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Collective efficacy and natural hazards: differing roles of social cohesion and task-specific efficacy in shaping risk and coping beliefs

Philipp Babcicky[a] and Sebastian Seebauer[b]

[a]Wegener Center for Climate and Global Change, University of Graz, Graz, Austria; [b]LIFE – Centre for Climate, Energy and Society, JOANNEUM RESEARCH Forschungsgesellschaft mbh, Graz, Austria

ABSTRACT

Previous research in non-disaster contexts has shown that the concept of collective efficacy, which is a group's sense of its ability to achieve a specific objective, assists understanding of community readiness and households' decisions to take preparedness actions. Collective efficacy expands the concept of social capital, which refers to social resources such as trust, norms and networks, by addressing how likely communities are to activate these resources for specific tasks. This paper empirically investigates the effect of three distinct collective efficacy components on risk perception, fear and self-efficacy regarding natural hazards in Austria. The three components have differing impacts on risk and coping beliefs: (1) *Social cohesion* decreases risk perception and fear but has no effect on self-efficacy; (2) *Efficacy belief in social support* increases self-efficacy; (3) *Efficacy belief in citizen groups* increases risk perception and fear. The combination of efficacy belief in social support and citizen groups seems to be most promising for stimulating protective action, as they together promote both risk and coping appraisal. However, overreliance on social support may have the undesirable effect of creating a false sense of safety among disaster-prone households. The findings demonstrate that collective efficacy provides a meaningful perspective from which to examine risk and coping beliefs but caution against treating it as an umbrella concept, given the differing effects of its components. Future studies are needed to investigate the impact of collective efficacy on other key explanatory factors of protective action, such as response efficacy or non-protective responses.

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1. Introduction

Recent developments in the management of natural hazards show a trend towards a renegotiation of responsibilities between public and private actors (EU 2007, Adger et al. 2016). Private actors, such as households in risk areas, are expected to take an active role in strengthening both their own resilience and the overall resilience of their community (e.g. BMLFUW 2017). Households at risk of flooding, for instance, can either engage in protective actions individually

CONTACT Philipp Babcicky philipp.babcicky@uni-graz.at Wegener Center for Climate and Global Change, University of Graz, A-8010 Graz, Brandhofgasse 5, Graz, Austria

(e.g. by adopting property-level measures) or organise in neighbourly networks and citizen groups aimed at reducing risks collectively (Mees, Crabbé, and Driessen 2017).

Collective action in natural hazard management takes many forms (Dittrich et al. 2016). Flood action groups are a recent example of local bottom-up civic action; their activity portfolio spans from the prevention to the recovery stage, including the clearance of debris from streams, participation in planning processes, training of flood wardens, deployment of sandbag barriers or the provision of charitable donations to flood victims (Seebauer et al. 2018). Voluntary emergency and rescue services, such as fire brigades, are well-established disaster management institutions in many countries (Alexander 2002). Support groups may form spontaneously in the aftermath of a flood event, recruiting their workforce among neighbours (Gil-Rivas and Kilmer 2016) or from other, unaffected parts of the country (DRK 2014). Although every citizen group has its own and particular focus, they all share the common objective of increasing disaster resilience in their communities collectively.

Critical for the effectiveness of any collective, however, is 'a group's shared belief in its conjoint capabilities to organise and execute the courses of action required to produce given levels of attainment' (Bandura 1997, 477), termed 'collective efficacy' in Bandura's influential work on the exercise of control. Individuals' belief in a group's collective efficacy, Bandura argues, does not only affect the performance of a group but also how individuals themselves manage their own resources, strategies and motivations. This bridging characteristic of collective efficacy is supported by previous studies in non-disaster contexts, demonstrating that beliefs about the ability of a group to achieve particular goals also influence perceptions and behaviours at the individual level (e.g. Jugert et al. 2016; Ferguson and Mindel 2007). Consequently, collective efficacy may also affect attitudes and behaviours with respect to preparing for, reacting to or recovering from natural disasters.

Despite its long tradition in other research contexts, particularly in crime (Hipp 2016) and education research (Klassen et al. 2011), the concept of collective efficacy has received little attention in disaster risk research. To date, community resilience to disasters has mostly been studied from a social capital perspective (Cutter, Boruff, and Shirley 2003; Aldrich and Meyer 2015); however, social capital is widely used as a catch-all concept encompassing shared norms, trust, networks, manifest assistance and possibly other relational aspects among members of a community (Adger 2003; Norris et al. 2008). While collective efficacy similarly addresses social cohesion from trustful relations, its added value lies in focussing on the specific tasks that a group of citizens strives to achieve. Shifting the focus to collective efficacy allows emphasis of the fact that collectives pursue specific purposes by engaging in dedicated tasks, and that the consequences of collective action may depend on the particular purpose of a group.

In the remainder of this paper, we first review the theoretical foundations of and relevant work on collective efficacy before proposing a role in shaping disaster risk and coping beliefs. Two empirical studies on natural hazards in Austria illustrate that the task-specific components of collective efficacy have differing effects on risk perception, fear and self-efficacy. We conclude with suggestions for highlighting task-specific effects of collective action in risk management and risk research.

2. Background

2.1. Collective efficacy and its components

Collective efficacy is rooted in social cognitive theory, suggesting that the key to human agency is the belief in one's own or group capability 'to organize and execute the courses of action required to manage prospective situations' and that such beliefs 'influence how people think, feel, motivate themselves, and act' (Bandura 1995, 2). Efficacy beliefs enable human agency through four major processes, including cognitive (e.g. analytic thinking), motivational (e.g. beliefs about what can be achieved), affective (e.g. distress or anxiety) and selection processes (e.g. choosing courses of action). These efficacy-activated processes are assumed to operate in concert, ultimately regulating human functioning (Bandura 1995).

Collective efficacy is closely linked to and in part overlaps with other social mechanisms, particularly with social capital (Lochner, Kawachi, and Kennedy 1999). In its broadest sense, social capital refers to the 'features of social organisation, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated actions' (Putnam, Leonardi, and Nanetti 1993, 167). Despite their similarity in describing the social background against which collective action emerges, there are nuanced but important differences between the two concepts. While social capital underscores the general potential for mutual support rooted in social relationships and networks, the emphasis of collective efficacy lies on the ability of a group to leverage this potential for pursuing specific tasks (Drakulich 2014). Alternatively, as Cagney and Wen (2008, 242) succinctly put it: 'social capital is about relationships and collective efficacy is about converting those relationships into action'; however, collective efficacy also acknowledges that collective action is embedded in the general social context and therefore consists of both a social cohesion component and a component that captures expectations about task-specific actions (Sherrieb, Norris, and Galea 2010; Ansari 2013; Sampson 2006).

In the literature on collective efficacy, the social cohesion component typically captures aspects related to mutual trust (e.g. 'people in this neighbourhood can be trusted') and solidarity (e.g. 'people around here are willing to help their neighbours') (Browning and Cagney 2002, 389). Far less attention is directed towards social networks, because the intention to act collectively is assumed to be primarily influenced by the sense of attachment to a community, rather than by the density of pre-existing social networks (Browning and Cagney 2002; Sampson 2006).

The conceptualisation of the task-specific component of collective efficacy hinges on shared beliefs, either about performing particular actions or about achieving particular outcomes. Sampson, Morenoff, and Earls (1999) for instance, assess shared belief and mutual engagement regarding specific actions in child social control. Goddard (2002) and Van Zomeren, Postmes, and Spears (2008), on the other hand, stress that people's expectations focus on whether collective action would achieve its desired outcomes effectively. Taken together, the task-specific component of collective efficacy captures a group's conjoint capability to perform specific tasks aimed at achieving a particular goal (Zaccaro et al. 1995).

2.2. Effects of collective efficacy

On account of its potential for the study of virtually any type of collective action (Hipp 2016), collective efficacy has been embraced by different fields of research. One of the earliest empirical applications to neighbourhood crime and disorder found that collective efficacy is strongly negatively related to perceived violence, even after controlling for social factors such as residential stability or poverty (Sampson, Raudenbush, and Earls 1997). The education literature has also devoted considerable attention to collective efficacy and found a close link between the belief of teachers in the collective efficacy of their school and student achievement (Goddard 2002, 2001; Goddard, Hoy, and Hoy 2000; Bandura 1993). Collective efficacy is relevant in a wide range of contexts, including pro-environmental behaviour (Chen 2015), group problem solving (Kline and MacLeod 1997), substance abuse (Fagan, Wright, and Pinchevsky 2014), athletics (Greenlees, Graydon, and Maynard 1999), child development (Smith et al. 2013), parenting (Ma and Grogan-Kaylor 2017), political attitude and participation (Lee 2006) and community gardening (Teig et al. 2009).

While collective efficacy is mostly used for predicting behavioural variables such as group performance and behavioural intentions, it can also influence perceptions and affective responses. Belief in a community's ability to successfully manage disaster response cushions psychological distress in the aftermath of a disaster under conditions of high resource loss (Benight 2004).

Collective efficacy, measured as the trustworthiness of neighbours and their willingness to intervene when they observe delinquent behaviour, reduces perceived risk and fear of local crime (Gibson et al. 2002). Teachers who believe that their school is able to handle the challenges related to its institutional role effectively are more likely to feel attached to the goals and values of their school (Caprara et al. 2003) and experience positive emotions at work, such as excitement, happiness and encouragement (Stephanou, Gkavras, and Doulkeridou 2013).

Efficacy at the individual and the group level influence each other (Bandura 1995, 1997). Bandura uses the metaphor of a sports team, where an individual team member judges her own capabilities (i.e. self-efficacy) with reference to the capabilities of the team as a whole (i.e. collective efficacy) and, vice versa, judges the team's chances of success in the light of her own potential contribution to its success. This relationship between collective efficacy and self-efficacy has been confirmed empirically, for instance in the education context (Stephanou, Gkavras, and Doulkeridou 2013; Caprara et al. 2003; Goddard and Goddard 2001) and for pro-environmental behaviours (Jugert et al. 2016).

3. Linking collective efficacy with risk and coping beliefs related to natural hazards

Despite its relevance in other behavioural contexts, collective efficacy has largely been neglected in the literature on natural hazards. Notable empirical exceptions are studies on the effect of disasters on collective efficacy (Fay-Ramirez, Antrobus, and Piquero 2015; Benight 2004), on the impact of collective efficacy on mental-health outcomes (Heid et al. 2017; Fullerton et al. 2015; Ursano et al. 2014), on perceived community resilience (Cohen et al. 2013) and on earthquake and tsunami preparedness (Paton et al. 2009, 2010; McIvor, Paton, and Johnston 2009). However, although it has been confirmed that collective efficacy influences not just behavioural variables but also the perceptions and attitudes leading to a particular behaviour, none of these studies investigated risk and coping beliefs as factors for how people prepare for and react to natural hazards.

Risk perception, fear and self-efficacy are key explanatory factors for protective behaviour of individuals according to Protection Motivation Theory (PMT; Rogers 1975, 1983). In the PMT, risk perception is conceptualised as a combination of the perceived severity and consequences of a threat. Self-efficacy is a central component of coping appraisal and is defined as a person's perceived ability to carry out a specific action aimed at reducing potential negative consequences (Floyd et al. 2000). A person who is afraid of flooding and believes that her flood risk is high, and also feels capable of reducing her risk through personal efforts is more likely to take action (Bamberg et al. 2017; Kievik and Gutteling 2011; Grothmann and Reusswig 2006) such as installing flood barriers or purchasing flood insurance (Bubeck et al. 2013). Risk perception, fear and self-efficacy are linked to the social environment: Elliott and Pais (2006, 300) emphasise that 'people respond to disasters not as isolated individuals but as members of overlapping forms of social affiliation'. Social capital dampens risk perception and fear but increases self-efficacy of households at risk from natural hazards (Wolf et al. 2010; Babcicky and Seebauer 2017). Recognising the importance of risk perception, fear and self-efficacy for stimulating protective action, as well as the conceptual similarity between social capital and collective efficacy, the present study analyses these three constructs as possible consequences of collective efficacy. Furthermore, risk perception and fear reflect the cognitive and affective processes posited by Bandura (1995; see Section 2.1) by which efficacy belief enables human agency.

Socio-demographic variables, such as gender (Babcicky and Seebauer 2017; Kellens et al. 2011), age (Thistlethwaite et al. 2018; Kellens et al. 2011; Zaalberg et al. 2009) and income (Babcicky and Seebauer 2017) have a significant influence on risk perception, fear and self-efficacy. Experience-related and geographical factors, such as disaster experience and risk zone, also significantly influence risk perception, fear and self-efficacy of disaster-prone households (Babcicky and Seebauer 2017; Terpstra 2011). The present study considers these socio-demographics as control variables in order to ascertain the unique effect of collective efficacy on risk perception, fear and self-efficacy.

Based on these premises, this study sets out to illustrate how collective efficacy, or in other words, a group's shared belief in its conjoint capabilities to achieve a specific objective, influences risk perception, fear and self-efficacy as key factors in household decisions whether or not to take protective actions. We understand collective efficacy to consist of two distinct components: social cohesion and task-specific efficacy beliefs. While social cohesion is a context-independent general quality of a community and does not refer to a particular field of action, task-specific efficacy beliefs are situational and therefore need to be tailored to a specific context (here, natural hazards) (Sampson 2006). Efficacy beliefs are further detailed by varying degrees of task specificity, ranging from more general tasks (providing social support during a disaster) to more specific tasks in being part of a citizen group engaged in preventive or participatory actions to reduce risk of disaster. Whereas the provision of social support during a disaster refers to community-wide expectations, the more specific efficacy beliefs refer to an imagined sub-group of citizens aimed at reducing disaster risk by engaging in preventive (e.g. clearing debris from streams) and participatory actions (e.g. conducting planning activities together with the authorities).

This paper aims to confirm that collective efficacy has an influence on risk and coping beliefs of disaster-prone households. Based on the findings in other contexts (e.g. neighbourhood crime; Gibson et al. 2002), we expect that both social cohesion and task-specific efficacy beliefs are negatively related to risk perception and fear. In contrast, we expect that both collective efficacy components have a positive effect on self-efficacy, that is, the perceived ability to take protective action. This assumption is in line with the positive reinforcement between efficacy beliefs posited by Bandura (1995, 1997; empirically supported, for example in educational research, Goddard and Goddard 2001).

In the following sections, we present the methods and results of two empirical studies: In the *Main Study*, we assess the respective influence of collective efficacy components on risk perception, fear and self-efficacy in the case of mountain hazards in Eastern Tyrol, Austria. However, given that this study is based on cross-sectional data, claims about the direction of causality are of a theoretical nature based on existing literature. To validate our causal assumptions, we replicate the effects of a selected task-specific efficacy belief (i.e. providing social support during a disaster) in a *Validation Study* by means of a two-wave longitudinal design in ten flood-prone municipalities in Austria. Note that in the Austrian alpine environment, natural hazards predominantly relate to pluvial torrents and riverine floods. The two studies were conducted in different regions of Austria with different hazard characteristics, therefore they do not constitute a single case study, but rather the Validation Study enables partial replication of the Main Study's findings.

4. Main study

4.1. Data

The Main Study was conducted in Eastern Tyrol, Austria, an alpine mountain region containing approximately 50,000 residents and characterised by a multi-hazard environment with a long history of disastrous events, including the 1965/66 Drava floods, the 1998 torrential flood event affecting the capital of the province and the 2013 Felbertauern landslides.

Standardised self-completion questionnaires were distributed as an insert in the regional newspaper 'Osttiroler Bote' in May 2018. Households could return the questionnaire with a pre-stamped envelope or complete an identical online survey. Respondents were offered participation in a lottery as an incentive to take part in the survey. With 216 valid questionnaires returned, the response rate was relatively low (1.5% based on the newspaper's circulation of

14,000 copies). The distribution by socio-demographic characteristics corresponds fairly well to the population, except for male and older residents, who are slightly overrepresented in the sample (Table A3). A potential self-selection bias cannot be ruled out, therefore, and generalisation of our findings to other contexts needs to be made with caution.

4.2. Measures

All factors were operationalised as multi-item scales to correct for measurement error of single items. Unless otherwise stated, items were measured on a 5-step response scale, ranging from 'fully agree' to 'fully disagree'. Detailed wording of items, descriptives for each factor and its corresponding items are given in Table A1 in the Appendix.

Collective efficacy was measured as a two-component construct differentiating between social cohesion and task-specific efficacy beliefs. *Social cohesion* was operationalised as a 5-item measure adopted from Grootaert et al. (2004) and Wang et al. (2014), designed to capture the general trust and cohesion of a community. Responses could be given on a 5-step response scale ranging from +2 to −2 (e.g. 'most people can be trusted' – 'you can't be too careful when dealing with others'). *Task-specific efficacy beliefs* were differentiated between those relating to tasks provided by the whole community and those provided by hypothetical citizen groups. General expectations about receiving social support by community members were measured with three items (e.g. 'In a natural hazard event, I can count on support by others'; Seebauer and Babcicky 2018). Citizen groups similar to flood action groups do not (yet) exist in the study region; therefore, detailed descriptions of two hypothetical types of citizen groups were provided (see Table A2 in the Appendix): *preventive* (conducting emergency exercises, clearing debris from streams, maintaining stocks of stored hazard defence materials) and *participatory* (taking an active role in decision-making for natural hazard protection together with the authorities). The expected efficacy of these groups' actions was measured by three items each (e.g. 'Collective action in a [preventive/participatory] citizen group would improve natural hazard protection'; van Zomeren, Saguy, and Schellhaas 2013).

Risk perception was measured as a combination of perceived probability and severity of a potential natural disaster (Grothmann and Reusswig 2006), both for the respondent's property (household level) and the entire municipality (community level). Probability and severity were measured on a 10-step response scale, ranging from very likely (10) to very unlikely (1) and very high (10) to none (1) respectively.

Fear captures the affective aspect of risk (Terpstra 2011), in the sense of worrying about or being afraid of natural hazards. Fear was measured by two items (e.g. 'I am very worried about the potential threat of natural hazards').

Self-efficacy was operationalised as a person's perceived ability to take protective action (Bubeck et al. 2013), measured by three items (e.g. 'I am capable of protecting myself from natural hazards').

Socio-demographic control variables. Gender, age, income, disaster experience and risk zone are included as control variables in the regression models. The summary statistics for these variables are given in Table A3 in the Appendix.

4.3. Results and discussion

First, we test for discriminant validity by assessing the intercorrelations between the collective efficacy components: (1) social cohesion, and task-specific efficacy beliefs subdivided into (2) social support, (3) preventive group efficacy and (4) participatory group efficacy. We find between no and relatively weak bivariate correlations between social cohesion and the three task-specific efficacy beliefs (Table 1). The strongest correlation is found between social cohesion

Table 1. Intercorrelations between collective efficacy measures in the Main Study.

	Social cohesion	Social support	Preventive group efficacy	Participatory group efficacy	Group efficacy
Social cohesion	–	.349**	−.125	−.062	−.097
Social support		–	.196**	.154*	.189**
Preventive group efficacy			–	.772**	.940**
Participatory group efficacy				–	.943**

Pearson correlations; *$p < .10$; **$p < .05$; Group efficacy: composite index combining preventive and participatory group efficacy.

Table 2. Regression results of the Main Study.

	Risk perception	Fear	Self-efficacy
Age	−.181**	−.141*	−.039
Gender (0 = female, 1 = male)	.071	.112	.149*
Income	.116	−.089	.164*
Risk zone (0 = no, 1 = yes)	.165**	.115*	−.069
Disaster experience (0 = no, 1 = yes)	.192**	−.010	.145*
Social cohesion	−.183**	−.181**	−.014
Social support	−.130	−.064	.210*
Group efficacy	.156*	.246*	.059
adj. R2	.177	.127	.095
n	154	154	154

Standardised beta coefficients: *$p < .10$; **$p < .05$.

and social support ($r = .349$). No significant association is evident between social cohesion and efficacy belief in preventive or participatory groups. These low correlations indicate that social cohesion and task-specific beliefs are distinct from each other and need to be measured separately (Hipp 2016). Among the three task-specific measures, we find weak correlations ($r = .154$–$.196$) between social support and preventive/participatory group efficacy. The high correlation between preventive and participatory group efficacy ($r = .772$) however, suggests that respondents do not distinguish between these two types of citizen groups. Due to this poor discriminant validity and to avoid multi-collinearity in the subsequent analyses, we aggregate the two measures into the composite index *group efficacy*, which shows excellent internal consistency (Cronbach's $\alpha = .91$) and low correlations with social cohesion ($r = -.097$) and social support ($r = .189$).

The main goal of this study is to determine the effect of collective efficacy on risk and coping beliefs. To this end, risk perception, fear and self-efficacy are regressed on the components of collective efficacy and a set of socio-demographic control variables. All regression results are given in Table 2. The total set of predictors explains between 10 and 18% of the variance, depending on the predicted variable.

The regression coefficients indicate that the three components of collective efficacy significantly influence risk perception, fear and self-efficacy, but that the direction and strength of their influences vary. Social cohesion, the general trust component of collective efficacy, decreases risk perception and fear but is unrelated to self-efficacy. Possibly, a strong sense of belonging to a community reduces concern about impending danger from natural hazards. The task-specific efficacy belief in the provision of social support is unrelated to risk perception and fear but increases self-efficacy. This implies that households holding stronger expectations about receiving support during a disaster feel more capable of taking measures to reduce disaster risks at their own properties. Group efficacy has no effect on self-efficacy but a positive impact on risk perception and fear. Households who believe that a citizen group can effectively reduce the vulnerability of a community, judge flood risk higher and are more afraid of flooding. According to the PMT, both risk perception and self-efficacy need to be high for households to take action. Our results suggest that this can be achieved through a combination of high group efficacy (which increases risk perception and fear) and social support (which increases self-efficacy). Note, though, that the effects of social support and group efficacy are only marginally significant ($p < .10$).

The effects of the socio-demographic control variables resonate with previous findings (e.g. Babcicky and Seebauer 2017). Age decreases risk perception and fear; being male and having a higher income increase self-efficacy. Living in a risk zone leads to higher risk perception and fear, and disaster experience is associated with higher levels of risk perception and self-efficacy.

5. Validation study

5.1. Data

The first wave of the Validation Study was conducted between October 2014 and February 2015 in 10 flood-prone municipalities in Austria. The sample in the first wave (t1) contains 2,008 households, corresponding to a response rate of 13%. About 1.5 years (two early summer flood seasons) later, those households who had agreed to participate in a follow-up survey and had provided valid address data were contacted for the second wave (t2); 65% complied, yielding a longitudinal sample of 554 cases. At t1, questionnaires were distributed as inserts in municipal newspapers and also made available online. At t2, the panel households received a postal questionnaire and a single reminder postcard, or a link to an identical online questionnaire and two reminder emails. In both waves, respondents were invited to participate in a lottery for gift vouchers.

Table A5 (see Appendix) indicates that the t1 sample characteristics are largely in line with the population data. Male, older and medium-income respondents are slightly overrepresented. Lustenau is the largest municipality surveyed and therefore represents about 65% and 63% of the total sample at t1 and t2, respectively. Overrepresentation of male and older respondents slightly increased in t2, but the income distribution better conforms to the population data. Overall, the sample composition appears to be fairly stable over time, and systematic drop-outs could not be detected.

5.2. Measures

All measures used in the Validation Study were identical with the measures of the Main Study, except that the items used in the Validation Study refer to ‘flood risk’ instead of ‘natural hazard’. Wording and descriptives of all items used in t1 and t2 are given in Table A4 in the Appendix. Since the Validation Study was not designed for the explicit purpose of studying collective efficacy, the data only include one task-specific efficacy belief: expectation of receiving social support during a disaster. Self-efficacy was only measured at t2.

5.3. Results and discussion

In the first analytical step, we assess the temporal stability of all variables from t1 to t2 (Table 3). Age, gender and income exhibit high temporal stability (up to $r = .984$), which confirms that in almost all households the same person completed the questionnaire at t1 and t2 and that financial resources for individual preparedness remained (largely) unchanged. Risk zone is only moderately stable, possibly because the t1 questionnaire had encouraged some surveyed

Table 3. Stability of t1 and t2 measures in the Validation Study.

	Age	Gender	Income	Risk zone	Flood experience	Risk perception	Fear	Social support
Pearson correlation t1–t2	.984**	.917**	.745**	.436**	.256**	.587**	.705**	.635**

*$p < .10$; **$p < .05$.

Table 4. Regression results of the Validation Study.

	Risk perception	Fear	Self-efficacy
Age	−.206***	−.005	.015
Gender (0 = female, 1 = male)	.019	−.054	.074
Income	.006	.023	.108**
Risk zone (0 = no, 1 = yes)	.130**	.130**	.113**
Disaster experience (0 = no, 1 = yes)	.172***	.260***	.130**
Social support	−.177***	−.190***	.297***
Adjusted R2	.108	.131	.125
N	345	347	339

Standardised beta coefficients: *p < .10; **p < .05; ***p < .01; all predictor variables measured at t1; all dependent variables measured at t2; sample size varies due to missing values.

participants to look up their objective risk; in addition, in some of the surveyed municipalities, the public risk maps might have been revised as a consequence of the national implementation of the European Floods Directive (EU 2007). The stability of flood experience is relatively low because flood experience at t1 referred to any prior flood experience, but at t2 this item referred to the short time span of 1.5 years since t1. The stabilities of risk perception, fear and social support are moderate to high (r = .587 to .705).

As the temporal sequence of causes preceding effects is considered a precondition for causality, the two-wave longitudinal design of the Validation Study allows us to validate the direction of causal effects on social support. The three multiple regression models from the Main Study are replicated by using predictors measured at t1 to explain the three dependent variables of risk perception, fear and self-efficacy measured at t2. As shown in Table 4, the three models explain between 11 and 13% of the variance, a slight decrease compared to the Main Study; this may be attributed to the smaller number of collective efficacy predictors.

The task-specific efficacy belief in social support during a flood event decreases risk perception and fear and increases self-efficacy. This confirms the effects of social support found in the Main Study, where social support shows negative (but not significant) coefficients on risk perception and fear and a significant positive effect on self-efficacy.

The results related to our socio-demographic control variables are largely consistent with the Main Study findings. However, the effects of age on fear and gender on self-efficacy could not be reproduced. As the larger sample in the Validation Study leads to lower significance levels p, risk zone and disaster experience now also influence self-efficacy. The effect of flood experience on fear might be traced back to increased salience of biographical experiences after completing the t1 questionnaire.

6. General discussion and conclusion

The goal of this paper has been to introduce the concept of collective efficacy to disaster risk perception research and to demonstrate its capability to explain risk and coping beliefs as key antecedents of preparedness for natural hazards. From a collective efficacy perspective, the general availability of social resources—commonly referred to as social capital—does not suffice to promote individual risk reduction; in addition, to activate these resources, it also requires perceived joint ability to carry out collective action. Consequently, collective efficacy unites two components: social cohesion (i.e. trust and solidarity) as the foundation for collective action, and efficacy beliefs relating to specific tasks where social resources are converted into action.

Our results on discriminant validity confirm that these two components are indeed distinct from each other, and that task-specific efficacy beliefs can be further broken down into social support and citizen group action. What is striking is that these collective efficacy components have differing impacts on risk and coping beliefs: risk perception and fear are lowered by social cohesion, but are increased by efficacy belief in citizen groups engaged in preventive and participatory action. Social cohesion and group efficacy do not increase self-efficacy, but belief in social support does. Given that the effects of group efficacy are only marginally significant ($p < .10$), interpretations need to be made with caution. Future studies are needed to confirm these effects based on larger samples.

As its effects on risk and coping beliefs are not uniform, collective efficacy and, by extension, the related concept of social capital, should not be treated as an overarching umbrella factor. Instead, when aiming to capture the readiness of communities to engage in collective action, risk researchers and risk managers should define precisely the context and the specific tasks of the collective action they want to address. Possibly, findings in previous studies about weak or inconsistent effects of social capital have been obscured by a lack of context- and task-specific operationalisation.

In this study, we conceptualised social cohesion as a component of collective efficacy vis-à-vis beliefs specific to a particular task. An alternative approach would be to consider social cohesion an antecedent of the task-specific component; this seems plausible against the view that social cohesion is a resource potential and collective efficacy is the ability to draw on this resource (Drakulich 2014; Zaccaro et al. 1995). Methodologically, this translates into a causal chain from social cohesion to task-specific efficacy beliefs to risk and coping beliefs. This alternative approach has been used in the context of informal social control (Collins, Neal, and Neal 2017; Gau 2014) and merits investigation in the natural hazards context; an empirical confirmation of the assumed causal chain requires longitudinal or experimental data, though.

The acknowledgement that social resources are specific to the tasks for which they are employed has critical implications for tailored practices in natural hazard management. Residents with high levels of trust in their community perceive themselves to be at lower risk and therefore may have weaker intentions to prepare for a natural disaster. In a situation of high objective disaster risk, perceiving low risk may lead to a false sense of safety among residents, as discussed in Babcicky and Seebauer (2017). To prevent such an undesired consequence, social cohesion should instead be channelled into hazard-specific collective actions, since the task-specific components of collective efficacy do not seem to bear the risk of counterproductive effects. Belief in social support and in effective citizen group action has the potential to empower residents by making them feel more capable of protecting themselves against natural hazards. If residents believe that they can tackle local risk issues effectively by joining preventive or participatory citizen groups, they tend to be more aware about natural hazards. Here, collective efficacy beliefs may spill over to the individual level, encouraging as well as empowering residents to take risk-reducing actions. Social support and group efficacy together may increase risk perception as well as self-efficacy; this combination is regarded as a pre-condition for protective behaviour (Grothmann and Reusswig 2006).

Collective efficacy emerges not just from the way a group is perceived by its (potential) members but may also be purposefully directed by the way the group presents itself in public discourse. To instil belief in its capabilities and to attract additional members, a citizen group might actively market its mission and successes, in a similar way to the public relations activities that businesses undertake in the commercial sector. However, the marketed objectives a group claims to be able to achieve need to be realistic; otherwise, the group's efficacy could be questioned, or the group may even be distrusted by the community. Citizen groups could, therefore, be advised to appoint a group head or spokesperson who is experienced in communicating with different audiences through various media, such as speaking at public meetings, writing newspaper articles or participating in (online) debates.

An important limitation of the present study, which at the same time provides a new avenue for future research, pertains to our group efficacy measures that refer to hypothetical citizen groups. Although the questionnaire included detailed descriptions about the activities these groups would carry out, evaluating the efficacy of non-existing groups requires substantial mental effort from survey respondents to imagine what such a group could look like and how it would perform. This may also be one reason why respondents hardly distinguish between preventive and participatory group efficacy, which is evident from the high correlation between the two measures. We would therefore welcome future studies to analyse collective efficacy in real-life examples of citizen action groups. Comparing groups that differ with respect to their history, mission or performance in disaster risk reduction could offer a deeper understanding of how citizens weigh these aspects when assessing group efficacy and when translating group efficacy into personal risk and coping attitudes. Measuring collective efficacy is in itself a challenging task, however. Collective efficacy is a group-level attribute; if reported by group members (as suggested by Bandura 1997 and Drakulich 2014, and as implemented in the present study), those group members may draw on partial or biased experiences of the group's performance, or infer the group's capability from their personal capability. Instead of aggregating the individual perceptions of group members of their joint efficacy, alternative approaches could take into consideration the coordination and interaction dynamics that characterise group settings.

Finally, this paper addressed only three selected factors that impact protection motivation: risk perception, fear and self-efficacy. The effect of collective efficacy, however, is likely to reach beyond these factors. Future studies might, therefore, focus on other drivers of (or barriers to) disaster preparedness, such as non-protective responses (e.g. denial, fatalism, wishful thinking) or the response efficacy of specific risk-reducing measures. Finally, and perhaps most interestingly, future work could embed collective efficacy as an explanatory factor in the full PMT framework to determine whether or not its indirect effects on protective action remain intact. Overall, answers to these questions could help generate a more complete picture of the role that collective efficacy plays in natural hazard preparedness.

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ORCID

Philipp Babcicky http://orcid.org/0000-0002-5616-4958
Sebastian Seebauer http://orcid.org/0000-0003-4592-9529

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Online Appendix

Table A1. Item wordings, descriptives and internal consistency of measures in the Main Study.

Factor	Item	Response scale	*N*	Mean	SD	α
Social cohesion	Generally speaking, in my hometown, …					.83
	… most people can be trusted / … you can't be too careful when dealing with others	+2 = positive statement /−2 = negative statement	213	0.55	1.18	
	… most people try to be fair / … most people take advantage of others if they get the chance		213	0.30	1.16	
	… many people are engaged in formal associations or churches / … only a few people are engaged		213	0.83	1.19	
	… people try to make the town a better place to live / … people hardly bother about the town		215	0.55	1.08	
	… people care for each other / … people primarily consider their own needs		214	0.04	1.21	
Social support	In a natural hazard event, I can count on support by others.	Five-step, 5 = fully agree	215	3.82	1.05	.80
	Many people would help me during a natural hazard event.		215	3.80	0.96	
	In a natural hazard event, many people would stand by me.		211	3.87	0.89	
Preventive group efficacy	Collective action in a preventive citizen group would improve natural hazard protection.	Five-step, 5 = fully agree	207	3.88	0.82	.83
	Through collective efforts, a preventive citizen group would achieve progress in natural hazard protection.		205	3.67	0.93	
	A preventive citizen group would improve natural hazard protection, even if it meets resistance or difficulties.		204	3.78	0.89	
Participatory group efficacy	Collective action in a participatory citizen group would improve natural hazard protection.	Five-step, 5 = fully agree	203	3.75	0.85	.86
	Through collective efforts, a participatory citizen group would achieve progress in natural hazard protection.		200	3.60	0.90	
	A participatory citizen group would improve natural hazard protection, even if it meets resistance or difficulties.		201	3.68	0.98	
Group efficacy	[composite index of all preventive and participatory group efficacy items]	–	–	–	–	.91
Risk perception	How likely do you consider a severe natural hazard event to occur at your building within the next ten years?	Ten-step, 10 = very likely	196	2.83	2.03	.85
	How likely do you consider a severe natural hazard event to occur in your municipality within the next ten years?		211	5.26	2.65	
	What level of damage do you expect, if a severe natural hazard event occurs at your building?	Ten-step, 10 = very high	192	2.93	2.12	
	What level of damage do you expect, if a severe natural hazard event occurs in your municipality?		207	4.82	2.29	
Fear	I am afraid of natural hazards.	Five-step, 5 = fully agree	216	2.80	1.30	.77
	I am very worried about the potential threat of natural hazards.		214	2.85	1.26	
Self-efficacy	My knowledge and skills suffice to implement natural hazard protection by myself.	Five-step, 5 = fully agree	216	2.87	1.18	.69
	I can set up natural hazard protection on my own, even if it is costly and difficult.		214	2.83	1.16	
	I am capable of protecting myself from natural hazards.		211	2.71	1.12	

N = number of cases; SD = Standard deviation; α = Cronbach's Alpha; all original items were in German and translated for this paper.

Table A2. Descriptions of preventive and participatory citizen groups used in the Main Study questionnaire.

Type of citizen group	Description used in the questionnaire
Preventive	Group members prepare jointly for a potential natural disaster. They organise machinery and equipment and practise for emergency situations. The citizen group monitors local slopes and streams, clears debris from waterways and alerts residents to imminent hazards.
Participatory	Group members jointly represent their needs to authorities and officials. They participate in assigning risk zones and in planning built protection. The citizen group acquires specialised knowledge, gets involved in negotiations and engages in media relations to ensure that residents get heard.

Table A3. Socio-demographics of sample and population in the Main Study.

	Gender	Age (years)					Monthly net household income (€)						Disaster experience	Risk zone
	Female	20–34	35–49	50–64	65–79	≥80	<1,200	1,200–1,799	1,800–2,899	2,900–4,399	4,400–6,000	>6,000	Yes	Yes
Sample	33%	7%	21%	36%	31%	5%	8%	21%	35%	21%	13%	2%	43%	20%
Population	50%	22%	25%	28%	17%	8%	~25%		~25%	~25%	~25%		n.a.	n.a.

Population data refer to the Province of Tyrol (Statistics Austria 2017, 2018); income categories of population data refer roughly to quartiles of the Austrian income distribution; risk zone = flood return period of 300 years or less, or yellow/red risk zone; risk zone was coded '0' if respondent answered with 'no' or 'don't know'; prior analysis, income was converted into a metric scale using the respective category midpoints.

Table A4. Item wordings, descriptives and internal consistency of measures in the Validation Study.

Factor	Item	Response scale	t1				t2			
			N	Mean	SD	α	*N*	Mean	SD	α
Social support	In a flood event, I can count on support by others.	Five-step, 5 =	1,901	3.92	1.00	.83	510	3.51	0.99	.88
	Many people would help me during a flood.	fully agree	1,931	3.3	1.03		540	3.43	1.03	
	In a flood event, many people would stand by me.		1,860	3.35	1.01		543	3.58	1.04	
Risk perception	How likely do you consider a severe flood to occur at your building within the next ten years?	Ten-step, 10 = very likely	1,934	4.22	2.76	.83	539	4.52	2.79	.81
	How likely do you consider a severe flood to occur in your municipality within the next ten years?		1,977	5.41	2.77		545	5.62	2.66	
	What level of damage do you expect, if a severe flood occurs at your building?	Ten-step, 10 =	1,894	5.96	3.01		540	6.38	2.89	
	What level of damage do you expect, if a severe flood occurs in your municipality?	very high	1,937	6.54	2.63		544	7.13	2.55	
Fear	I am afraid of a potential flood.	Five-step,	1,951	3.17	1.33	.87	542	2.85	1.29	.86
	I am very worried about the potential threat of flooding.	5 = fully agree	1,867	3.14	1.24		546	2.82	1.26	
Self-efficacy	I can count on my knowledge and skills, even if I am planning to implement difficult flood protection measures.	Five-step, 5 = fully agree	n.a.	n.a.	n.a.	n.a.	525	2.86	1.16	.68
	I can solve problems regarding my flood protection by myself.		n.a.	n.a.	n.a.		520	2.52	1.09	
	I am able to take on activities regarding my flood protection, even if they are stressful and difficult.		n.a.	n.a.	n.a.		509	2.98	1.06	

N = number of cases; SD = Standard deviation; α = Cronbach's Alpha; t1 = assessed in first survey wave; t2 = assessed in second survey wave; all original items were in German and translated for this paper.

Table A5. Socio-demographics of sample and population in the Validation Study.

Municipality		Percentage of total sample	Gender	Age (years)					Monthly net household income (€)						Flood experience	Risk zone
			Female	20–34	35–49	50–64	65–79	≥80	<1,100	1,100–1599	1,600–2599	2,600–3999	4,000–5500	>5,500	Yes	Yes
Eisenerz	S t1	3.1%	40%	9%	17%	31%	39%	5%	11%	30%	39%	11%	2%	7%	18%	25%
	S t2	2.0%	0%	0%	10%	20%	60%	10%	0%	14%	29%	57%	0%	0%	9%	44%
	P	n.a.	53%	12%	18%	27%	29%	14%	7%	14%	21%	34%	17%	7%	n.a.	10–30%
Fernitz	S t1	2.2%	25%	11%	46%	27%	16%	0%	10%	10%	17%	43%	17%	3%	63%	23%
	S t2	2.5%	36%	7%	57%	21%	14%	0%	8%	15%	39%	31%	8%	0%	21%	36%
	P	n.a.	52%	22%	30%	28%	14%	6%	7%	14%	21%	34%	17%	7%	n.a.	10–30%
Gosdorf	S t1	3.7%	51%	6%	30%	36%	20%	7%	14%	32%	36%	16%	2%	0%	49%	28%
	S t2	3.2%	41%	0%	29%	29%	29%	12%	31%	39%	15%	15%	0%	0%	12%	33%
	P	n.a.	50%	20%	28%	27%	18%	6%	7%	14%	21%	34%	17%	7%	n.a.	10–30%
Gössendorf	S t1	7.6%	34%	13%	37%	32%	17%	1%	1%	17%	37%	32%	10%	4%	68%	44%
	S t2	9.4%	39%	13%	24%	31%	29%	2%	0%	8%	27%	43%	19%	3%	12%	48%
	P	n.a.	51%	22%	32%	25%	15%	6%	7%	14%	21%	34%	17%	7%	n.a.	0–10%
Hatzendorf	S t1	2.9%	29%	18%	32%	32%	18%	0%	13%	27%	31%	22%	4%	2%	50%	22%
	S t2	3.1%	40%	13%	25%	38%	25%	0%	15%	15%	39%	23%	8%	0%	0%	44%
	P	n.a.	50%	23%	28%	27%	16%	6%	7%	14%	21%	34%	17%	7%	n.a.	0–10%
Mooskirchen	S t1	2.5%	54%	17%	28%	37%	17%	0%	13%	10%	43%	20%	13%	0%	48%	22%
	S t2	2.7%	43%	14%	21%	21%	36%	7%	0%	38%	38%	13%	0%	13%	13%	46%
	P	n.a.	51%	23%	29%	26%	14%	7%	7%	14%	21%	34%	17%	7%	n.a.	10–30%
Radmer	S t1	1.7%	46%	6%	27%	36%	18%	12%	12%	54%	19%	12%	4%	0%	61%	42%
	S t2	2.2%	58%	0%	17%	67%	0%	17%	9%	64%	27%	0%	0%	0%	8%	64%
	P	n.a.	50%	13%	22%	29%	23%	13%	7%	14%	21%	34%	17%	7%	n.a.	10–30%
Lustenau	S t1	65.0%	34%	12%	25%	29%	26%	8%	6%	15%	38%	29%	9%	3%	15%	16%
	S t2	62.8%	24%	9%	25%	28%	31%	7%	3%	14%	25%	38%	14%	6%	1%	32%
	P	n.a.	51%	27%	29%	24%	16%	5%	8%	10%	36%	31%	8%	7%	n.a.	0–10%
Mellau	S t1	3.1%	38%	8%	28%	34%	18%	12%	4%	20%	41%	26%	7%	2%	59%	20%
	S t2	3.2%	22%	11%	22%	17%	44%	6%	0%	19%	31%	31%	19%	0%	0%	29%
	P	n.a.	49%	26%	28%	24%	15%	6%	3%	9%	24%	35%	22%	7%	n.a.	0–10%
Nenzing	S t1	8.2%	29%	7%	34%	32%	26%	2%	6%	17%	33%	33%	9%	3%	34%	10%
	S t2	8.8%	31%	7%	21%	29%	36%	7%	6%	18%	24%	30%	18%	3%	2%	15%
	P	n.a.	50%	24%	30%	25%	16%	5%	3%	9%	24%	35%	22%	7%	n.a.	10–30%
All regions	S t1	100%	34%	11%	27%	31%	24%	6%	6%	18%	36%	28%	8%	3%	26%	20%
	S t2	100%	29%	9%	25%	29%	31%	6%	5%	17%	27%	35%	13%	4%	4%	34%
	P	n.a.	51%	23%	28%	25%	17%	6%	7%	12%	28%	33%	14%	7%	n.a.	n.a.

Number of cases: $N = 2{,}007$ (at time 1), $N = 554$ (at time 2); S t1 = sample data at first survey wave; S t2 = sample data at second survey wave; P = population data (at t1); risk zone = flood return period of 300 years or less, or yellow/red risk zone; risk zone was coded '0' if respondent answered with 'no' or 'don't know'; flood experience at t2 relates to the occurrence of a flood since t1; gender and age data: Statistics Austria (2014); household income data: Statistics Austria (2009); risk zone data: HORA (2015); percentages may not total 100 due to rounding.

Online Appendix References

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