the relationships between preparedness behavior, i.e. information-seeking, and potential predictors may vary according to hazards. This finding may also help explain why previous literature disagreed on the effects of variables, such as sex and age: they vary depending on the hazard. Our findings also suggest that perception of risks may depend on the spatial dimension of hazards – or rather peoples' perception thereof. Feeling a perceived high risk at frequently visited places is, for example, relevant for information-seeking on earthquakes. By contrast, a perceived high risk at home or at the workplace is a predictor for information-seeking on pandemics.

People make decisions about risk based on a rationalisation process, which may differ between experts and laypeople. Importantly, laypeople are not necessarily wrong, but may require particular information that helps them to understand risk in a way that reflects the expert's view. The extensive connectivity between civil society and civil protection as well as the technical knowhow in Switzerland should therefore be leveraged for designing recipient-oriented, helpful risk information messages.

6.3 Preparedness requires planning

One of the most important findings of the study is that, like organizations, individual preparation requires planning. As in the case of an emergency management or civil protection organization, this requires foresight and a strategic approach. For individuals, the interplay between structural demographic factors and socio-cognitive factors on decision making, strongly influence peoples' objective and subjective capacities to think strategically and with foresight about how they can prepare for different hazards.

The difficulty associated with thinking strategically about hazards that could potentially have an impact leads people to cognitively bias their levels of preparedness. This is particularly evident with respect to emergency plans and emergency supplies – two important elements of individual preparedness advocated by Swiss civil protection authorities. Our research demonstrated that people who had developed an emergency plan were more likely to be well prepared than those people reporting they had an emergency supply of food and water. This raises several important questions: Is a plan better than an emergency supply? If people have both, this is obviously the best situation, but do people understand exactly what an emergency supply or emergency plan are? How do peoples' beliefs about the effectiveness or existence of these elements of preparation influence peoples' actual information seeking or levels of preparedness? If people over-estimate their levels of preparedness, what does this mean for authorities' future risk communication planning and community outreach?

We were able to identify important differences with respect to preparations in the form of emergency plans and supplies. Establishing an emergency plan requires individuals or households to critically think about the potential of an emergency, how it might directly impact them, and how they could minimize this impact. By

contrast, many households have a store of food, which might be confused with an emergency supply, yielding false perceptions of preparedness. We distinguish, then, between 'hard' preparations, which people must specifically consider, and 'weak' preparations that people tend to accomplish when going about their daily lives. Emergency planning at the household level is an important 'hard' preparation, while the emergency food supply tends to be a 'weak' form of preparation.

6.3.1 Cognition versus socio-demographic factors as drivers of information seeking and preparedness

The results of this project support existing findings about the importance of considering socio-cognitive decision making in the development of practical risk information. While our results also suggest the need to communicate differently to different (socio-demographically diverse) population groups, the need to consider the way people think about risk information, and how this thinking influences their decisions about seeking information and about preparing, are most important.

Considering socio-cognitive drivers in the development of risk communication permits a finer approach to risk messaging. Given that different people are approaching information seeking and preparedness in different ways, and for different reasons, establishing scaled and targeted communication processes is likely to increase the overall reception of risk messages and ultimately behavior change.

The all-hazards approach to risk communication and hazard preparedness, both at the individual level, and in broader integrated risk management practices, has been a focus of disaster management for perhaps the last decade – principally driven by the rubric of efficiency. While convenient, it is simply impractical to approach risk communication for each hazard and all people in the same way. Finding a balance in the trade-off between effort (in risk communication) and outcome (preparedness) remains a fundamental challenge in risk communication and hazard preparedness. Yet a considered investment in gaining a practical understanding of the interplay between cognitive and demographic drivers of preparedness must inform the trade-off. Research conducted in this project suggests there are no shortcuts to effective risk communication.

6.3.2 Emergency plans as first order ('hard') preparations

In order to establish an emergency plan, householders must engage directly with potential hazards. To do so, people must develop a specific and critical awareness of the risk they are exposed to, and how this risk might be minimized.

Preparing for a hazard can take the form of myriad protective behaviors. All contribute something to the ability of the householder to successfully mitigate risk, although the individual value (in terms of how it contributes to personal or household safety) of each preparation behavior, and the difficulty (the knowledge, skill, time or money required) associated with accomplishing them, varies considerably. Developing an emergency plan requires people to accumulate the knowledge, skills, and resources necessary to create and execute a plan, if required.

For these reasons, and based on the research reported here, we consider having an emergency plan as a good indicator of household preparedness. It is reassuring that advice on how to make hazard-specific emergency plans has been available to the Swiss public through the Federal Office for Civil protections' Alertswiss App since it was released in 2015. This study has highlighted both demographic and socio-cognitive characteristics of people that influence whether they are likely to establish emergency plans for certain hazards, and this information could be utilized to further promote emergency plan development among the Swiss population.

6.3.3 Emergency supplies as second order ('weak') preparations

Many people self-report they have an emergency supply, but the veracity of these claims has not been tested by systematic explorations that compare claims to actual stores. Results from the research conducted as part of this study suggest that, because people tend to over-estimate the utility of their typical food stores in an emergency, the focus on the emergency food supply in Swiss hazard preparedness should be examined. In particular, expectations that the public are well-prepared from an emergency supply perspective should be tempered by a realization that peoples' understanding of an actual emergency supply may not reflect formal advice.

In a survey of the Swiss population in 2017, Switzerland's Federal Office for National Economic Supply conducted a self-reporting assessment of the population's emergency food supply. In the survey, the agency reported that, on average, people estimated they had supplies for between 15 and 18 days, with only ~30% of

people indicating they had supplies that would last for fewer than seven days – the agency's recommended supply. However, the agency also identified that if only foodstuffs that could be consumed without electricity were considered in the assessment, then 70% of the population would not have the recommended supplies in the event of an emergency (Zimmermann et al., 2018). This finding suggests that people tend to over-estimate their capacity to endure emergencies utilizing an emergency food supply. Indeed, without a professional knowledge of what constitutes an emergency supply, it's easy to confuse a typical household's food store as sufficient in an emergency.

An emergency supply that meets official guidelines is a form of preparedness that is valid and important. Yet households typically have stores of food and beverages in a pantry, which if conflated with a real emergency supply, could dangerously expose people in the event of an emergency. If people estimate they have 15-18 days of supplies, they are also likely to perceive themselves to be prepared. But this is a form of 'weak' preparedness. Recognizing and addressing this potential for confusion in formal communications about the emergency supply should be a focus of future efforts.

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