THE RELATIONSHIP OF PSYCHOLOGICAL SAFETY WITH SAFETY-RELEVANT AND RISK-TAKING BEHAVIOR

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presented by
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The Relationship of Psychological Safety with Safety-Relevant and Risk-Taking Behavior

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Acknowledgements

Working on this dissertation, the research projects it is based on, and everything that comes with it, was a big undertaking. It is no surprise then that it feels like I did not work on it alone. Therefore, I want to acknowledge the help and support that I received along my way—although the brevity of it will never do it justice.

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Summary

Psychological safety—a climate where individuals feel safe to be themselves, make mistakes, and ask questions—has received growing attention in research over the last 30 years. Studies have demonstrated psychological safety’s beneficial effects in teams and organizations: It is positively related to learning behavior, speaking up, voice, and performance. However, to date, there is only little theorizing on the mechanisms of action of the construct. For instance, it is not clear how exactly psychological safety affects individual behaviors. In this dissertation, I present three scientific papers in which I investigated psychological safety in order to deepen the understanding of the construct, its general effect on individual behavior, and its relationship with safety-relevant and risk-taking behavior specifically.

To this end, I conducted five studies in total. The study in the first paper was conducted in three Swiss rehabilitation centers. It evolved around psychological safety’s role with regard to coordination and communication in interprofessional healthcare teams. Together with my co-authors, I found that a shared professional language was positively connected to safety-relevant behavior in the form of perceived quality of care. Moreover, this relationship was serially mediated by relational coordination and psychological safety.
The second and third paper evolved around the role of psychological safety in the prediction of individual behavior. Based on the reasoned action model, I developed a theory-driven model explicating psychological safety’s mechanisms of action. In the second paper, I conducted a field study in a Swiss hospital and used the developed model to predict physicians’ seasonal influenza vaccination behavior. We found that psychological safety strengthened the effect of physicians’ attitude toward getting vaccinated on their intention and, subsequently, their likelihood to get vaccinated.

In the third paper, I used the model developed in the second paper to predict participants’ risk-taking behavior in an online quiz game. In three consecutive experiments, I manipulated participants’ attitude toward risk taking, their perceived team norm on risk taking as well as their psychological safety within the team to test these factors’ combined effects on participants’ intended or actual risk taking in the game. The results showed that psychological safety mainly weakened the effect of participants’ attitudes on their (intended) risk-taking behavior.

The findings of this dissertation provide novel insights into how psychological safety is related to safety-relevant and risk-taking behavior and the interpersonal climate’s mechanism of action with regard to individual behavior. The newly developed, theory-driven model enables to consider psychological safety’s effect on different kinds of individual behaviors—also potential detrimental behaviors that might be facilitated if psychological safety is enhanced.
Zusammenfassung


Um diese Fragestellung zu untersuchen, habe ich insgesamt fünf Studien durchgeführt. Die Studie im ersten Artikel wurde in drei Schweizer Rehabilitationszentren durchgeführt. Im Fokus stand dabei, welche Rolle die psychologische Sicherheit für die Koordination und Kommunikation innerhalb interdisziplinärer Teams in der Gesundheitsversorgung spielt. Es zeigte sich, dass eine gemeinsame berufliche Sprache positiv mit sicherheitsrelevantem Verhalten in Form von wahrgenommener Qualität der Pflege zusam-
menhing. Zudem fanden wir, dass dieser Zusammenhang durch interdisziplinäre Koordination und psychologische Sicherheit seriell mediiert wurde.


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Part One
1 | Introduction

The way employees work in organizations has changed drastically over the past decades. Individual, independent work used to be predominant, but interdependent work in teams has increased tremendously since the 1980s (Kozlowski, 2018). While the modes of working transformed, so did the corresponding research. Many of the early research on teams was carried out in the field of social psychology, but with increasing importance of teams in the workplace, organizational psychology and other related fields took an ever greater interest in the subject (Kozlowski, 2018; Mathieu, Hollenbeck, van Knippenberg, & Ilgen, 2017). Fittingly, Levine and Moreland (1990, p. 620) remarked in their review on progress in small group research that “the torch has been passed” on from social to organizational psychology. At the core, this new team research has focused on what factors influence team effectiveness (Mathieu et al., 2017). Looking at the research of the last 30 years, psychological safety proved to be one of those factors (Frazier, Fainsmidt, Klinger, Pezeshkan, & Vracheva, 2017).

Psychological safety is an interpersonal climate which essentially renders individuals feel comfortable to be who they are and safe to engage in interpersonally risky behaviors that challenge the status quo (Edmondson, 1999; Kahn, 1990). The climate has been found to facilitate a number of beneficial behaviors such as speaking up or voice (Bienefeld & Grote, 2014; Detert & Burris, 2007; Liang, Farh, & Farh, 2012), learning behaviors in teams
(e.g., Carmeli & Gittell, 2009; Edmondson, 1999; Liu, Hu, Li, Wang, & Lin, 2014), and also team performance (Kessel, Kratzer, & Schultz, 2012; Schaubroeck, Lam, & Peng, 2011). Although research on psychological safety has increased over the last years, still more research is required to better understand the construct and its theoretical and practical implications. Especially, there is little theorizing in the literature on the process of how psychological safety affects the behavior of the individual members within a team or organization. It is important to get more insights into how psychological safety influences individuals in order to be able to harvest the beneficial effects of psychological safety, without risking potential detrimental effects (Newman, Donohue, & Eva, 2017).

In this dissertation, I investigate psychological safety in different roles, contexts, and samples in order to generate more knowledge on the workings of the construct. My focus lies on the relationship of psychological safety with safety-relevant and risk-taking behavior of individuals in a social environment. This cumulative dissertation includes three scientific papers. In the first paper, I look at the rehabilitation context where healthcare workers with different professions work together. Interprofessional teams consist of members with different educational backgrounds, who therefore developed different perspectives and speak different professional languages (Frank, 1961; Hall, 2005). I investigate how the use of a shared professional language in interprofessional teams is associated with coordination and psychological safety within the team and how psychological safety relates to the perceived quality of care provided to patients. In this paper, psychological safety acts as a critical mediator between shared language, relational coordination among different professions, and a safety-relevant outcome.

In the second and third scientific paper, I investigate psychological safety’s role when it comes to predicting individual behavior that is performed in a team context. Based on previous
empirical and theoretical work in social psychology, I suggest a theoretical model on how psychological safety can exert an effect on individuals’ behaviors. In the proposed model, psychological safety takes on a moderating role and strengthens or weakens the effects of individual attitudes and perceived norms on individual behavior through intention. The model allows for psychological safety to predict beneficial as well as detrimental behavior—to date, the latter has been largely neglected in the literature on psychological safety (Newman et al., 2017). The model is tested in the field and in an experimental setting and applied to safety-relevant as well as risk-taking behavior. In the second paper, I test the model in the medical context with physicians’ influenza vaccination behavior as the focal individual behavior. In the third paper, I further scrutinize the model by conducting three consecutive experimental studies on task-related risk taking in order to get closer to the causal workings of psychological safety.

With the studies conducted in this dissertation, I aim to contribute to a deeper understanding of psychological safety. The studies explore new potential antecedents and consequences of psychological safety, and generate important insights into its role with regard to safety-relevant and risk-taking behavior. Further, with my scientific papers, I aim to contribute to the theoretical foundation of psychological safety by suggesting a model on the process underlying psychological safety’s contextual influence on individual behavior. The model enables a new perspective on psychological safety, which will hopefully encourage new research, and will also allow looking at previous findings in a new light.

Because of the practical relevance of psychological safety as a construct, and also due to the applied nature of my field studies, this dissertation and its findings also have implications for practice. The insights gained in my studies may show practitioners new possibilities how to promote psychological safety in their teams. The findings may also disclose critical aspects that need to be considered when enhancing psychological safety in order not to
accidentally promote behaviors that are not in line with organizational norms, goals, or values. This will be especially important for teams and organizations in which risk and safety behaviors are critical.

This dissertation consists of two parts. The first part will serve to outline, summarize, and integrate the three scientific papers that I developed during my doctorate, while the second part will include the full versions of the papers. In the following, I will first define and explain the concepts and theories that are most central to the papers, and give an overview of the existent empirical work on psychological safety. Based on this background, I will formulate the core research aims of this dissertation. Second, I will outline the research methods and statistical analyses that I employed in the studies that were conducted. Third, I will summarize the three scientific papers that I wrote for this dissertation. Fourth, I will interpret my findings, discuss their implications for theory and practice as well as limitations of the studies and I will reflect on possible paths for future research. The final part of the dissertation will include the complete version of the three scientific papers that I wrote as first author.
2 | Theoretical and Empirical Background

In this chapter, I will introduce the theoretical and empirical background, which serves as a basis for this dissertation and the scientific papers. First, I will elaborate on the concept of psychological safety and depict how the construct is defined and described in the literature. Second, I will provide a concise review of relevant empirical research that has been conducted on psychological safety thus far. Third, I will define safety, safety-relevant behavior and risk taking for this dissertation. Fourth, I will introduce into the reasoned action model, which will serve as a theoretical foundation for two of my three scientific papers as well as for my theorizing on psychological safety’s mechanisms of action. Fifth, I will present the research aims of this dissertation, give an overview of the three scientific papers, and explain how they integrate into an overall research model.

2.1 The Concept of Psychological Safety

The origin of the concept of psychological safety is attributed to Schein and Bennis (1965) who described psychological safety as an atmosphere or culture, in which individuals feel safe to experiment
and take chances without fear of experiencing retaliation for failures. This initial description has been further developed in newer work, where psychological safety has been defined as a context or climate in which individuals feel safe to be themselves (Kahn, 1990) and to engage in interpersonally risky behaviors (Edmondson, 1999). In all definitions, an important consideration is the expectation of others’ reactions. Psychological safety coincides with a “sense of confidence that the team will not embarrass, reject, or punish someone” (Edmondson, 1999, p. 354) for behaviors such as asking questions, admitting mistakes, or asking for help. These are all behaviors which contain an interpersonal risk for the individual to be regarded as ignorant, incompetent, negative, or disruptive (Edmondson, 2003). In psychologically safe teams, these worries are alleviated. Interpersonally risky behaviors allow individuals to reflect on their work and improve on it, which is why psychological safety is deemed especially important for learning in teams and organizations.

Different wordings in the definitions already suggest that psychological safety can be conceptualized on different levels. Kahn’s definition concentrates on the individual level by stating that psychological safety is “experienced as feeling able to show and employ one’s self” (1990, p. 708). The individual and his or her experience lies in the focus of the definition, but the author notes that it is a given context—for example, a group or an organization—which makes individuals feel safe or not. In Edmondson’s definition, the focus lies on the team level when she writes, “team psychological safety is defined as a shared belief that the team is safe for interpersonal risk taking” (1999, p. 354). Finally, Baer und Frese extend the concept to the organizational level and state that an organizational psychological safety climate refers to “a work environment where employees are safe to speak up without being rejected or punished” (2003, p. 50). Clearly, these definitions share a lot of similarities and should not be regarded as competing or even opposite. On the contrary, they all tap into the same phenomenon—a
feeling or experience of being safe to be oneself and act without fear of receiving negative reactions. What varies, is the context and the level of measurement. The whole body of work on the construct suggests that psychological safety can develop and exist in any form of social group—starting from a dyad of individuals and going up to large organizations. While it is the individual who experiences psychological safety, the construct can also be measured on a team and organizational level.

2.2 Empirical Work on Psychological Safety

In the last 30 years, a considerable amount of studies has investigated psychological safety, its antecedents and consequences on the individual, team, and organizational level (see Edmondson & Lei, 2014; Frazier et al., 2017; Newman et al., 2017). In the following, I will give a brief overview of the empirical work that has been conducted on psychological safety thus far. The overview is based on the systematic literature review by Newman et al. (2017), complemented by newer research that has been conducted after the review was released. The authors have grouped empirical findings under broader headings, which I will use as categories in my overview. To give a concise recount of the extensive research, I will concentrate on the categories that include the most studies and name a few example studies to illustrate each category. Accompanying the brief review in text, Table 2.1 depicts a broader overview of the literature, including all categories and additional example studies.

2.2.1 Antecedents of Psychological Safety

A number of studies have examined factors that predict psychological safety. These factors can be broadly grouped into supportive leadership behaviors, supportive organizational practices,
relationship networks, team characteristics, and individual and team differences (see Newman et al., 2017). The findings of the category with the most studies on antecedents—supportive leadership behaviors—imply that leaders can support the development of psychological safety. For example, it has been shown that leader openness (Detert & Burris, 2007), and behavioral integrity (Palanski & Vogelgesang, 2011) are positively related to perceptions of psychological safety on the individual level, and that leader inclusiveness (Hirak, Peng, Carmeli, & Schaubroeck, 2012; Nembhard & Edmondson, 2006) is associated with psychological safety on the team level. Further, specific leadership styles were found to be beneficial: For example, transformational leadership (Nemanich & Vera, 2009) and ethical leadership (Tu, Lu, Choi, & Guo, 2019; Walumbwa & Schaubroeck, 2009) were found to positively relate to psychological safety.

The findings of the category with the second most studies on antecedents—relationship networks—imply that the relationships between individuals are important for developing psychological safety. For example, high-quality relationships between employees (Carmeli & Gittell, 2009), and social capital, which includes aspects such as trust (Gu, Wang, & Wang, 2013; Huang & Jiang, 2012) are positively related to psychological safety on the individual and team level, respectively. On the organizational level, the strength of social networks between organization members has been found to be associated with psychological safety (Carmeli, 2007). In sum, leader behaviors as well as relationships with coworkers seem to play important roles in the development or promotion of a psychologically safe environment at work.

2.2.2 Consequences of Psychological Safety

Several studies have investigated outcomes of psychological safety. These outcomes can be categorized into communication (including knowledge sharing and voice behavior), learning behavior, perfor-
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mance (including innovation and creativity), employee attitudes and other outcomes (see Newman et al., 2017). Findings regarding communication—one of the categories with the most studies—indicate that psychological safety facilitates communication in different ways. For example, psychological safety on the individual and team level has been found to be positively associated with reporting of treatment errors (Leroy et al., 2012), knowledge sharing (Mu & Gnyawali, 2003; Siemsen, Roth, Balasubramanian, & Anand, 2009), and voice or speaking up behavior (e.g., Bienefeld & Grote, 2014; Detert & Burris, 2007; Hu et al., 2018; Liang et al., 2012). Overall, the studies suggest that psychological safety constitutes an environment where employees feel comfortable to communicate with one another—even in cases where the communication is about mistakes or issues (Leroy et al., 2012; Liang et al., 2012).

A similar number of studies have looked at learning behaviors as outcomes. Findings in this category show that psychological safety is positively related to general learning behaviors (e.g., Harvey, Johnson, Roloff, & Edmondson, 2019; Liu et al., 2014; Ortega, Sanchez-Manzanares, Gil, & Rico, 2010; Van den Bossche, Gijselaers, Segers, & Kirschner, 2006), and more specifically to learning from failures (Carmeli, 2007; Carmeli & Gittell, 2009). The findings imply that psychological safety promotes learning in organizations and teams by reducing social barriers.

Finally, psychological safety has been found to be associated with different performance-related outcomes such as team and organizational performance (Baer & Frese, 2003; Schaubroeck et al., 2011; Singh, Winkel, & Selvarajan, 2013), creativity (Carmeli, Reiter-Palmon, & Ziv, 2010; Kark & Carmeli, 2009), innovation (Gu et al., 2013; Lee, Swink, & Pandejpong, 2011; Post, 2012), and knowledge creation (Choo, 2011). Certainly, the three above-mentioned categories are not independent from each other. Communication promotes learning and successful learning can translate into better performance. In several studies, psychological
safety has been found to predict performance via learning behaviors (e.g., Brueller & Carmeli, 2011; Edmondson, 1999; Hirak et al., 2012). Also, many studies have modelled psychological safety as a mechanism that mediates the effects of antecedents such as ethical leadership on consequences such as voice behavior (Walumbwa & Schaubroeck, 2009). Together, the studies on psychological safety’s consequences illustrate that the interpersonal climate represents an environment which is beneficial for the organization and team with regard to communication, learning, and performance.

2.2.3 Interactions with Psychological Safety

Compared to the amount of empirical work on psychological safety’s antecedents and consequences, far less studies have considered interaction effects with psychological safety as the predictor or moderator (see Newman et al., 2017). A few studies have looked at factors that enhance or diminish the effect of psychological safety. For example, the positive relationships of psychological safety with learning behaviors and performance were found to be stronger in knowledge-intensive settings, where tasks are complex and require social interactions, discussions, and planning (Sanner & Bunderson, 2015). Also, psychological safety’s positive association with voice behavior was found to be strengthened by employees’ felt obligation for constructive change and weakened by organization-based self-esteem (Liang et al., 2012).

Some studies have considered psychological safety as a moderator which enhances or diminishes other relationships. Psychological safety has been found to strengthen the negative effect of team priority of safety on reporting of treatment errors (Leroy et al., 2012). In another study, task conflict had a positive effect on team performance only when psychological safety was high (Bradley, Postlethwaite, Klotz, Hamdani, & Brown, 2012). Finally, psychological safety was found to strengthen the positive relationship
between utilitarianism and unethical behavior (Pearsall & Ellis, 2011). The existing research illustrates that other factors and relationships need to be considered when looking at psychological safety in order to understand how the interpersonal climate works.
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<td>work engagement (May et al., 2004; Nembhard &amp; Edmondson, 2006), attitude toward teamwork (Ulloa &amp; Adams, 2004)</td>
</tr>
<tr>
<td>Other outcomes</td>
<td>Feedback giving and seeking (Wilkens</td>
<td></td>
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<tr>
<td></td>
<td>&amp; London, 2006), initial perceived</td>
<td></td>
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<tr>
<td></td>
<td>trustworthiness of new team members</td>
<td></td>
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<td></td>
<td>(Roussin &amp; Webber, 2012)</td>
<td></td>
</tr>
<tr>
<td>Interactions with psychological</td>
<td>Psychological safety as predictor</td>
<td></td>
</tr>
<tr>
<td>safety</td>
<td>Task environment (Sanner &amp; Bunderson, 2015), organizational identification (Roussin &amp; Webber, 2012)</td>
<td></td>
</tr>
<tr>
<td>Area of study</td>
<td>Category</td>
<td>Example constructs and studies</td>
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<td>-------------------------</td>
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<tr>
<td>Psychological safety as</td>
<td>moderator</td>
<td>Achievement orientation (Tangirala, Kamdar, Venkataramani, &amp; Parke, 2013), expertise and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>expertness diversity (Martins, Schilpzand, Kirkman, Ivanaj, &amp; Ivanaj, 2013), nationality</td>
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<tr>
<td></td>
<td></td>
<td>diversity (Gibson &amp; Gibbs, 2006; Kirkman, Cordery, Mathieu, Rosen, &amp; Kukenberger, 2013), team</td>
</tr>
<tr>
<td></td>
<td></td>
<td>conflict (Bradley et al., 2012), team priority of safety (Leroy et al., 2012), utilitarianism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Pearsall &amp; Ellis, 2011)</td>
</tr>
</tbody>
</table>

*Note.* This table is based on the systematic literature review by Newman et al. (2017), and was adapted for this dissertation. Listed constructs are positively related to psychological safety unless marked with a ⊗, which signifies a negative relationship.
2.3 Safety and Risk Taking

In pertinent research, different definitions exist for safety and risk taking. Common to most if not all conceptualizations of safety is the incorporation of harm. Also in everyday speech, most people will agree that if an action leads to harm—either for the actor or another person—it is considered unsafe. According to Möller, Hansson, and Peterson (2006), the concept of safety includes three dimensions: the probability that harm occurs, the severity of that harm, and the uncertainty about this probability. Changing any of the three components will affect safety. It generally holds that the lower the probability of harm, its severity, and the uncertainty is, the higher is safety.

The term safety-relevant behavior used throughout this dissertation applies to any behavior that is related to the safety of an individual or group. Referring back to the safety definition of Möller et al. (2006), any behavior that affects the probability of harm, its severity or the uncertainty may be considered safety-relevant. To give an example, in a hospital environment, healthcare workers’ hand hygiene constitutes safety-relevant behavior, because it may affect the patients’ (or their own) safety by increasing the probability that harm occurs (e.g., transmitting an infectious disease from one patient to another).

Risk taking can be broadly defined as an action that involves a chance of loss (Furby & Beyth-Marom, 1992). In this definition, loss refers to the actor’s values and is determined by the actor’s perspective. Similarly, Byrnes, Miller, and Schafer (1999) qualify a behavior as risk taking if it can lead to more than one outcome and if some of these outcomes are undesirable. Instead of loss, the authors speak of negative consequences. Along with potential negative consequences or loss, Ben-Zur and Zeidner (2009) also see perceived positive consequences or gains as a constituent of risk taking. What all of these definitions have in common is the possibility of negative consequences, which is frequently termed
risk. Risk often encompasses both, the probability as well as the amount or severity of loss (Slovic, 1964). This conceptualization of risk illustrates its propinquity to safety, which incorporates the severity and probability of harm (rather than loss) along with the uncertainty of the probability. Often, risk and safety are looked at as two opposite ends of the same continuum (Möller et al., 2006). However, staying with the aforementioned definitions, one difference is that risk includes a very general “loss” or negative consequence, while safety is concerned with a more specific “harm”. Loss can represent negative consequences that do not involve any sort of harm that would normally be considered a problem for safety. For example, if a person gambles and uses a small amount of money, this behavior involves the risk of losing the money. While losing money certainly represents a kind of loss and gambling therefore constitutes risk taking, in ordinary circumstances, the behavior would not be safety-relevant. Accordingly, a behavior can be risky without being unsafe, and risk taking is a behavior which includes potential negative consequences without necessarily being safety-relevant.

It is often reiterated that psychological safety enables or facilitates interpersonal risk taking (Edmondson, 1999). Interpersonal risk taking refers to a specific form of risk taking where the potential negative consequence is social or interpersonal in nature. Interpersonal risk taking constitutes a behavior which has an increased risk of resulting in negative reactions by the other individuals such as the members of one’s work group. Typical examples of interpersonal risk taking are behaviors that challenge the status quo of the team (Edmondson, 2003; Frazier et al., 2017)—for example, by speaking up about issues or voicing suggestions for change. For these behaviors, there is an increased risk that team members could punish the actor, for instance by rejecting or shaming them. While the relationship between psychological safety and interpersonal risk taking has been investigated in many studies,
it is unclear how the interpersonal climate relates to task-related risk taking.

2.4 Reasoned Action Model

In this dissertation, the individual behavior plays an important role. Since the reasoned action model\(^1\) (Fishbein & Ajzen, 2010) is used as a theoretical basis in two of the three scientific papers, it is necessary to give an account of the theory. The reasoned action model is a well-known theory in social psychology on individual behavior and its precursors. The theory has been applied to a wide range of behaviors and tested in a wealth of studies and meta-analyses (Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Armitage & Conner, 2001; Godin & Kok, 1996). The core statements of the reasoned action model are that individuals’ behaviors are preceded by behavioral intentions (i.e., the intention to show a specific behavior), which are in turn preceded by individuals’ attitudes toward the behavior, perceived norms, and perceived behavioral control (Fishbein & Ajzen, 2010).

Attitudes can be understood as associations between a person, object, or behavior and an individuals’ evaluation of it (Fazio, 2007; Fazio, Chen, Mcdonel, & Sherman, 1982). In the reasoned action model, an attitude consists of the sum of evaluations of a behavior and its anticipated outcomes. A positive overall evaluation of a behavior will lead an individual to form an intention to perform the behavior.

Perceived norms stand for a perceived social pressure (not) to perform a behavior (Fishbein & Ajzen, 2010). In the reasoned action model, perceived norms are based on perceptions of injunctive

\(^1\)With the term *reasoned action model*, I refer to the newest formulation of the theory by Fishbein and Ajzen (2010). It encompasses what has, in its early form, been termed *theory of reasoned action* (Ajzen & Fishbein, 1980) and has later been expanded to the *theory of planned behavior* (Ajzen, 1991).
and descriptive norms. Injunctive norm refers to what other people approve or disapprove—in other words, what people consider the right thing to do; descriptive norm refers to what most people actually do (Cialdini, Kallgren, & Reno, 1991; Cialdini, Reno, & Kallgren, 1990). Perceived norms will facilitate the formation of concordant behavioral intentions.

Perceived behavioral control is an individual’s perception of whether he or she has control over (not) performing a behavior (Fishbein & Ajzen, 2010). According to the reasoned action model, these perceptions affect whether individuals will ultimately develop a behavioral intention.

Finally, behavioral intentions are representations of an individual’s willingness to perform a behavior (Ajzen, 1991). The reasoned action model states that an individual’s intention to behave a certain way will lead to that behavior: The stronger their intention, the more likely it is that they will perform the behavior—given that the behavior is under the individual’s control (Ajzen, 1991; Fishbein & Ajzen, 2010). Perceived behavioral control is used as a proxy variable for actual control, which corresponds to objective circumstances (e.g., does the individual actually have the necessary resources, the ability, and the knowledge to perform the behavior). As a proxy, it acts as a moderator of the relationship between an individual’s intention and the actual behavior (Fishbein & Ajzen, 2010).

### 2.5 Research Aims

A majority of the studies on the consequences of psychological safety have focused on interpersonally risky behaviors such as speaking up or voice, feedback seeking and giving, and knowledge sharing or, more broadly, communication and learning behaviors (Edmondson & Lei, 2014; Frazier et al., 2017; Newman et al., 2017). Although these behaviors can have implications for
safety (for example, speaking up in a healthcare context may help enhance patient safety), there is far less work on safety-relevant outcomes and risk-taking behavior, and about how psychological safety is connected with them. These relationships are critical, however, because they have immediate implications for practice: The behaviors are connected with the safety of individuals and—more generally—with a risk of negative consequences for individuals, teams, or organizations. Therefore, it is crucial to gain further insights into how psychological safety, safety-relevant and risk-taking behavior are related.

Moreover, even though there is a growing body of empirical literature on psychological safety and its antecedents and consequences, there is relatively little work on the theoretical underpinnings of psychological safety (Newman et al., 2017). For example, little is known about how exactly psychological safety develops, and how it dissipates (Edmondson & Lei, 2014). Some studies have used theories such as social learning theory or social identity theory to argue for specific relationships between psychological safety and its antecedents or consequences (e.g., Liu et al., 2014; Singh et al., 2013). However, there is little theorizing on the mechanisms of action of psychological safety, especially in the prediction of individual behavior. It is important to elaborate on and theoretically undergird psychological safety’s mechanisms in order to understand and predict behaviors that are informed and affected by it. Providing a solid theoretical frame for psychological safety can help advance the literature on the construct and also has important practical implications.

A deeper understanding of the mechanisms of action of psychological safety will help to harvest its advantages and at the same time anticipate and avoid potential detrimental effects. The latter have been largely ignored in the literature on psychological safety so far (Edmondson & Lei, 2014; Newman et al., 2017), but there are findings that illustrate that psychological safety can have direct undesirable effects or facilitate them as a contextual
moderator. Deng, Leung, Lam, and Huang (2019) found that psychological safety is negatively related to group work motivation. Pearsall and Ellis (2011) found that psychological safety in student teams can facilitate cheating behavior by enhancing the effect of utilitarianism. Given that psychological safety has been shown to be related to many desirable behaviors, organizations may strive to enhance psychological safety in their teams—without knowing if this could also promote detrimental behavior.

The aim of this dissertation is to address these gaps in order to deepen the understanding of the construct of psychological safety as well as how the construct may exert influence on behavior in general, and on safety-relevant and risk-taking behavior specifically. Two broad research questions serve as a guide for the overall aim of this dissertation:

**Research Question 1:** How does psychological safety affect safety-relevant and risk-taking behavior?

**Research Question 2:** What are mechanisms of action of psychological safety in the prediction of individual behavior in a social context?

I address these research questions with three scientific papers which constitute this dissertation. Figure 2.1 illustrates the overall research model for this dissertation and where the three scientific papers were set. In the first paper, I take a perspective on psychological safety that is in line with the present literature on the construct. Together with my co-authors, I looked at antecedents of psychological safety, namely shared language and relational coordination in the context of interprofessional healthcare teams. We explored whether psychological safety acted as a mediating mechanism in the relationship between these antecedents and safety-relevant behavior in the form of quality of care. The paper addresses the first research question.
In the second paper, I adopted a new perspective on psychological safety. Based on the reasoned action model, my co-authors and I proposed that psychological safety should be considered as a moderator, which strengthens or weakens the effects of attitude and perceived norm on behavior. We applied the model to safety-relevant behavior, namely physicians’ influenza vaccination behavior and tested it in the field in a Swiss hospital. The second paper addresses both the first and second research question.

In the third paper, we further scrutinized the theoretical model developed in the second paper and employed the experimental method to be able to test the model’s propositions in a more constrained setting. We carried out a series of three studies, experimentally manipulating attitude, perceived norm and psychological safety, in order to measure their combined effects on either intended or actual risk-taking behavior in an online quiz. The third paper, too, addresses the first as well as the second research question.
3 | Methods

To address the research questions presented above, I conducted five studies in total which involved a number of different samples, designs and analysis approaches. I chose the methods in a way to best approach each study’s research aims. By varying the samples the data were collected from, the results give more information on how psychological safety and its effects may depend on a given context. Variance in study design was a deliberate choice in order to counterbalance advantages and disadvantages of the corresponding designs.

In the following, I am going to present a summary of the methods that were used in the five studies by providing information on the sample, the employed study design, and statistical analyses for each scientific paper. An overview of the applied methods can be found in Table 3.1.

3.1 First Scientific Paper

In the first paper, I investigated psychological safety in the context of interprofessional collaboration in healthcare, acting as a mediator between antecedents (i.e., shared language, relational coordination) and safety-relevant behavior (i.e., quality of care). Data were collected in the field, in three Swiss rehabilitation centers.
To be able to capture the different perspectives in the interprofessional healthcare teams, the sample consisted of participants from different professions, which all collaborated in the rehabilitation process. The sample encompassed nursing staff, different kinds of therapists, social care staff, physicians and administrative staff.

A survey study design was employed with one measurement point. The survey consisted of validated questionnaire scales where available, and self-generated questionnaire items. It included measures for shared language, relational coordination, psychological safety, perceived quality of care, and job satisfaction. Following Gittell (2002), for shared language and relational coordination, participants rated the items with respect to each of the professions that were involved in the work at the rehabilitation center separately. In total, 197 rehabilitation center employees filled in the questionnaire—either in a paper-pencil or in an online version.

To analyze the data, I conducted multiple regression analyses. The main effects were calculated using a hierarchical linear regression approach. Further, to test for the hypothesized serial mediation (with psychological safety as one of two subsequent mediators), I computed indirect effects and constructed bootstrap confidence intervals (Hayes, 2013; Preacher & Hayes, 2008). This approach has been shown to have several advantages over other approaches to establish mediation such as the “causal steps approach” by Baron and Kenny (Hayes, 2013).

3.2 Second Scientific Paper

In the second paper, I investigated psychological safety’s moderating role in the prediction of individual behavior. I collected data in the field, in a Swiss hospital. The sample consisted of the hospital’s physicians and the focal safety-relevant behavior was physicians’ seasonal influenza vaccination.
I employed a survey study design with two measurement points. Since the aim of the study was to predict vaccination behavior, I gathered data before and after the hospital’s seasonal influenza vaccination phase, during which healthcare staff could get voluntary and free vaccination shots. I measured physicians’ attitude toward getting vaccinated, their perceived norm within the physicians team, their intention to get vaccinated as well as the psychological safety within their team before the vaccination phase using validated scales and self-generated, pre-tested items. I developed the items to measure the reasoned action model variables specifically for this context, based on the recommendations by Fishbein and Ajzen (2010). After the influenza vaccination phase was completed, we asked the physicians whether they had got vaccinated or not. In total, 208 physicians participated at both measurement points.

To analyze the data, I again used a multiple regression approach. For the main effects, hierarchical linear and logistic regression analyses were used. The mediation and moderated mediation effects were established by computing the indirect and conditional indirect effect, respectively, and constructing bootstrap confidence intervals for each (Hayes, 2013; Preacher & Hayes, 2008).

3.3 Third Scientific Paper

For the third paper, I conducted a series of three studies to address psychological safety’s moderating role in the prediction of individual risk-taking behavior. The underlying research model of the third paper resembled the one used in the second paper. To get additional information on the validity and generalizability of the results, I used a different sample, focal behavior, and methodological design in the third paper. This also helped to compensate for some of the disadvantages of the correlative design applied in the second paper.
I employed online experiments to isolate the different interaction effects between behavioral antecedents and psychological safety on risk-taking behavior, and to establish causal evidence. For the first two studies in the paper, I collected data from a sample recruited via Amazon Mechanical Turk. Both of these studies were based on a scenario created around a fictitious online quiz game that was supposed to be played within randomly sampled teams. The game was described to consist of multiple questions and that each player would try to choose the right out of four given answers in order to score points for the team. For each question, the player could use a risk option which would delete a predefined number of false answers, but included the risk of losing points for the team. I created different versions of the scenario in order to experimentally manipulate participants’ attitude toward risk taking, their perceived norm on risk taking within the team (i.e., perceived team norm), and the psychological safety within the team.

To manipulate attitude, the instructions to the game differed on the usefulness of the risk option, which would delete either one or two false answers from the quiz. Perceived team norm was manipulated via a fictive chat history where the fictitious team members mentioned whether they want to take the risk option or not. Also manipulated via the chat history, different levels of psychological safety were induced by having the fictitious team members react either positively or negatively towards other members’ behavior. As the dependent variable, I assessed participants’ intention to take risk in the scenario by having them estimate how often they would use the risk option in the game.

In the third study of the paper, I collected data from students who were recruited from multiple Swiss universities. This time, I implemented an actual online quiz game, which participants were led to believe to play in an actual team of three participants. The other two team members were, in fact, pre-programmed. Again, I experimentally manipulated participants’ attitude and perceived
team norm with regard to risk taking as well as their psychological safety within the team.

The attitude manipulation in the third experiment was similar to the one used in the previous two experiments, but was slightly adapted to exclude the manipulation of risk probability. Psychological safety and perceived team norm were manipulated by having the participants and fictitious team members fill in a questionnaire on their general behavior in teams and on their strategy for the quiz game with regard to risk taking. To create different conditions, I provided the participants with differing pre-programmed answers by the team members. The dependent variable was participants’ actual risk-taking behavior during the quiz in the form of choosing the implemented risk option.

In the three studies, 220 participants, 302 participants, and 265 participants partook in the experiments, respectively. In all three studies, the dependent variable represented a proportion measure (i.e., how many times out of 10 they intended to use or they actually used the risk option). To analyze this type of data, I used generalized linear models with a binomial distribution and logit link (see Smithson & Merkle, 2014).
<table>
<thead>
<tr>
<th>Study design</th>
<th>Sample</th>
<th>Statistical analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper 1: Online experiment with a 2×2×2 design</td>
<td>265 students of Swiss universities</td>
<td>Generalized linear models with binomial distribution and logit link, multiple regression analyses, mediation analyses using bootstrap confidence intervals, moderation analyses, mediation analyses using regression analyses, moderated regression, linear and logistic models.</td>
</tr>
<tr>
<td>Paper 2: Survey study with a 2×2×2 design</td>
<td>208 physicians of a Swiss hospital</td>
<td>Hierarchical linear and logistic models, mediation analyses using bootstrap confidence intervals, and moderated regression analyses.</td>
</tr>
<tr>
<td>Paper 3: Survey study with one measurement point</td>
<td>197 healthcare workers of Swiss rehabilitation centers</td>
<td>Multiple regression analyses, mediation analyses using bootstrap confidence intervals, and moderated regression analyses.</td>
</tr>
</tbody>
</table>

Table 3.1: Overview of the Methods Employed in the Studies Reported in the Three Scientific Papers
Summary of the Scientific Papers

In the following sections, I will provide brief summaries of the three scientific papers that I wrote as a first author as a part of this dissertation, with a focus on their main findings. My contribution to each scientific paper as well as the studies presented in them is outlined in Table 4.1.

Table 4.1
Overview of My Contribution to the Studies and Scientific Papers Presented in this Dissertation

<table>
<thead>
<tr>
<th>Contribution</th>
<th>Status</th>
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<tbody>
<tr>
<td><strong>Paper 1</strong></td>
<td></td>
</tr>
<tr>
<td>• Fleshing out the empirical model</td>
<td>Published in Frontiers in Psychology</td>
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<tr>
<td>• Analyzing the data</td>
<td></td>
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<tr>
<td>• Drafting and revising the manuscript</td>
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<tr>
<td><strong>Paper 2</strong></td>
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<tr>
<td>• Developing the empirical model</td>
<td>Submitted to Journal of Organizational Behavior</td>
</tr>
<tr>
<td>• Conceptualizing, preparing, and conducting the study</td>
<td></td>
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<tr>
<td>• Analyzing the data</td>
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<tr>
<td>• Drafting and revising the manuscript</td>
<td></td>
</tr>
<tr>
<td><strong>Paper 3</strong></td>
<td></td>
</tr>
<tr>
<td>• Developing the empirical model</td>
<td>Under review at Organizational Behavior</td>
</tr>
<tr>
<td>• Conceptualizing, preparing, and conducting all three studies</td>
<td>and Human Decision Processes</td>
</tr>
<tr>
<td>• Analyzing the data</td>
<td></td>
</tr>
<tr>
<td>• Drafting and revising the manuscript</td>
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</tbody>
</table>
4.1 First Scientific Paper

I Hear You, but Do I Understand? The Relationship of a Shared Professional Language with Quality of Care and Job Satisfaction

Manuel Stühlinger\textsuperscript{1}, Jan B. Schmutz\textsuperscript{1,2}, and Gudela Grote\textsuperscript{1}

\textsuperscript{1}ETH Zurich

\textsuperscript{2}Northwestern University

In the first scientific paper, I addressed the first research question of this dissertation by investigating psychological safety’s role in interprofessional healthcare teams with regard to the safety-relevant outcome quality of care. In many industries today, there are multi-professional teams working towards a shared goal. These teams consist of members who ran through different educations and therefore tend to speak different professional languages (Frank, 1961; Hall, 2005). This can pose difficulties for effective communication and coordination within the team and can lead to misunderstandings or communication errors. In the healthcare environment, studies have found that communication errors are a root cause of many adverse events (e.g., Leonard, Graham, & Bonacum, 2004; Lingard et al., 2004), which can lead to medication errors or delayed treatment (Rabøl et al., 2011). Although there is a common belief that a shared language in interprofessional healthcare teams is important (e.g., Pamplin, Murray, & Chung, 2011; Swayne, 1993), there seems to be no quantitative research that investigated the positive consequences of a shared language. Therefore, my co-authors and I wanted to find out whether the usage of a shared language in interprofessional healthcare teams would be related to patient and staff outcomes (i.e., quality of care and job satisfaction).
We identified two mechanisms that should mediate between shared language and outcomes. First, shared language should be positively associated with relational coordination—a construct which incorporates communication quality (e.g., frequent and accurate communication) and relationship quality (e.g., shared goals and mutual respect) as components (Gittell, 2006; Gittell, Weinberg, Pfefferle, & Bishop, 2008). Second, relational coordination should be positively related with psychological safety, which in turn is related with staff and patient outcomes. For example, mutual respect and frequent communication should foster trust and reduce uncertainty regarding the behavior of other team members (Siemsen et al., 2009), thereby enhancing psychological safety. High psychological safety should constitute a beneficial working climate which supports learning and performance (Carmeli & Gittell, 2009; Kessel et al., 2012) as well as employees’ well-being (Kark & Carmeli, 2009), translating into a higher quality of care and job satisfaction.

We collected data from three Swiss rehabilitation centers via questionnaire. The final sample of 197 employees consisted of workers from various professions involved in the rehabilitation process.

The results of our multiple regression analyses supported our hypotheses. We found that shared language between employees of interprofessional healthcare teams was indeed positively associated with perceived quality of care and employees’ job satisfaction and that both relationships were serially mediated by relational coordination and psychological safety. Our results indicate that a shared professional language as well as a high relational coordination—which consists of high communication and relationship quality—may help foster psychological safety in interprofessional healthcare teams. The construct of relational coordination provides further details on potentially important aspects in creating psychological safety. Specifically, we considered mutual respect, shared knowledge, shared goals as well as communication
frequency and timeliness. These factors seem to support the development of psychological safety in interprofessional teams. Psychological safety was further shown to be positively related to quality of care, which essentially signifies performance of healthcare teams and is relevant for patient safety. These findings suggest that psychological safety may act as a direct precursor of safety-relevant behavior in the context of interprofessional healthcare teams.
4.2 Second Scientific Paper

To Get Vaccinated or Not? Psychological Safety as a Catalyst for Alignment Between Individual Beliefs and Behavior

Manuel Stühlinger¹, Jan B. Schmutz¹, Gudela Grote¹, Dunja Nicca², and Domenica Flury³

¹ETH Zurich
²University of Basel
³Cantonal Hospital St. Gallen

In the second scientific paper, I aimed to clarify the role of psychological safety in the prediction of individual behavior and applied the model to safety-relevant behavior, thereby addressing both the first and second research question of this dissertation. While many studies have considered psychological safety’s antecedents and consequences (see Edmondson & Lei, 2014; Frazier et al., 2017; Newman et al., 2017), there is little theorizing on psychological safety’s mechanisms of action (Newman et al., 2017). Furthermore, while psychological safety has mainly been looked at as a direct antecedent of interpersonally risky behavior such as speaking up (Bienefeld & Grote, 2014; Detert & Burris, 2007) or error reporting (Leroy et al., 2012), some researchers expressed that psychological safety may be more accurately looked at as a facilitating contextual factor and therefore as a moderator (Sanner & Bunderson, 2015).

In this paper, my co-authors and I aimed to clarify and theoretically undergird psychological safety’s effect on individual behavior. Since psychological safety has been described to make members of a team feel safe to employ their self (Kahn, 1990),
we argued that psychological safety should act as a catalyst of alignment between individual beliefs and behavior. We resorted to the reasoned action model, which states that individuals’ attitudes and perceived norms predict behavior through intentions. Psychological safety is defined and empirically found to reduce interpersonal risk by providing team members with confidence that interpersonally risky behaviors will not lead to negative reactions (Edmondson, 1999; Edmondson, 2003). We argue that every individual behavior performed in a team (or, more generally, in a social context) involves some degree of risk of receiving negative reactions by others. In particular, behaviors which go against team norms will be interpersonally risky, because team members tend to enforce team norms by punishing deviates (Fehr & Fischbacher, 2004; Fehr & Gächter, 2000). In teams with high psychological safety, where members feel safe to be who they are and confident that they will not be rejected for interpersonally risky behavior, individuals should be more likely to act in accordance with their personal attitude. At the same time, they should be less likely to conform to perceived norms within the team (i.e., perceived team norms). By contrast, in teams with low psychological safety, individuals fear negative reactions by others (Edmondson, 1999) and should therefore feel greater social pressure to adhere to team norms in order to avoid these reactions (Spitzer, Fischbacher, Herrnberger, Gron, & Fehr, 2007). Thus, psychological safety should strengthen the effect of individuals’ attitudes and weaken the effect of individuals’ perceived team norms on their intentions and behaviors.

We applied the model to physicians’ influenza vaccination behavior. We gathered data from 208 physicians via questionnaire before and after the influenza vaccination phase at a Swiss hospital. Hierarchical linear and logistic regression analyses were employed to analyze the data.

Consistent with the reasoned action model, physicians’ attitude toward getting vaccinated and their perceived norm on vac-
cination in the physicians team had a positive effect on their intention to get vaccinated. Physicians’ intention, in turn, had a positive effect on their likelihood to get vaccinated during the hospital’s vaccination phase. Most importantly, psychological safety moderated the relationship between attitude and intention: Higher psychological safety strengthened this relationship. Our findings therefore provide first evidence that psychological safety leads individuals to act more in accordance with their personal attitude. Notably, this was true in both ways: Psychological safety strengthened the effect of positive as well as negative attitude in a way that physicians were more and less likely, respectively, to get vaccinated. However, we did not find that psychological safety moderated the relationship between perceived norm and intention to get vaccinated. Taken together, the results support our view that psychological safety can indeed affect individual, safety-relevant behavior by moderating the effect of personal antecedents of behavior in the form of individuals’ attitudes.
4.3 Third Scientific Paper

Psychological Safety’s Role in the Prediction of Risk Taking in Teams: Interaction Effects with Team Members’ Attitude and Perceived Team Norm

Manuel Stühlinger, Jan B. Schmutz, Gudela Grote, and Petra C. Schmid

ETH Zurich

In the third scientific paper, I built on the second dissertation study and further investigated psychological safety’s role in the prediction of individual behavior by using different methods and focusing on risk taking. With the third paper, I again addressed the first and second research question of this dissertation. Psychological safety constitutes a team climate where interpersonal risk taking is enhanced due to alleviated fear of negative reactions by others (Edmondson, 1999). In a general definition, risk taking is a behavior which involves potential losses and gains for the individual (Byrnes et al., 1999; Furby & Beyth-Marom, 1992). Interpersonal risk taking comprises a risk of negative reactions by other individuals, for example in the form of social disapproval or even tangible consequences (Edmondson, 1999; Nemhard & Edmondson, 2006). In the literature on psychological safety, to our knowledge there is no clear evidence on the effect of psychological safety on task-related risk taking that involves a risk of negative consequences for the whole team.

In this paper, my co-authors and I aimed to increase the understanding of psychological safety’s effects when it comes to task-related risk-taking behavior that affects the team. Further, we aimed to gather evidence on the causal workings of psychological safety by employing an experimental design. Our paper therefore
also has an important methodological contribution by illustrating ways to experimentally manipulate psychological safety. Based on the reasoned action model, we hypothesized that individuals’ attitudes and perceived team norms should have a positive effect on their risk-taking behavior. Further, based on the model developed in the second paper, these two relationships should be moderated by psychological safety: Higher psychological safety should strengthen the effect of attitudes and weaken the effect of perceived team norms on risk taking, respectively.

We conducted a series of three experiments to test our hypotheses. In the first two studies, we ran scenario-based online experiments with two diverse samples from Amazon Mechanical Turk (\(N = 220\) and \(N = 302\)). In the third study, we ran an online experiment including actual behavior with 265 students from multiple Swiss universities. In all three studies, we experimentally manipulated participants’ attitude toward risk taking, perceived team norm on risk taking, and psychological safety within the team, and we assessed participants’ intention to take risk in a scenario on an online quiz (first two studies), and their actual risk-taking behavior in a real online quiz (third study). We used generalized linear models to test our hypotheses.

In all three studies, we found support for the positive main effects of individuals’ attitudes and perceived team norms on their intention to take risk, and their actual risk taking. In addition, results showed that psychological safety interacted with individuals’ attitudes in the prediction of risk taking, but the findings diverged between experiments to some degree. In the first study, we found that—consistent with our model—psychological safety strengthened the effect of attitude on behavioral intention, whereas in the other two studies, psychological safety weakened the effect of attitude. The differences in results may be ascribed to adjustments of the experimental manipulations between experiments. The findings which contradict our hypothesis, namely that psychological safety weakens the effect of attitudes on intention and
behavior, may be explained by resorting to social identity theory (Tajfel & Turner, 1979) and self-categorization theory (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). In the high psychological safety condition, participants might have been more willing to accept their (fictitious) collaborators as their team, resulting in an increased social identification and therefore a stronger willingness to conform to team norms (see Christensen, Rothgerber, Wood, & Matz, 2004).

The results on the interaction between psychological safety and perceived team norms were less conclusive. In the first and third study we did not find significant interaction effects, while psychological safety strengthened the effect of perceived team norms on intention to take risk in the second study. Therefore, the evidence for the interaction is rather weak and future studies need to further investigate the probably more complex relationship between team norms and psychological safety. To conclude, the findings show that psychological safety can act as a moderator in the prediction of individual behavior also in the case of risk taking, although the direction of the effect might be different than anticipated with psychological safety weakening the effect of attitudes.
In the final chapter of this dissertation, I will discuss the findings of the three scientific papers. First, I will interpret the findings and describe their implications for the theoretical and empirical body of work on psychological safety as well as for practice. Second, I will delineate the main limitations of the studies. Third, I will depict possible paths for future research on psychological safety and give ideas on how studies could build on the findings of this dissertation. Fourth, I will close the discussion with a short conclusion.

5.1 Findings and Theoretical Implications

The aim of this dissertation was to deepen the understanding of psychological safety by investigating the construct’s relationship with safety-relevant and risk-taking behavior (first research question), and by theorizing on and testing psychological safety’s mechanisms of action in the prediction of individual behavior in a social context (second research question).

With regard to the first research question, in the first paper, I conceptualized psychological safety’s role in a way that was informed by previous research. Psychological safety was considered a direct precursor of performance-like measures. In our study, psychological safety was shown to act as a mediator between shared
language, relational coordination, and quality of care. The paper provides evidence that psychological safety is related with the performance-like, safety-relevant measure quality of care in interprofessional healthcare teams. Whereas psychological safety is usually considered to promote communication behaviors such as knowledge sharing (Mu & Gnyawali, 2003), our model suggests that it might also work the other way around—that shared knowledge and frequent communication can promote a psychologically safe climate, because communication reduces uncertainty about team members’ reactions. In reality, this might translate into a mutually enforcing cycle, in which psychological safety and communication reinforce each other.

In the second and third paper, I explored the role of psychological safety as a contextual factor, conceptualizing psychological safety in a way that is more consistent with the construct’s definition as an interpersonal, facilitating climate. Thus, psychological safety was modeled as a moderator that exerts its impact on safety-relevant and risk-taking behavior by strengthening or weakening the effect of individuals’ beliefs on behavior. The two papers provide evidence that psychological safety affected physicians’ influenza vaccination behavior and participants’ risk taking in an online quiz by strengthening or weakening the effect of individuals’ attitudes, respectively.

To summarize, this dissertation contributes to the literature on psychological safety by providing evidence that psychological safety affects different kinds of safety-relevant and risk-taking behaviors and does so via different processes. Many studies on psychological safety have shown that the construct facilitates interpersonal risk taking. Even though some of these interpersonal behaviors may have implications for safety such as reporting of treatment errors (Leroy et al., 2012), far less focus has been put on behaviors that are closer to safety and on task-related risk taking as well as on alternative ways how psychological safety could affect these behaviors. The findings presented in this disserta-
tion illustrate new effects of psychological safety which can create valuable suggestions for future research.

With regard to the second research question, I postulated a theory-driven model of psychological safety’s mechanisms of action with regard to individual behaviors in social contexts. Based on the reasoned action model, I hypothesized that individuals’ attitudes and perceived norms predict their intentions and behaviors. Together with my co-authors, I argued that psychological safety acts as a contextual factor which allows individuals to act according to their personal attitudes and which decreases social pressure on individuals to conform to team norms. The lack of theoretical understanding of psychological safety’s mechanisms of action and its necessity have been noted previously (Newman et al., 2017). This dissertation contributes to the current literature on psychological safety by undergirding the construct with established theoretical concepts that allow the prediction of a wider range of effects than just specific relationships between psychological safety and one antecedent or consequence. Also, our theoretical model seems to be closer to the common definitions of psychological safety, which describe psychological safety as a facilitating or enabling context or climate (Edmondson, 1999; Kahn, 1990). Whereas psychological safety has mainly been looked at as a causing factor of learning and similar behaviors, we follow previous thought that psychological safety might be better conceptualized as the moderating, facilitating factor it is often described as (Sanner & Bunderson, 2015).

The suggested model highlights a new perspective on psychological safety that enables us to look at previous findings in a new light. For example, psychological safety was found to directly affect learning behaviors (e.g., Liu et al., 2014; Van den Bossche et al., 2006). The line of argumentation is that learning behaviors can be interpersonally risky and that psychological safety is positively connected to these behaviors, because it reduces the fear of negative reactions from others. Based on our model, we would go
deeper and say that alleviating such social worries means that individuals feel more comfortable to act according to their attitude. If individuals have a positive attitude towards learning behaviors, they will be more likely to perform them under high psychological safety, but if their attitude is negative, psychological safety will actually impede these behaviors. The reason why positive relationships between psychological safety and learning behaviors (as well as other interpersonally risky behaviors) are frequently found may simply be that the majority of employees has positive attitudes toward learning, communicating, and improving their work.

My co-authors and I found some support for the model in the second paper when testing it in the field with physicians’ influenza vaccination behavior as the focal behavior. Indeed, psychological safety strengthened the effect of attitude on intention to get vaccinated. The results portray how psychological safety can impede beneficial behavior—in our study by strengthening negative attitudes toward getting vaccinated, which led to weaker behavioral intentions and a lower likelihood to actually get vaccinated. The proposed model allows for a more differentiated view on psychological safety and its mechanisms of action by which it affects individual behavior—beneficial as well as detrimental ones. It may serve as a basis for future studies on potential harmful effects of psychological safety, which has been found to be severely lacking in the literature (Newman et al., 2017).

The postulated model was further tested in the third paper, where experiments were employed to scrutinize psychological safety’s effect with regard to individual, task-related risk taking. The findings were not unanimous, but they mainly showed that psychological safety weakened the effect of attitudes on the intention to take risk and actual risk taking. This finding stands in contrast to the strengthening effect psychological safety was found to have on the relationship between attitude toward getting vaccinated and intention to get vaccinated in the second paper.
The studies in the two papers differed in a number of ways such as regarding their study design (i.e., correlative vs. experimental), study setting (i.e., field study vs. online experiment), and their focal behavior (i.e., vaccination behavior vs. risk taking in an online game). Any of these differences could be responsible for the divergent findings, and additional studies are needed to investigate, which of these factors are relevant.

One difference I want to single out lies in the nature of the focal behaviors of the studies. While in the second paper, getting vaccinated mainly had consequences for the individual and no direct consequences for the physicians team, the task-related risk-taking behavior in the third paper included the risk of harming the whole team by losing points and possibly bonus money. Psychological safety’s effect may depend on individuals’ social identification (Tajfel & Turner, 1979) with the team or organization. If the behavior to predict mainly has consequences for the individual, the social group might be less salient and the identification with the group lower (Turner et al., 1987), which could lead individuals in a high psychological safety environment to focus on themselves and act according to their personal attitude. If, on the other hand, the behavior in question includes a considerable risk for the team (or organization), the social group might be salient and identification with the group stronger, which could lead individuals to conform to the team and act less according to their attitude.

To summarize, this dissertation contributes to the literature on psychological safety by providing a theory-driven model on the mechanisms of action of psychological safety in relation with individual behavior. The model provides a nuanced perspective on psychological safety’s effects which allows predicting both beneficial and detrimental behaviors. It highlights that psychological safety may, most importantly, act as a contextual factor, which facilitates or impedes behaviors by moderating the effects of individual beliefs on behavioral intentions. This mechanism of action
should be considered in future research on psychological safety, and, in particular, research should pay more attention to the possibility of unintended behaviors that might be facilitated by enhancing psychological safety in a team or organization.

5.2 Practical Implications

Along with their theoretical implications, the findings of this dissertation also have a number of practical implications. The first scientific paper highlights new antecedents of psychological safety—and these represent new potential ways to establish or promote a psychologically safe work environment. The results suggest that using a shared professional language in interprofessional teams could help create psychological safety, mediated through relational coordination. In healthcare or, more specifically, in the rehabilitation context that we looked at, a shared language might be promoted by using classification systems such as the International Classification of Functioning, Disability, and Health (World Health Organization, 2001). These classification systems allow members of different professions to resort to common terminology and definitions, and enable a common understanding. Such systems might help to foster psychological safety by promoting a shared language. The results further show that psychological safety is related to relational coordination, which includes relationship quality and communication quality. These findings are in line with previous studies that found that psychological safety is related to high-quality relationships (Carmeli & Gittell, 2009) and knowledge sharing (e.g., Mu & Gnyawali, 2003; Siemsen et al., 2009). As mentioned above, there might be a mutually enforcing cycle between psychological safety and communication, which means that psychological safety could be used to enhance communication (e.g., frequency and timeliness of communication), but also that psychological safety could be enhanced by increasing or improving communication among team members. This might be
achieved by conducting communication trainings and by employing a supportive leadership style to promote psychological safety. Enhancing psychological safety in healthcare seems especially desirable, since we found the interpersonal climate to be connected to better perceived quality of care.

The second paper depicts psychological safety’s mechanisms of action, which has direct practical implications. The proposed model suggests that psychological safety is an environment that encourages employees to be themselves—which might be a mixed blessing. The results of the study suggest that individuals will align their behavior with their personal beliefs when psychological safety is high. Practitioners who seek to enhance psychological safety in their teams or organizations should be aware that alongside beneficial behaviors such as learning, psychological safety might also promote unintended behaviors. If employees have positive attitudes toward detrimental behaviors, a higher psychological safety might facilitate the enactment of detrimental behaviors. Likewise, if employees have negative attitudes toward beneficial behaviors, a higher psychological safety might facilitate the omission of beneficial behaviors. The latter case has been found in the second dissertation study, where physicians with higher perceived psychological safety and negative attitude toward getting vaccinated had a weaker intention to vaccinate and, subsequently, lower likelihood of getting vaccinated. Therefore, it will be important for practitioners to make sure that employees’ attitudes are in line with organizational goals and values before enhancing psychological safety—especially with regard to those behaviors which are meant to be enhanced by the interpersonal climate. Engendering favorable attitudes will help organizations achieve better results with the enhancement of psychological safety. After promoting psychological safety, practitioners could further measure potential detrimental behaviors (e.g., counterproductive work behavior), and if a significant increase is detected, take countermeasures by identifying harmful beliefs and adjusting them. The proposed
model and its practical implications might especially be important for high-risk organizations, where safety-relevant behavior is of very high priority such as hospitals and public transport.

The third paper restricts the practical implications stated above—at least when it comes to risk-taking behavior. The results of the experiments mainly suggest that psychological safety weakens the effect of individual attitude on risk taking. According to these results, the effect of positive attitudes toward risk taking on risk-taking behavior were mitigated by psychological safety. In many organizations and especially high-risk organizations with a strong focus on safety, this represents an additional positive effect of psychological safety. Enhancing psychological safety in these organizations could therefore lead to less individual risk taking. However, this could also constitute a disadvantage in organizations or teams where task-related risk taking is actually desired to some extent such as in stock exchange trading.

To summarize, according to our developed model, the underlying reasoned action model (Ajzen, 1991; Fishbein & Ajzen, 2010) and our findings, the safest path for practitioners will be to make sure that employees’ attitudes and team norms are in line with organizational goals. This may be achieved by identifying detrimental beliefs with regard to relevant behaviors via questionnaire and changing them accordingly (Fishbein & Ajzen, 2010). For example, practitioners could issue an information campaign which corrects erroneous beliefs about behavioral consequences. In this way, enhancing psychological safety runs a lower risk of unintended behaviors and has a higher chance of promoting behaviors from which the team and organization will benefit.

5.3 Limitations

The three scientific papers which constitute this dissertation share some limitations, but they also have individual weaknesses of
which some are counterbalanced by others. In this section, three main limitations shall be discussed.

First, two of the three papers feature correlative designs. In the first and second paper, data were gathered using questionnaires either at one or at two measurement points. Although statistical analysis allows for testing whether the collected data are consistent with the hypothesized model, causal relationships cannot be proven in correlative designs (Cohen, Cohen, West, & Aiken, 2003). Alternative study designs are more suitable to provide evidence on the causality of the hypothesized relationships. For instance, longitudinal study designs can help establish effects that build over time. Especially scientific experiments are well-suited to establish causal effects and their directions: Participants are randomly assigned to experimental groups, which only systematically differ in the manipulated independent variables. As a result, differences in the dependent variable are attributable to the differences in the independent variables. To counterbalance the shortcomings of correlative designs, I employed an experimental design in the three studies reported in the third paper in order to gain further confidence in the findings of psychological safety acting as a moderator.

Second, two of the three papers include self-report and single-source data and are thus at risk for common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). We sought to reduce bias by using different response formats in the first paper and by using two measurement points in the second paper. Unfortunately, it was not possible to use objective or externally rated measures of vaccination behavior and quality of care, which would have strengthened the methodological design. In the case of vaccination behavior, the behavior is clear-cut and we are confident that participants knew very well whether they had got vaccinated or not—although we cannot rule out the possibility that they did not answer the question honestly due to social desirability. Again, the experiments we employed in the third paper were used to resolve
these methodological shortcomings. In experiments, independent variables (in our case, the two predictors as well as the moderator) are manipulated and do not depend on subjective ratings. In the first and second experiment of the third paper, the dependent variable was intention to take risk, which was the only self-report measure. This means that no relationships could have been statistically inflated due to common method variance (Podsakoff et al., 2003). In the third experiment, the dependent variable was an objective behavior measure and therefore not prone to common method bias.

Third, for all three papers, generalizability of the study results to other contexts and behaviors is uncertain. The first two studies were conducted in the field, in a healthcare environment. This environment shares characteristics with other organizational environments, such as employees working in interprofessional teams, which should enable comparability to other settings. Nevertheless, there are still notable differences that might restrict the generalizability of our findings to other contexts. For example, one important goal of healthcare teams is the physical safety and recovery of patients. Concerns about safety may be present in some organizational contexts, but not in others. Also, safety concerns can be very different in nature and a single study on safety-relevant behavior cannot establish generalizability to all other types of safety-relevant behaviors. Although all of my three papers focused on safety-relevant and risk-taking behavior, each behavior was different and had unique characteristics—which may be one of the reasons for the divergent findings reported in the second and third paper. Generalizability of the findings of this dissertation can only be established with additional studies that replicate the findings in different contexts and with different behaviors.
5.4 Future Research

The findings and implications of this dissertation will hopefully engender new research on psychological safety. I see several starting points where studies could tie in with the presented research. Some possible avenues for future research shall be discussed in the following.

This dissertation originates a theory-driven model that explains mechanisms of action of psychological safety with regard to individual behavior. I think it will be worthwhile to further test and refine this model. For example, it would be important to better understand under which conditions psychological safety interacts with individual beliefs in the prediction of behavior. Psychological safety’s moderating effect might depend on characteristics of the individual behavior to be predicted. For example, the argumentation underlying the model suggests that the size of psychological safety’s moderating effect should depend on whether the individual behavior is actually visible or overt to the social group where psychological safety originates from. An individual might only be affected by the interpersonal climate if he or she thinks that others will know about the behavior—only then should psychological safety actually be effective by alleviating social pressure (see Argyle, 1957). This assumption could be tested in an experimental setting with conditions that differ with regard to observability of the individual behavior in question, and additionally measuring individuals’ attitudes, perceived norms, and psychological safety in the team.

Further, the second and third paper generated different findings with regard to the direction of psychological safety’s moderating effect. The discussion of the findings depicted possible explanations for the divergent results. Future research could try to identify which of the explanations is accurate. As mentioned above, one reason for the different findings might be that the safety-relevant behavior in the second paper included risks that mainly
affected the actor, whereas in the third paper, the risk-taking behavior included risks that affected the whole team. Again, experiments could be employed, in which the target of the possible negative consequences stemming from the risk-taking behavior is varied between conditions (actor vs. actor’s team) in order to test whether psychological safety’s effect differs.

One part of the proposed model, namely the interaction between psychological safety and perceived norm, received only little empirical support with one of three experiments of the third paper yielding a significant result. The theoretical reasoning for why these two constructs should interact still holds. Future research might come up with explanations why the effects could not be established and might modify the model in order to better represent psychological safety’s mechanisms of action. The relationship between (perceived) team norm and psychological safety might be more complex than my co-authors and I hypothesized. For example, psychological safety might exert contradicting effects, which can lead to a non-significant total effect. A high psychological safety might at the same time enable individuals to be themselves and put less emphasis on team norms, but the positive, comfortable climate might also cause individuals to more strongly identify with the team, which would encourage them to conform to team norms (Hogg & Reid, 2006). Researchers could try to disentangle these competing effects, for example, by explicitly measuring mediating mechanisms (e.g., self-efficacy and team identification) and investigate under which conditions one or the other path is more influential.

In general, it will be critical to know whether and how the findings reported in this dissertation will generalize to other behaviors, social groups (e.g., co-worker dyad, team, organization), and contexts. I think it is especially important to consider potential detrimental effects of psychological safety (see Newman et al., 2017). One idea could be to look at counterproductive work behavior in organizations. Researchers could collect data on dif-
ferent teams and organizations and test whether a higher psychological safety is related with the alignment of individual beliefs and behavior—namely whether psychological safety encourages individuals with positive attitudes toward counterproductive work behavior to enact these detrimental beliefs. Knowing more about how psychological safety facilitates detrimental behavior will be practically important for all organizations which seek to enhance psychological safety in their work environment.

5.5 Conclusion

With this dissertation, I set out to generate novel insights into how psychological safety is related with safety-relevant and risk-taking behavior as well as with individual behavior in social contexts in general. While the empirical body on psychological safety has grown over the past 30 years, the center of attention may have moved further away from the construct itself. With this dissertation, the magnifying glass has been put back on psychological safety. I hope that my findings will serve as a basis for future research and that they will help teams and organizations get a little bit safer—not only psychologically, but also physically.
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Part Two
I Hear You, but Do I Understand? The Relationship of a Shared Professional Language with Quality of Care and Job Satisfaction

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Abstract

In various industries, individuals from different professions have to work together in a team to achieve their collective goal. Having gone through different educations, team members speak different professional languages, which poses a challenge to communication and coordination in interprofessional teams. A shared language is believed to improve collaboration. In this study, we examine if a shared language in interprofessional healthcare teams is associated with better relational coordination and if both are connected to higher quality of care as well as job satisfaction of the staff. We shed light on possible mechanisms between shared language, and quality of care and job satisfaction respectively, investigating relational coordination and psychological safety as mediators. We surveyed 197 healthcare workers from different professions in three rehabilitation centers in Switzerland. Multiple regression analyses showed that shared language was positively related to perceived quality of care and job satisfaction. Moreover, we found evidence for a serial mediation of these relationships by relational coordination and psychological safety. We discuss implications for healthcare and other types of interprofessional teams.
Introduction

Every year, a large number of people die in hospitals because of preventable adverse events. Estimations for the US vary from 44,000 to 98,000 deaths (Kohn, Corrigan, & Donaldson, 2000) up to 440,000 deaths per year that preventable adverse events contribute to (James, 2013). In various other countries around the world, comparable incidences are reported (e.g., Aranaz-Andres et al., 2008; Davis et al., 2002; Vincent, Neale, & Woloshynowycz, 2001; Zegers et al., 2009). Given that communication errors are found to be a root cause of many adverse events (e.g., Leonard, Graham, & Bonacum, 2004; Lingard et al., 2004; Morris et al., 2003) such as medication error or delayed treatment (Rabøl et al., 2011), we can assume that several thousand patients die in the US alone every year because of inadequate communication in interprofessional healthcare teams.

Today, interprofessional teams are used in a variety of industries, because work gets more and more complex and therefore requires a wide range of knowledge and skills that cannot be provided by one profession alone (Fay, Borrill, Amir, Haward, & West, 2006). This is especially true for the healthcare sector, where interprofessional collaboration between nurses, physicians, and other healthcare workers (HCWs) is required. Having run through different educational paths, the members of these teams often develop different values, beliefs, attitudes and behaviors (Hall, 2005). This includes differences in understanding of patient conditions and treatments and in terminology. Put simply, each profession develops its own language (Frank, 1961; Hall, 2005). This is illustrated by the finding that rehabilitation staff, when presented with a description of a patient and her performance in cognitive tests, labeled her cognitive state anywhere from “normal for her age” to “severely impaired” (Wanlass, Reutter, & Kline, 1992). It is obvious that such differences in the use
of basic terminology can lead to severe misunderstandings, which can slow down processes and potentially cause critical errors.

The importance of creating a shared language in interprofessional healthcare teams for avoiding communication-based errors has been recognized (e.g., Pamplin, Murray, & Chung, 2011; Swayne, 1993). To promote the development of a shared language, interprofessional education is one option (Priddis & Wells, 2011), although interprofessional education itself needs a shared language at its base (e.g., de Vries-Erich, Reuchlin, de Maaijer, & van de Ridder, 2017; Thistlethwaite et al., 2014). Another option is to introduce classification systems which provide clear guidance on the use of medical terminology and therefore help to establish a shared language among healthcare workers. One example is the International Classification of Functioning, Disability and Health (ICF) by the World Health Organization [WHO] (2001). The ICF is a manual which provides HCWs with a framework to define and evaluate disabilities and functions of patients by using common classifications and codes (WHO, 2001). For example, the ICF defines what a body function is and differentiates between different types of functions such as voice and speech functions. Speech functions are further divided into different aspects like fluency and speed of speech. With these classifications and definitions the ICF provides HCWs with a universal language to discuss patients’ insufficiencies and needs (Jette, 2006). The WHO (2013) states about the ICF that using a shared language makes collaboration between people from different professions more efficient.

Despite common belief that a shared language has positive effects on collaboration in interprofessional healthcare teams, quantitative research on the topic is scarce. Intervention studies have evaluated some of the instruments which are supposed to affect shared language (e.g., Cheung et al., 2012). However, to our knowledge, no study has quantitatively investigated whether a shared language actually has the anticipated positive consequences. Closest to this, one study has found a positive relationship be-
tween social capital (i.e., social resources available to a person, Coleman, 1988) and relational coordination, where shared language is a part of the cognitive dimension of social capital (Lee, 2013).

Our study tests the assumption that shared language is associated with better collaboration in interprofessional healthcare teams. We further examine if shared language is related to patient and staff outcomes (i.e., quality of care and job satisfaction) and we look at potential intermediate mechanisms, namely relational coordination and psychological safety.

With our study, we contribute to research and practice in two ways. First, our study empirically tests the relationship of a shared language in interprofessional healthcare teams with patient safety and staff outcomes. We aim to advance the conversation about whether striving for a shared language through the implementation of instruments like the ICF is worthwhile. Second, we help to improve the understanding of how shared language is related to patient and staff outcomes by suggesting possible mediating mechanisms. These insights could offer decision-makers potential starting points for interventions to improve team collaboration, overall quality of care, and job satisfaction. We hope our results prove instrumental for the prevention of communication errors which still cost lives every day.

Theory and Hypotheses

Effect of Shared Language and Mediation Through Relational Coordination

We are interested in understanding whether and how shared language is associated with quality of care and job satisfaction. We assume positive relationships between shared language and these outcomes. Furthermore, we hypothesize that these relationships
operate through improved collaboration captured by the concept of relational coordination. Relational coordination comprises two basic components: communication quality and relationship quality among groups of people working together (Gittell, 2006). Communication quality includes frequent, timely, accurate, and problem-solving focused communication (Gittell, Weinberg, Pfefferle, & Bishop, 2008). Relationship quality includes shared goals, shared knowledge, and mutual respect (Gittell, 2006).

We suggest that a shared language (e.g., using the same medical expressions and definitions) improves both, communication and relationship quality, within the interprofessional healthcare team in several ways. For example, a shared language facilitates communication between HCWs by promoting a shared understanding of patient conditions and their demands. If HCWs can resort to the same terminology, this reduces the potential for misunderstanding and error, thereby increasing communication accuracy.

The relationship quality should also improve. For example, based on Nahapiet and Ghoshal’s (1998) take on social capital theory, shared language acts as a medium of social interaction through which members of an interprofessional team can exchange and combine knowledge. This leads to shared knowledge among the team members.

Previous studies have shown that relational coordination is related to increased quality of care (e.g., Cramm & Nieboer, 2012; Gittell et al., 2000; Havens, Vasey, Gittell, & Lin, 2010) and higher job satisfaction of team members (Gittell, Weinberg, Pfefferle, et al., 2008). High-quality communication allows team members to perform better. For example, frequent and timely communication gives team members more opportunities to update other team members regarding their actions, plans, and unexpected events, allowing them to adapt to the new situation. Also, fewer communication failures should occur, eventually translating into a better care quality (Williams et al., 2010). Furthermore, high-
quality relationships, characterized by shared goals, shared knowledge and mutual respect, positively affect job satisfaction (Gittell, Weinberg, Pfefferle, et al., 2008). Therefore, we hypothesize that shared language is positively related to quality of care and job satisfaction and that relational coordination in interprofessional healthcare teams acts as a mechanism for the two relationships.

**Hypothesis 1:** Shared language between HCWs is positively associated with (a) quality of care and (b) HCWs’ job satisfaction.

**Hypothesis 2:** Relational coordination between HCWs mediates the relationships of shared language between HCWs with (a) quality of care and (b) HCWs’ job satisfaction.

**Mediation Through Psychological Safety**

We argue that psychological safety mediates the relationships of relational coordination with quality of care and job satisfaction. Psychological safety can be described as team members’ belief that their team is safe to take interpersonal risks (e.g., to speak up about issues), without fearing negative reactions or consequences by the other members (Edmondson, 1999).

Relational coordination incorporates high-quality relationships and communication, which should foster psychological safety in interprofessional teams. According to social exchange theory, reciprocal exchange evoke trust between the exchanging individuals (Blau, 1964). Relational coordination, including mutual respect, knowledge sharing, frequent and timely communication, is characterized by positive, reciprocal social exchange between members from the interprofessional team and should therefore promote an open and trusting working climate (Carmeli & Gittell, 2009). Social exchange also reduces uncertainty regarding the
behavior of other team members, thereby diminishing their fear of unforeseen negative reactions by other team members (Siemsen, Roth, Balasubramanian, & Anand, 2009). This suggests that relational coordination is positively associated with psychological safety, where team members feel safe to challenge the status quo by speaking about errors that occurred or making suggestions for improvement. Supporting our assumption, psychological safety has been found to mediate the relationship between high-quality relationships (operationalized by relational coordination’s relationship qualities) and learning from failures (Carmeli & Gittell, 2009).

Psychological safety, in turn, has been found to be positively associated with a number of desirable outcomes such as speaking up (e.g., Bienefeld & Grote, 2014; Detert & Burris, 2007; Liang, Farh, & Farh, 2012; Walumbwa & Schaubroeck, 2009), learning behaviors (e.g., Carmeli & Gittell, 2009; Edmondson, 1999; Hirak, Peng, Carmeli, & Schaubroeck, 2012) and performance (e.g., Baer & Frese, 2003; Kessel, Kratzer, & Schultz, 2012). We expect that these positive outcomes translate into increased quality of care in the healthcare context. For example, speaking up is considered an important factor in preventing medical errors (Okuyama, Wagner, & Bijnen, 2014). Psychological safety should therefore help to improve quality of care.

Psychological safety also enables an open team atmosphere (Edmondson, 1999). This climate is beneficial for the employees’ well-being (Kark & Carmeli, 2009) and is associated with the confidence that even when taking interpersonal risks, team members will not react negatively (Edmondson, 1999). Moreover, psychological safety is negatively related to conflict frequency in a team (Bunderson & Boumgarden, 2010). Therefore, we expect that in a team with high psychological safety, members feel more comfortable working together, which improves team members’ job satisfaction. These thoughts taken together, we hypothesize that relational coordination within interprofessional healthcare teams
is positively related to quality of care and job satisfaction and that psychological safety acts as a mechanism for the two relationships.

**Hypothesis 3:** Psychological safety mediates the relationships of relational coordination between HCWs with (a) quality of care and (b) HCWs’ job satisfaction.

Combining the above-stated hypotheses leads us to a serial mediation model, where shared language is positively related to relational coordination within interprofessional healthcare teams, which in turn is positively related to psychological safety, which in turn is positively related to quality of care and job satisfaction (see Figure 6.1).

**Hypothesis 4:** Relational coordination between HCWs and psychological safety serially mediate the relationships of shared language between HCWs with (a) quality of care and (b) HCWs’ job satisfaction.
Materials and Methods

Sample and Procedure

We gathered data from three Swiss rehabilitation centers. All three centers had, either recently or some time ago, implemented the ICF framework. The ICF was intended to facilitate the development of a shared language across professions. We expect that the development would only gradually be realized, therefore creating variance in the degree of shared language across professions. This created the opportunity to test the impact of shared language on the hypothesized outcomes, and the path through which shared language impacts those outcomes. We contacted currently employed HCWs from the three centers and encouraged them to complete our questionnaire either online or on paper.

In total, 237 employees started the questionnaire, of which we excluded 40 participants (16.9%) because their data was missing either for all \(N = 29\) or some \(N = 11\) of our model constructs completely, resulting in a final sample of 197 participants. Where we had item missing data, we used the remaining item data for scale means (Newman, 2014). From the final sample, 79 participants (40.1%) worked at rehabilitation center A, 59 participants (29.9%) worked at center B and 59 participants (29.9%) worked at center C. We registered a response rate of 19.3% for center A and a response rate of 67.8% for center C.\(^1\)

The final sample of 197 consisted of 150 women (76.1%) and 46 men (23.4%) with one participant not answering the question. The average age was 38.49 years \((SD = 10.27)\), ranging from 22 to 66 years. Most participants were Swiss (71.1%) followed by German (20.3%), French (2.0%), Dutch (2.0%), Austrian (1.5%),

\(^1\)Since the HCWs were contacted via a contact person from within the center, we do not have the exact number of HCW who have been contacted for the study for center B. Therefore, we cannot provide a response rate for center B.
Table 6.1

Sample Characteristics Segmented by Rehabilitation Centers

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Center A (n = 79)</th>
<th>Center B (n = 59)</th>
<th>Center C (n = 59)</th>
<th>Total (N = 197)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>37.08 (9.15)</td>
<td>38.44 (10.92)</td>
<td>40.47 (10.90)</td>
<td>38.49 (10.27)</td>
</tr>
<tr>
<td>Job tenure</td>
<td>11.83 (8.17)</td>
<td>12.86 (9.78)</td>
<td>14.93 (10.88)</td>
<td>13.06 (9.57)</td>
</tr>
<tr>
<td>Organizational tenure</td>
<td>6.32 (5.43)</td>
<td>6.30 (6.47)</td>
<td>8.99 (8.02)</td>
<td>7.11 (6.69)</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>78.5</td>
<td>66.1</td>
<td>83.1</td>
<td>76.5</td>
</tr>
<tr>
<td>Nationality (% non-Swiss)</td>
<td>30.4</td>
<td>45.8</td>
<td>10.2</td>
<td>28.9</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing staff</td>
<td>68.4</td>
<td>55.9</td>
<td>39.0</td>
<td>56.4</td>
</tr>
<tr>
<td>Therapists</td>
<td>13.9</td>
<td>20.3</td>
<td>49.2</td>
<td>26.7</td>
</tr>
<tr>
<td>Social care staff</td>
<td>6.3</td>
<td>10.2</td>
<td>6.8</td>
<td>7.7</td>
</tr>
<tr>
<td>Physicians</td>
<td>6.3</td>
<td>8.5</td>
<td>3.4</td>
<td>6.2</td>
</tr>
<tr>
<td>Administrative staff</td>
<td>2.5</td>
<td>5.1</td>
<td>1.7</td>
<td>3.1</td>
</tr>
</tbody>
</table>

*Note.* Means with standard deviations in parentheses are presented for variables age, job tenure, and organizational tenure; percentages are presented for all other variables.

and other nationalities (3.1%). Most participants were nurses and other care workers (55.8%) followed by occupational, physical and speech therapists (26.4%), social and psychological workers (7.6%), physicians (6.1%) and administrative staff (3%) with 2 participants not answering this question. Respondents from the nursing profession were slightly over- and the physicians under-represented. On average the participants had worked for 13.06 years (SD = 9.57) in their jobs and for 7.11 years (SD = 6.69) in their current institution. Table 6.1 provides a summary of sample characteristics segmented by study site.

Measures

Shared Language

HCW.s reported the degree to which a shared language is used with different professions. The measure was constructed to be similar
to the measure of relational coordination (Gittell, 2002). Participants were asked “All in all, how uniformly do the members of the following professions speak a shared language?” and rated the degree of shared language with each of the professional groups that are involved in the rehabilitation process of the institution (e.g., physicians, nurses and other care staff, occupational therapists, and social workers) separately. The mean of all the ratings was used for data analysis. The response scale ranged from 1 = *not at all* to 5 = *completely*.

**Relational Coordination**

Relational coordination was measured using the items from Gittell (2002). They were slightly adapted to better suit our setting, e.g., by referring to “the patient” instead of “the status of joint replacement patients.” Five of the seven relational coordination qualities were included in our survey: mutual respect, shared knowledge, shared goals, communication frequency and communication timeliness. The remaining two qualities, communication accuracy and problem-solving communication, were dropped due to constraints regarding the length of the questionnaire. Similarly to Gittell, Weinberg, Pfefferle, et al. (2008), who also assessed only two communication qualities, we assume that the overall score still represents the relational coordination construct.

Similar to shared language, participants rated each relational coordination quality with regard to each of the professional groups involved in the rehabilitation process. Two sample items were: “All in all, how frequently do you communicate with the members of the following professions?” for communication frequency, and “All in all, how much do the members of the following professions respect you and the work you do with the patient?” for mutual respect. The two communication qualities included two ratings per profession, one referring to ad hoc communication, the other referring to communication using official communication platforms.
Since we were interested in all communication channels, we averaged the two ratings. Answers were measured on a 5-point scale with anchors that matched the corresponding quality ($\alpha = .81$).

To arrive at an overall relational coordination score, consistent with previous research (e.g., Gittell, Weinberg, Bennett, & Miller, 2008; Havens et al., 2010), we first averaged the ratings for each quality, then computed the mean of the five quality scores. Principal component analysis showed that the five quality scores yielded one factor with an eigenvalue of 2.86 and factor loadings for all dimensions $\geq .73$.

**Psychological Safety**

We used four items by Edmondson (1999) to assess psychological safety. A sample item was: “All members of the team are able to bring up problems and tough issues”. The items were assessed with regard to the interprofessional team and the own profession. For our analysis, we used the mean of all eight ratings. The response scale ranged from 1 = *strongly disagree* to 5 = *strongly agree* ($\alpha = .73$).

**Job Satisfaction**

To measure overall job satisfaction, we used one item similar to the one used by Scarpello and Campbell (1983). The item read: “All in all, I am very satisfied with my job”. Previous research showed that for global or overall job satisfaction, a single-item measure is appropriate and has good psychometric properties (Scarpello & Campbell, 1983; Wanous & Hudy, 2001; Wanous, Reichers, & Hudy, 1997). The response scale ranged from 1 = *strongly disagree* to 5 = *strongly agree*. 
Quality of Care

We assessed quality of care with self-developed items based on the definition of quality care by Brook, McGlynn, and Shekelle (2000). As postulated by Brook et al. (2000), the two most important aspects of high quality of care are technical quality and respect towards patients. High technical quality means that treatments are performed in a professional way and based on the latest knowledge. Respectful treatment means to allow patients to participate in decisions regarding their therapy and, for example, incorporating their goals and obtaining their approval regarding the treatment. Quality of care was measured using 6 items: “The benefit of every treatment is evident”; “All treatments are performed in a professional way”; “All treatments are in accordance with the newest state of knowledge”; “The goals of the patient are considered when setting objectives”; “We take it very seriously that the patient agrees to the treatment objectives”; “In my opinion, the rehabilitation quality is very good here”. As with all the other measures, the items were rated by the HCWs and not the patients. The response scale ranged from 1 = strongly disagree to 5 = strongly agree ($\alpha = .85$).

Control Variables

We included participants’ affiliation to rehabilitation centers as a control variable, because we expected differences between centers for all our model variables. To control for affiliation to rehabilitation center we used dummy coding with the center with the highest subsample, center A, as reference group.

Confirmatory Factor Analyses

Since all model constructs were rated by HCWs, we conducted a confirmatory factor analysis (CFA) to test if the items used to
measure the constructs load on corresponding latent factors. We conducted the CFA using R 3.5.0 (R Core Team, 2017) and the R package lavaan (Rosseel, 2012), and specified a five-factor model including all items used to measure shared language, relational coordination, psychological safety, quality of care, and job satisfaction. For psychological safety, we used four parcels, each incorporating the same item asked with regard to the two different reference groups (i.e., interprofessional team and own profession). Four cases (2.5%) of our total sample of 197 had missings on at least one of the items or parcels and were excluded for this analysis. Results showed that all items loaded significantly on the corresponding latent factors ($p < .001$) and our measurement model had a reasonable model fit overall: $\chi^2(111) = 227.48, p < .001$; comparative fit index (CFI) = .90; root mean square error of approximation (RMSEA) = .07, 90% confidence interval (CI) [.06, .09]; standardized root mean square residual (SRMR) = .05. This five-factor model had a significantly better fit than a one-factor model, where all items and parcels loaded onto one single latent factor: $\chi^2(119) = 386.21, p < .001$; CFI = .77; RMSEA = .11, 90% CI [.10, .12]; SRMR = .08; $\Delta\chi^2 = 158.72, p < .001$.

**Results**

**Data Analysis**

We used SPSS 24 for data analysis. Intercorrelations, means and standard deviations for key study variables are presented in Table 6.2. To test our hypotheses, we conducted multiple regression analyses with Hayes’ (2013) PROCESS macro for SPSS. Mediation was tested with PROCESS by computing an indirect effect and constructing a 95% bootstrap CI using 10,000 bootstrapped samples (Preacher & Hayes, 2008). We tested separate models for each of our hypotheses and our two outcome variables, quality
Table 6.2

<table>
<thead>
<tr>
<th>Measure</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Center B</td>
<td>0.30</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>2. Center C</td>
<td>0.30</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>3. Shared language</td>
<td>3.79</td>
<td>0.64</td>
<td>.16**</td>
<td>.23***</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4. Relational coordination</td>
<td>3.67</td>
<td>0.41</td>
<td>.20**</td>
<td>.16*</td>
<td>.59***</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>5. Psychological safety</td>
<td>4.03</td>
<td>0.60</td>
<td>.03</td>
<td>.23***</td>
<td>.37***</td>
<td>.42***</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>6. Quality of care</td>
<td>4.04</td>
<td>0.59</td>
<td>.20**</td>
<td>.26***</td>
<td>.51***</td>
<td>.54***</td>
<td>.51***</td>
<td>—</td>
</tr>
<tr>
<td>7. Job satisfaction</td>
<td>4.34</td>
<td>0.69</td>
<td>.18*</td>
<td>.14*</td>
<td>.26***</td>
<td>.31***</td>
<td>.46***</td>
<td>.57***</td>
</tr>
</tbody>
</table>

Note. Ns range from 194 to 197 due to missing data.

*Affiliation to rehabilitation center was dummy coded with center A as reference group, 1 indicates affiliation to that center and 0 indicates affiliation to one of the other two centers.

*p < .05. **p < .01. ***p < .001.

of care and job satisfaction. For missing data, we used pairwise deletion. All significance tests were two-tailed.

Test of Hypotheses

Hypothesis 1 proposed that a shared language between HCWs is positively associated with (a) quality of care and (b) HCWs’ job satisfaction. We found significant total effects of shared language on quality of care (β = .41, p < .001) and on job satisfaction (β = .17, p = .018). Therefore, Hypotheses 1a and 1b were supported.

Hypothesis 2 predicted that the relationships of shared language among HCWs with (a) quality of care and (b) HCWs’ job satisfaction will be mediated by relational coordination among HCWs. We found a significant indirect effect of 0.17, 95% CI [0.09, 0.26], from shared language through relational coordination (β = .54, p < .001) to quality of care (β = .33, p < .001). Similarly, we found a significant indirect effect of 0.12, 95% CI [0.01, 0.25], from shared language through relational coordination
(β = .54, p < .001) to job satisfaction (β = .20, p = .020). Thus, Hypotheses 2a and 2b were supported.

Hypothesis 3 proposed that psychological safety mediates the relationships of relational coordination between HCWs with (a) quality of care and (b) HCWs’ job satisfaction. We found a significant indirect effect of 0.17, 95% CI [0.09, 0.28], from relational coordination through psychological safety (β = .39, p < .001) to quality of care (β = .30, p < .001). Similarly, we found a significant indirect effect of 0.25, 95% CI [0.14, 0.41], from relational coordination through psychological safety (β = .39, p < .001) to job satisfaction (β = .39, p < .001). Therefore, Hypotheses 3a and 3b were supported.

Hypothesis 4 predicted that relational coordination between HCWs and psychological safety serially mediate the relationships of shared language between HCWs with (a) quality of care and (b) HCWs’ job satisfaction. As depicted in Table 6.3 and Figure 6.2, we found a significant indirect effect of 0.04, 95% CI [0.02, 0.09], from shared language through relational coordination (β = .54, p < .001), next through psychological safety (β = .31, p < .001) to quality of care (β = .28, p < .001). Controlling for the two mediators reduced the total effect of shared language on quality of care (β = .41, p < .001) to a still significant direct effect (β = .18, p = .008). Thus, Hypothesis 4a was supported.

Similarly, as depicted in Table 6.3 and Figure 6.3, we found a significant indirect effect of 0.07, 95% CI [0.03, 0.13] from shared language through relational coordination (β = .54, p < .001), next through psychological safety (β = .31, p < .001) to job satisfaction (β = .39, p < .001). Controlling for the two mediators reduced the total effect of shared language on job satisfaction (β = .17, p = .018) to a non-significant direct effect (β = .01, p = .929). Therefore, Hypothesis 4b was supported.
Table 6.3: Multiple Linear Regression Analyses for the Serial Mediation Models Predicting Quality of Care and Job Satisfaction

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Quality of Care</th>
<th></th>
<th>Job Satisfaction</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center B (vs. A)</td>
<td>.13 (p = .000)</td>
<td>.12 (p = .000)</td>
<td>.19 (p = .000)</td>
<td>.24 (p = .000)</td>
</tr>
<tr>
<td>Center C (vs. A)</td>
<td>.39 (p = .000)</td>
<td>.90 (p = .329)</td>
<td>.41 (p = .000)</td>
<td>.41 (p = .329)</td>
</tr>
<tr>
<td>Shared language</td>
<td>.54 (p = .000)</td>
<td>.15 (p = .058)</td>
<td>.41 (p = .000)</td>
<td>.41 (p = .058)</td>
</tr>
<tr>
<td>Relational coordination</td>
<td>.31 (p = .000)</td>
<td>.25 (p = .000)</td>
<td>.08 (p = .329)</td>
<td>.08 (p = .329)</td>
</tr>
<tr>
<td>Psychological safety</td>
<td>.28 (p = .000)</td>
<td>.39 (p = .000)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[R^2\] = .37, .22, .33, .46, .12, .26

\[F\] = 37.36, .000, 13.88, .000, 31.23, .000, 32.40, .000, 8.37, .000, 13.12, .000

Note. \(N = 197\). \(b\) values are standardized regression coefficients.

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Figure 6.2. Serial mediation model showing the effect of shared language on quality of care mediated by relational coordination and psychological safety. Values depicted are standardized regression coefficients. The total effect of shared language on quality of care is written in parentheses.

**p < .01. ***p < .001.

Figure 6.3. Serial mediation model showing the effect of shared language on job satisfaction mediated by relational coordination and psychological safety. Values depicted are standardized regression coefficients. The total effect of shared language on job satisfaction is written in parentheses.

*p < .05. ***p < .001.
Discussion

The main goal of our study was to examine the role of shared language in the context of interprofessional collaboration in healthcare. To test the assumption of the ICF and other classification systems that a shared language among HCWs is vital, we investigated the relationship of shared language with important outcomes and underlying mechanisms. The results support our proposed models. We found a positive relationship of shared language with quality of care and job satisfaction. Both of these relationships were serially mediated by relational coordination and psychological safety.

The results indicate that the relationship with quality of care as the outcome was partially mediated whereas the relationship with job satisfaction was fully mediated. This suggests that in the case of quality of care, shared language explains variance which is not captured by relational coordination or psychological safety. One possibility is that shared language directly leads to fewer communication errors. For example, using the same terminology should eliminate certain types of communication problems, which might not be captured by relational coordination’s communication qualities, therefore exerting a direct effect on quality of care. In contrast, our two tested mediators explain most of the shared variance between shared language and job satisfaction, rendering the direct effect non-significant. Therefore, we may have caught the most important mediators with relational coordination and psychological safety.

Overall, our findings indicate that a shared language between HCWs is associated with better interprofessional collaboration in healthcare teams and with higher quality of care as well as higher job satisfaction of HCWs. Psychological safety in those interprofessional teams seems to play an important role in mediating these effects.
Theoretical Implications

Our study contributes to the existing literature in three ways. First, it provides quantitative evidence for a positive relationship between shared language, relational coordination, and beneficial outcomes, namely quality of care and job satisfaction. Previous literature on the potential positive effects of shared language in the healthcare sector has mainly used qualitative methods (e.g., Cedraschi, Nordin, Nachemson, & Vischer, 1998; Cheung et al., 2012) without directly addressing the relationship between shared language and quality of care or job satisfaction. Our study therefore extends previous literature with quantitative and more specific support for the assumed beneficial effects of shared language.

Second, with shared language we have identified a valuable antecedent of relational coordination, extending the existing theory. Previous studies have explored a number of antecedents, for example, supervisory span (Gittell, 2001), high performance work practices (Gittell, Seidner, & Wimbush, 2010), boundary spanners, and team meetings (Gittell, 2002). However, this study is the first to explore the impact of shared language on relational coordination. Given the strong relationship between them, we think shared language is an important antecedent and might even be a prerequisite for developing relational coordination.

Third, we shed light on the mechanisms that act between shared language and outcomes. Besides relational coordination we found that psychological safety mediates said relationships. Based in part on previous findings (Carmeli & Gittell, 2009), we proposed psychological safety to be a mechanism between relational coordination and our outcome variables. Whereas Carmeli and Gittell (2009) solely looked at the relationship quality of relational coordination, we considered the whole relational coordination construct, including communication quality. Communication quality, which includes frequent, timely, accurate, and problem-solving focused communication, is critical for a successful coordi-
nation in care. This is illustrated by the finding that communication failures (e.g., due to poor timing or inaccurate information) can lead to inefficiency, delay, and even errors (Lingard et al., 2004). Therefore, our study advances the work of Carmeli and Gittell (2009) by including care-critical communication quality. Our results are consistent with the notion that relational coordination could help to foster psychological safety in teams, enriching our understanding of how psychological safety is created in teams and organizations.

Limitations

A limitation of our study is that we cannot rule out that the chain of causality between shared language, relational coordination, psychological safety, and quality of care and job satisfaction is different. For example, it is possible that a psychologically safe climate in an interprofessional team promotes the development of relational coordination, because in psychologically safe teams, individuals feel safer to share information and knowledge (Kessel et al., 2012). Theoretically, one could also argue for a mutually enforcing relationship between relational coordination and psychological safety. To gain certainty over the causal processes, longitudinal data is necessary, with which developmental aspects can be captured.

Gathering all data from one source (i.e., the HCW) can lead to common method bias, resulting in statistically inflated or deflated observed relationships (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Yet, we sought to reduce the common method bias through psychological separation (Podsakoff et al., 2003) by using different response formats for shared language and relational coordination (items referring to each professions) on the one hand, and psychological safety, quality of care and job satisfaction (items referring to team or general situation) on the other.
Finally, we used a new measure for quality of care. Our reliability test and CFA looked promising. However, to gain further confidence in the validity of this measure it should be tested in other samples and future studies should aim to include objective quality indicators (e.g., objective patient outcomes).

Future Research on Shared Language

Future research could take a closer look at the construct of shared language and try to further dissect it. In our study, we provided positive results by measuring shared language in a general way. It would be interesting to see what is needed to create shared language and which specific elements constitute a successful shared language. A more detailed look at the term “shared language” and its elements could help to gain further insights into what exactly is necessary to improve interprofessional collaboration.

Moreover, the implementation of interprofessional education or of frameworks such as the ICF, which are aimed at creating a shared language, should generally be accompanied by quantitative research to test its success more objectively (e.g., Cheung et al., 2012). Such studies would allow to gain further insights into the efficacy and practicability of interventions targeted at shared language.

Our study provides first evidence that a shared language in interprofessional healthcare teams is associated with better performance in the form of quality of care. Future studies could try to replicate and further develop our model in other contexts. There is an increasing number of organizational contexts today where employees with different professions or different educational backgrounds have to work together. We expect that shared language in interprofessional teams from other industries such as research or product development works in similar psychological mechanisms and therefore also leads to higher quality work and higher employee job satisfaction via increased relational coordination and
psychological safety. We hope that our research can be the starting point of further studies investigating shared language in interprofessional teams from a variety of industries.

Practical Implications and Conclusion

Our findings reinforce the calls for a shared language in the interprofessional healthcare sector (e.g., Pamplin et al., 2011; Swayne, 1993). The results provide quantitative support for the importance of shared language for interprofessional collaboration. Therefore, it is important to promote efforts to enhance shared language in interprofessional teams, for example by means of interprofessional education or the use of classification systems like the ICF.

Our findings also provide insights into possible mechanisms, through which a shared language may influence outcomes. For practitioners, these represent potential starting points for alternative interventions in areas where a shared language might be very difficult to achieve. Supporting leaders in establishing relational coordination and psychological safety could be a possible course of action. For example, supportive (Edmondson, 1999) and inclusive (Nembhard & Edmondson, 2006) leaders who are open to and invite speaking up behavior have been shown to be associated with a psychologically safer climate.

In conclusion, we hope that our findings will engender a new research stream on shared language. Learning more about how shared language develops and what specific characteristics of shared language improves collaboration as well as psychological safety in interprofessional teams will contribute to enhance team performance and deliver better care. In healthcare, we believe that a new perspective and focus on shared language can help prevent at least some of the futile deaths caused by communication errors.
Ethics Statement

For this study, we gathered survey data. Participants received written information about the study prior to answering the questions and had the opportunity to decline to participate in the study without any negative consequences. Participants gave their consent by continuing with the study either by clicking on a button (online version) or by filling in the questionnaire (paper version). No personal health-related or patient-related data were assessed. Furthermore, the survey was completely confidential and the data anonymized after completion of the study. Therefore, in compliance with Swiss national law, no ethics approval was necessary.

Author Contributions

MS was responsible for developing the theoretical model, analyzing the data, and drafting and revising the manuscript. GG contributed to project planning, GG and JS contributed to drafting and revising the manuscript and approved the submitted version.

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Zegers, M., de Bruijne, M. C., Wagner, C., Hoonhout, L. H. F., Waaijman, R., Smits, M., . . . van der Wal, G.
To Get Vaccinated or Not? Psychological Safety as a Catalyst for Alignment Between Individual Beliefs and Behavior

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Abstract

While many studies have investigated the consequences of psychological safety for behavior, there is little theorizing on the mechanisms that account for these effects. Since psychological safety makes individuals feel safe to express their true self, we argue that it should act as a catalyst for alignment between individual beliefs and behavior. Drawing on the reasoned action model, we postulate that psychological safety interacts with individuals’ attitudes and perceived norms in predicting intention and behavior. We tested our model with physicians’ influenza vaccination behavior. We surveyed 208 physicians from a Swiss hospital before and after the vaccination phase. Results show that the effect of attitude, but not perceived norm, on intention to get vaccinated was moderated by perceived psychological safety in the physicians’ team: High psychological safety strengthened the effect of physicians’ attitude on their intention, which in turn predicted actual vaccination behavior. We provide first evidence that high psychological safety may render individuals more comfortable to act in accordance with their attitudes. Depending on whether attitudes are in line with organizational goals, increasing psychological safety could facilitate positive or negative consequences. This more differentiated understanding of psychological safety can fruitfully inform both future research and organizational practice.
Introduction

Psychological safety—defined as a belief that it is safe to take interpersonal risks in a team (Edmondson, 1999)—is widely considered to be an important team climate that yields several beneficial outcomes for the team and its members as well as for organizations (Edmondson & Lei, 2014; Frazier, Fainshmidt, Klinger, Pezeshkan, & Vracheva, 2017; Newman, Donohue, & Eva, 2017). Among these effects are increases in speaking up or voice (e.g., Bienefeld & Grote, 2014; Detert & Burris, 2007), reporting of patient treatment errors (Leroy et al., 2012), learning behavior in teams (e.g., Edmondson, 1999; Van den Bossche, Gijsselaers, Segers, & Kirschner, 2006), perceived quality of care (Stühlinger, Schmutz, & Grote, 2019), and general team performance (Schaubroeck, Lam, & Peng, 2011). However, as Sanner and Bunderson (2015) argue, psychological safety might be more appropriately looked at as a moderator variable, since it is most often described as a climate that facilitates behaviors such as reporting errors rather than directly stimulating them.

Only few studies have looked at psychological safety’s moderating effects so far. For example, high psychological safety has been found to mitigate the negative effect of task conflict on synergistic knowledge development (Mu & Gnyawali, 2003), and enabled a positive effect of task conflict on team performance (Bradley, Postlethwaite, Klotz, Hamdani, & Brown, 2012). Pearsall and Ellis (2011) investigated unethical behavior in student teams and found that utilitarianism—an ethical orientation aimed at maximizing the utility or pleasure for actors (Mill, 1863)—was more strongly associated with team cheating behavior in teams with high rather than low psychological safety. A number of theories have been used to explain specific relationships between psychological safety and other constructs (e.g., social learning theory or social exchange theory, see Newman et al., 2017). However, there is little theorizing on psychological safety’s basic work
mechanisms. We argue that it is important to gain a better understanding of the theoretical underpinnings of psychological safety and its role as an enabling climate, especially because it has been shown that psychological safety does not only enable positive behavior (e.g., learning behavior; Edmondson, 1999), but can also facilitate detrimental behavior (e.g., behavior that goes against social or institutional norms; Pearsall & Ellis, 2011).

With our paper, we aim to contribute to the psychological safety literature in two ways. First, we flesh out a general theoretical model on psychological safety’s work mechanisms. We draw on the reasoned action model (RAM; Fishbein & Ajzen, 2010) as the basic theory to explain how psychological safety acts as a moderating climate which interacts with individuals’ attitudes and perceived norms to shape behavior. Based on Kahn (1990) who has found that psychological safety allows individuals to express their true selves, we argue that psychological safety should act as a catalyst for alignment between individual beliefs and behavior. The extended model will allow to predict both desirable and undesirable behavior and may also be used to reinterpret previous findings regarding psychological safety.

Second, we put the proposed model to the test by applying it to an individual behavior with high social relevance: influenza vaccination behavior of physicians. Not getting vaccinated can pose health risks for healthcare workers themselves, but more importantly can endanger patients. Research has shown that vaccinated healthcare workers have a lower incidence rate of influenza infections than unvaccinated healthcare workers (Kuster et al., 2011). Also, higher vaccination rates of healthcare workers have been found to be associated with lower mortality in elderly patients (Carman et al., 2000; Hayward et al., 2006; Lemaitre et al., 2009; Potter et al., 1997). Hence, we do not only offer theoretical insights into the mechanisms underlying the effects of psychological safety, but also provide empirical evidence for those mechanisms in a highly relevant application domain.
Psychological Safety and Reasoned Action

Psychological safety is widely understood to constitute a specific climate, which allows individuals to feel safe to challenge the status quo in their social context, for example, by speaking up about errors or by suggesting changes (Edmondson & Lei, 2014). It permits “to show and employ one’s self” (Kahn, 1990, p. 708) without fear of negative consequences, such as feelings of embarrassment triggered by others’ reactions. We argue that in order to better understand the work mechanisms by which psychological safety influences individual behavior, the relationship between individual beliefs, intentions and behavior in social contexts should be examined. To this end, we will first explicate the reasoned action model (RAM), which constitutes the foundation of our research model, and apply it to our chosen context of physicians’ influenza vaccination behavior. In a second step, we will explain psychological safety’s role in predicting individual behavior.

The RAM (Fishbein & Ajzen, 2010) is among the best-known theories for predicting behavior. It has been found to predict a wide range of behaviors (Albarracin, Johnson, Fishbein, & Mueller-leile, 2001; Armitage & Conner, 2001; Godin & Kok, 1996), such as losing weight (Schifter & Ajzen, 1985), pro-environmental behavior (De Leeuw, Valois, Ajzen, & Schmidt, 2015), or entrepreneurship (Kautonen, van Gelderen, & Fink, 2015). The core assumptions of the RAM are that attitudes toward a behavior, perceived norms and perceived behavioral control predict an individual’s intention to engage in a specific behavior, which in turn predicts the individual’s actual behavior (Fishbein & Ajzen, 2010). A positive attitude—that is a positive evaluation of the behavior and its anticipated outcomes—will make an individual intend to act out that behavior. Perceived norms create pressure to (not) perform a behavior (Fishbein & Ajzen, 2010). These norms can be injunctive—what other people consider the right thing to do—or descriptive, that is what most people actually do (Cialdini, Kall-
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gren, & Reno, 1991; Cialdini, Reno, & Kallgren, 1990). Finally, perceived behavioral control over performing (or not performing) a behavior influences the intention to perform that behavior (Fishbein & Ajzen, 2010). In the RAM, perceived behavioral control is also used as a proxy for actual control, which acts as a facilitator in the relationship between an individual’s behavioral intentions and actual behavior (Fishbein & Ajzen, 2010).

Predicting Influenza Vaccination Behavior of Physicians

We applied the RAM to influenza vaccination behavior of physicians. We chose this behavior, because it is clear-cut (getting vaccinated or not), highly relevant, and happens in a social context which is suitable to test the role of psychological safety in the prediction of individual behavior. Co-workers are usually aware of each other’s vaccination status and may challenge individuals for their decision to get vaccinated or not, creating a situation of interpersonal risk. In addition, some healthcare workers fear vaccine side effects or question the vaccine’s effectiveness (e.g., Abramson & Levi, 2008; Heimberger et al., 1995). Therefore, physicians can develop different attitudes toward influenza vaccination. While the seasonal influenza vaccination is mandatory in some US hospitals, it is only recommended in others (Greene et al., 2018), including most hospitals in Switzerland and other European countries (Galanakis, D’Ancona, Jansen, Lopalco, & Gatekeepers, 2014; Maltezou & Poland, 2014). Since physicians are free to get vaccinated or not, the behavior is under volitional control of the individual, which is why perceived behavioral control was not considered as a predictor of intention in this study.

Based on the RAM, we hypothesize that physicians’ attitude toward getting vaccinated and their perceived norm on influenza vaccination are positively related to their intention to get vacci-
nated. Their intention, in turn, is positively related to their vaccination behavior. Previous findings seem to support predictability of parts of the RAM in the context of healthcare workers’ influenza vaccination (Cornally et al., 2013; Godin, Vezina-Im, & Naccache, 2010; Kung, 2013). According to the RAM, physicians’ attitude toward getting vaccinated is represented by how they evaluate the influenza vaccination and its potential effects. The more positive and stronger the attitude is, the stronger the physicians’ behavioral intention should be.

**Hypothesis 1:** Physicians’ attitude toward getting vaccinated is positively associated with their intention to get vaccinated.

Moreover, the RAM states that the perceived norm impacts the individual’s intention (Fishbein & Ajzen, 2010). In our context, the reference team (i.e., the team to which psychological safety and perceived norm are referred to) is the physicians team, which is a uni-professional team consisting only of physicians. In the hospital context, this should be the group with which physicians most strongly identify, and they should therefore be influenced by that group’s norms (Hogg & Reid, 2006). Accordingly, we propose that the perceived norm with regard to influenza vaccination within the physicians team influences physicians’ intention to get vaccinated.

**Hypothesis 2:** Physicians’ perceived norm on vaccination in the physicians team is positively associated with their intention to get vaccinated.

Further, based on the RAM, we hypothesize that physicians’ vaccination behavior will depend on their behavioral intentions. The stronger their intention to get an influenza vaccination, the more likely it should be that they indeed get vaccinated.
**Hypothesis 3:** Physicians’ intention to get vaccinated is positively associated with their likelihood to get vaccinated.

Finally, the RAM states that intention is actually the mechanism through which attitude and perceived norm affect an individual’s behavior (Fishbein & Ajzen, 2010). Therefore, we propose that physicians’ intention to get vaccinated acts as a mediator between their attitude toward getting vaccinated and their perceived norm on vaccination in the physicians team, and their vaccination behavior.

**Hypothesis 4:** There are indirect effects from (a) physicians’ attitude toward getting vaccinated and (b) physicians’ perceived norm on vaccination in the physicians team through physicians’ intention on their likelihood to get vaccinated.

**Psychological Safety’s Role in Predicting Vaccination Behavior**

An important aspect of psychological safety is the absence of fear of negative consequences following challenging actions such as speaking up (Kahn, 1990; Nembhard & Edmondson, 2006). Negative consequences of such challenging actions may—on the harmless end of the spectrum—include negative social reactions by team members leading to feelings of embarrassment, up to—on the harmful end—very tangible consequences such as losing one’s job. Accordingly, previous research has found the construct to be positively related to a number of interpersonally risky behavior such as speaking up within aircrew teams (Bienefeld & Grote, 2014), subordinates’ improvement-oriented voice (Detert
& Burris, 2007), reporting of treatment errors in hospitals (Leroy et al., 2012), and negatively related to different types of silence toward supervisors (Brinsfield, 2013). We argue that, by giving individuals space for expressing themselves without fear of negative consequences, psychological safety translates into low social pressure to conform to group norms. Punishing members of a social group for not adhering to group norms is one measure to enforce norms (e.g., Fehr & Fischbacher, 2004; Fehr & Gächter, 2002). Even the threat of punishment can make individuals conform to norms (Spitzer, Fischbacher, Herrnberger, Gron, & Fehr, 2007). Therefore, freeing individuals from such fears, signified by a high psychological safety, should reduce pressure exerted by social norms.

Psychological safety is connected to interpersonally risky behavior. For example, in low psychological safety teams, members do not feel safe to admit errors or ask for help (Edmondson, 1999). However, every behavior within a team contains some degree of risk of receiving negative reactions by team members such as social rejection or punishment. In fact, especially behavior which does not correspond to group norms will be interpersonally risky, since others will tend to enforce these norms by punishing the deviate (Fehr & Fischbacher, 2004; Fehr & Gachter, 2000). In low psychological safety teams, team members should therefore feel greater social pressure to adhere to the current team norm with regard to individual behaviors compared to team members in high psychological safety teams. This assumption is also compatible with the predictions of uncertainty-identity theory, which states that the more uncertain people are, the more likely they are to identify with a social group (Hogg, 2007). Psychological safety can be construed as an absence of uncertainty about how other team members will react to an individuals’ behavior, which is why in low psychological safety teams, members should feel more uncertain and therefore identify stronger with the team and follow its norms to reduce uncertainty. Hence, we hypothesize that psycho-
logical safety has a moderating impact on the effect of perceived norm on intention.

**Hypothesis 5:** Psychological safety in the physicians team moderates the relationship between physicians’ perceived norm on vaccination in the physicians team and their intention to get vaccinated: The relationship is stronger in teams with low rather than high psychological safety.

We have argued that in psychologically safe teams, individuals feel little pressure to follow the group norms. On the contrary, individuals should feel particularly comfortable to be themselves (Kahn, 1990), and act according to their personality, attitudes and opinions, even if these actions may contradict team norms. In our context, this means that physicians in psychologically safe teams should pay greater attention to their personal attitude toward influenza vaccination and develop a corresponding behavioral intention also if the team norm dictates otherwise. Thus, we hypothesize a moderating impact of psychological safety on the effect of attitude on intention.

**Hypothesis 6:** Psychological safety in the physicians team moderates the relationship between physicians’ attitude toward getting vaccinated and their intention to get vaccinated: The relationship is stronger in teams with high rather than low psychological safety.

In summary, we postulate a moderated mediation model of psychological safety’s role in the prediction of individual behavior in teams (see Figure 7.1), spelled out in the final hypothesis.
Hypothesis 7: There are moderated indirect effects from (a) physicians’ attitude toward getting vaccinated and (b) physicians’ perceived norm on vaccination in the physicians team through physicians’ intention on their likelihood to get vaccinated. Psychological safety moderates both indirect effects by (a) strengthening the effect of attitude and (b) weakening the effect of perceived norm.

Figure 7.1. Hypothesized moderated mediation model. H7 signifies the moderated indirect effect from (a) attitude and (b) perceived norm through intention to likelihood to get vaccinated.

Method

Participants and Procedure

We gathered data at two measurement points using online questionnaires that we administered in a large Swiss hospital. We contacted all physicians employed at the hospital via e-mail before the hospital started to provide free influenza vaccination at T1. We sent a link to the first questionnaire, which included the measures for attitude toward vaccination, perceived norm on vaccination, psychological safety and intention to get vaccinated.
We also assessed several descriptive variables as well as our control variables. After the end of the influenza vaccination phase, around three months after T1, we sent out the link to the second questionnaire (T2). The second survey included the measure of vaccination behavior, and some additional questions about situational aspects of the vaccination (e.g., if they received it in their ward or after an information event). These additional measures were not considered for this paper.

We contacted 816 physicians, of which 290 (35.5%) completed the first online questionnaire. Two participants commented they were not able to correctly answer the questions about their teams (perceived norm, psychological safety) and were therefore excluded. Of the remaining 288 participants, 208 (72.2%) completed the second questionnaire.

The sample at T1 included 131 females (45.5%) and 146 males (50.7%) with 11 participants not answering the question. On average, the participants were 39.42 years old (SD = 9.35), ranging in age from 25 to 66 years old. They had worked in that particular hospital for an average of 7.12 years (SD = 7.01) and in their job more generally for an average of 12.75 years (SD = 9.19). The physicians worked in different clinics of the hospital including oncology, internal medicine, pathology, surgery, anesthesia, and radiology. In the sample at T2, participants were 43.3% women, had an average age of 40.02 years (SD = 9.63), an average organizational tenure of 7.16 years (SD = 6.78), and an average job tenure of 13.34 years (SD = 9.15). We compared the sample at T2 with the participants who did not fill in the questionnaire at T2. We found no significant differences in age, $F(1,265) = 3.14$, $p = .078$, gender, $\chi^2(1, N = 277) = 1.86$, $p = .180$, organizational tenure, $F(1,239) = 0.02$, $p = .900$, or job tenure, $F(1,262) = 2.87$, $p = .091$. 
Measures

RAM variables (i.e., attitude, perceived norm, and intention) were measured with self-generated items in compliance with recommendations by Fishbein and Ajzen (2010). All self-generated items were pre-tested with 19 physicians of the same hospital. The pre-test showed there were no difficulties in answering the items and no problems with internal consistency (all Cronbach’s alpha > .70). For the intention to get vaccinated, the pre-test revealed that two items were redundant. For the questionnaire at T1, they were therefore replaced with a newly generated item.

Attitude toward getting vaccinated

We used five items to assess participants’ attitude toward vaccination. The items started with “My getting vaccinated during the upcoming influenza season would be,” followed by semantic differentials with poles such as useful vs. useless and important vs. unimportant. Answers were assessed on a 7-point scale and ranged from −3 to +3 (α = .87).

Perceived norm on vaccination

We measured participants’ perceived norm on vaccination in their physicians team with five items. Sample items were: “Members of my team think one should get vaccinated during the upcoming influenza season” and “Members of my team are getting vaccinated during the upcoming influenza season.” Participants answered on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree) (α = .92).
**Intention to get vaccinated**

We used four items to assess participants’ intention to get vaccinated. Sample items were: “I will get vaccinated during the upcoming influenza season” and “It is likely that I’m getting vaccinated during the upcoming influenza season.” Reliability analyses showed that one of the four items had a low intercorrelation with the other items. Inspection of the data showed that a large number of the participants did not answer the negatively phrased and reverse coded item consistently with the other items. Therefore, the item was excluded from our analyses. Participants answered on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) ($\alpha = .95$).

**Psychological safety**

Psychological safety was assessed using the seven-item scale by Edmondson (1999). The items were translated into German using the translation by Baer and Frese (2003) as a guideline. Items were back-translated and compared to the original items to ensure that the meaning of all items were the same as in English (Schaffer & Riordan, 2003). The items were slightly adapted to better suit our setting, changing the wording from “on/in this team” to “in my team”. A sample item was, “Members of my team are able to bring up problems and tough issues.” The rating was assessed on a response scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) ($\alpha = .78$).

**Vaccination behavior**

Vaccination behavior was measured with one item: “During the last influenza season, have you got vaccinated?” The answer was assessed in a binary format (0 = no, 1 = yes).
Control variables

We controlled for gender because women have been found to report more adverse effects from influenza vaccination than men (Beyer, Palache, Kerstens, & Masurel, 1996). Therefore, women are more likely to have had unpleasant experiences with vaccination, which might cause them to avoid future vaccinations. Furthermore, we controlled for physicians’ job tenure. Physicians with higher job tenure have more personal experience when it comes to influenza vaccination. Depending on whether negative or positive experiences (e.g., unpleasant side-effects vs. never contracting influenza) are predominant, physicians with higher job tenure could tend to develop unfavorable or favorable vaccination intentions.

We compared our results with and without control variables. Since we did not find any differences in the pattern of our results, we are going to report the results without control variables (Becker, 2005; Becker et al., 2016).

Confirmatory Factor Analyses

We conducted confirmatory factor analyses (CFAs) to test if our measurement model fits our data and if alternative models would be a better fit. We conducted the analyses using R version 3.6.1 (R Core Team, 2019) and the package lavaan (Rosseel, 2012). First, we specified a four-factor model including the items used to measure attitude, perceived norm, intention to get vaccinated, and psychological safety. The CFA showed that the model had an acceptable fit to the data, $\chi^2(164) = 350.36, p < .001$, comparative fit index (CFI) = .96, root mean square error of approximation (RMSEA) = .06, 90% confidence interval (CI) [.05, .07], standardized root mean square residual (SRMR) = .06. This four-factor model had a significantly better fit than a three-factor model with attitude and perceived norm as a combined factor,
Δχ^2(3) = 842.72, p < .001, than a three-factor model with attitude and intention to get vaccinated as a combined factor, Δχ^2(3) = 393.09, p < .001, and than a one-factor model with all items loading on a single factor, Δχ^2(6) = 1918.50, p < .001.

Results

Data Analysis

Before testing our model, we checked our data for different types of outliers, following recommendations by Aguinis, Gottfredson, and Joo (2013). In detail, we used multiple-construct techniques (standardized residuals, scatter plots, studentized deleted residuals and leverage values) and we checked for model fit outliers as well as prediction outliers (Cook’s distance, standardized difference in fits, and standardized difference in betas). To be conservative, we excluded cases only if they were identified as outliers by at least two of the techniques mentioned above. Seven cases of our sample met these criteria and were excluded from further analyses.

We used SPSS 25 to analyze our data. Descriptive statistics and correlation coefficients for the key study variables are presented in Table 7.1. To test our hypotheses, we computed a series of hierarchical linear and logistic regression analyses as well as mediation and moderated mediation analyses. All significance tests are two-tailed.

Testing Hypotheses Based on RAM

We first analyzed Hypotheses 1 to 4 which concern the RAM fundament of our research model. Hypotheses 1 and 2 proposed that physicians’ attitude toward getting vaccinated as well as their perceived norm on vaccination in the physicians team are both
positively related to physicians’ intention to get vaccinated. We analyzed the hypotheses using a linear regression model. We entered our two predictors, attitude toward vaccination and perceived norm on vaccination, to test for main effects of the predictors. Results of the linear regression analysis are depicted in Table 7.2.

As shown in Table 7.2, in Model 1, physicians’ attitude toward vaccination \((B = 1.27, p < .001; f^2 = 1.28)\) as well as their perceived norm on vaccination \((B = 0.16, p = .006; f^2 = 0.03)\) were positively and significantly associated with their intention to get vaccinated. Therefore, Hypotheses 1 and 2 were supported.

Hypothesis 3 predicted that physicians’ intention to get vaccinated is positively associated with their likelihood to get vaccinated. We analyzed Hypothesis 3 using a hierarchical logistic regression model. In Step 1, we entered attitude toward getting vaccinated and perceived norm on vaccination. In Step 2, we entered intention to get vaccinated, to test for its main effect. Results of the hierarchical logistic regression analyses are depicted in Table 7.3.

As shown in Table 7.3, in Model 2, there was a positive and significant relationship between intention to get vaccinated and
Table 7.2
Hierarchical Linear Regression Analyses Predicting Intention to Get Vaccinated from Attitude Toward Vaccination, Perceived Norm on Vaccination, and Psychological Safety

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Intention to get vaccinated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Constant</td>
<td>5.77***</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>1.27***</td>
</tr>
<tr>
<td>Perceived norm</td>
<td>0.16**</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
</tr>
<tr>
<td>Psychological safety</td>
<td>0.06</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
</tr>
<tr>
<td>Attitude × Psychological safety</td>
<td>0.21**</td>
</tr>
<tr>
<td>Perceived norm × Psychological safety</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

R²   | .65  | .65  | .67  |
F    | 261.97*** | 174.93*** | 110.25*** |
ΔR² | .00  | .01  |
ΔF  | 0.95 | 5.22** |

Note. N = 281. B values are unstandardized regression coefficients. *p < .05. **p < .01. ***p < .001.

vaccination behavior (B = 0.77, p < .001). The odds ratio (OR) for this relationship was 2.16, which indicates that physicians with strong intentions to get vaccinated were more than twice as likely to actually get vaccinated than physicians with weak intentions. Thus, Hypothesis 3 was supported.

Hypothesis 4 proposed that there are indirect effects from (a) physicians’ attitude toward getting vaccinated and (b) physicians’ perceived norm on vaccination in the physicians team through physicians’ intention to their likelihood to get vaccinated. To test for mediation in Hypothesis 4, we used PROCESS, a macro for the SPSS software package (Hayes, 2013). To test our model’s mediation effect, we constructed a bootstrap confidence interval.
Table 7.3
Hierarchical Logistic Regression Analyses Predicting Vaccination Behavior from Attitude Toward Vaccination, Perceived Norm on Vaccination, and Intention to Get Vaccinated

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Model 1</th>
<th></th>
<th>Model 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
<td>$SE$</td>
<td>$OR$</td>
<td>$B$</td>
</tr>
<tr>
<td>Constant</td>
<td>-6.16***</td>
<td>1.19</td>
<td>0.00</td>
<td>-4.47***</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>1.46***</td>
<td>0.24</td>
<td>4.32</td>
<td>0.55</td>
</tr>
<tr>
<td>Perceived norm</td>
<td>-0.01</td>
<td>0.19</td>
<td>0.99</td>
<td>-0.21</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention</td>
<td></td>
<td></td>
<td></td>
<td>0.77***</td>
</tr>
<tr>
<td>Nagelkerke $R^2$</td>
<td>.45</td>
<td></td>
<td>.54</td>
<td></td>
</tr>
<tr>
<td>Model $\chi^2$</td>
<td>65.78***</td>
<td></td>
<td>82.48***</td>
<td></td>
</tr>
<tr>
<td>$\Delta$Nagelkerke $R^2$</td>
<td></td>
<td></td>
<td>.09</td>
<td></td>
</tr>
<tr>
<td>Model $\Delta\chi^2$</td>
<td></td>
<td></td>
<td>16.70***</td>
<td></td>
</tr>
</tbody>
</table>

Note. $N = 203$. $B$ values are unstandardized regression coefficients. $OR =$ odds ratio. ***$p < .001$.

for the indirect effect (Preacher & Hayes, 2008) using 10,000 bootstrap samples generated by the PROCESS macro (Model 4). The analysis was performed separately for two mediation models, once with attitude toward getting vaccinated as the predictor, once with perceived norm on vaccination as the predictor. There was a significant indirect effect of $0.97$, 95% CI $[0.59, 1.53]$ from physicians’ attitude toward getting vaccinated through intention to get vaccinated to vaccination behavior. There was also a significant indirect effect of $0.11$, 95% CI $[0.01, 0.26]$ from

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1While a dichotomous outcome such as our vaccination behavior leads to scaling differences between different logistic regression models, the product of path coefficients can still be used to test for mediation effects (e.g., MacKinnon, Lockwood, Brown, Wang, & Hoffman, 2007; Preacher, 2015; Valeri & VanderWeele, 2013).
physicians’ perceived norm on vaccination in the physicians team through intention to get vaccinated to vaccination behavior. Therefore, Hypotheses 4a and 4b were supported.

**Testing Hypotheses on Psychological Safety**

Next, we analyzed Hypothesis 5 to 7 which concern psychological safety’s role in the prediction of individual behavior. Hypothesis 5 predicted that psychological safety in the physicians team moderates the relationship between physicians’ perceived norm on vaccination in the physicians team and their intention to get vaccinated such that psychological safety weakens the relationship. We analyzed the hypotheses using a hierarchical linear regression model. In Step 1, we entered our two predictors, attitude toward vaccination and perceived norm on vaccination. In Step 2, we entered the moderator—psychological safety. In Step 3, the two interaction terms of attitude toward vaccination with psychological safety and perceived norm on vaccination with psychological safety were entered to test for moderation effects. Results of the hierarchical linear regression analyses are depicted in Table 7.2. Predictors and the moderator were mean-centered prior to analysis.

As shown in Table 7.2, in Model 3, there was no significant interaction effect between perceived norm on vaccination and psychological safety on intention to get vaccinated ($B = -0.04, p = .533; f^2 = 0.00$). Therefore, Hypothesis 5 was not supported.

Hypothesis 6 predicted that psychological safety in the physicians team moderates the relationship between physicians’ attitude toward getting vaccinated and their intention to get vaccinated such that psychological safety strengthens the relationship. As shown in Table 7.2, in Model 3, there was a significant interaction effect between attitude toward getting vaccinated and psychological safety on intention to get vaccinated ($B = 0.21,$
As can be seen in the interaction plot in Figure 7.2, among those high in psychological safety (1 SD above the mean), the relationship between attitude toward vaccination and intention to get vaccinated was stronger than with those low in psychological safety (1 SD below the mean). Thus, Hypothesis 5 was supported. Simple slope analyses showed that both slopes were significant ($B = 1.07, p < .001$ for low psychological safety and $B = 1.48, p < .001$ for high psychological safety). We further wanted to see whether there was a significant difference in intention for low vs. high psychological safety for physicians with a negative attitude specifically. To test this, we performed a simple slope analysis with switched predictor and moderator (Dawson, 2014). We found that physicians with a negative attitude toward getting vaccinated (1 SD below the mean) had a significantly weaker intention to get vaccinated when psychological safety was high rather than low, $B = -0.31, p = .003$.

Finally, Hypothesis 7 predicted that there are moderated indirect effects from (a) physicians’ attitude toward getting vaccinated and (b) physicians’ perceived norm on vaccination in the physicians team through physicians’ intention to their likelihood to get vaccinated. Psychological safety was hypothesized to moderate the indirect effects by strengthening the effect of attitude and weakening the effect of perceived norm. To test this hypothesis, we again used the PROCESS macro (Model 7) for SPSS (Hayes, 2013). Similar to the mediation analysis described above, 10,000 bootstrap samples were generated and used to construct a bootstrap confidence interval for the conditional indirect effect or moderated mediation effect. Again, the analysis was performed for the two model predictors separately.

The analysis revealed a significant moderated mediation effect of 0.12, 95% CI [0.01, 0.30] of attitude toward getting vaccinated with psychological safety through intention to get vaccinated on vaccination behavior. Conditional indirect effects of attitude through intention on vaccination behavior at varying lev-
Figure 7.2. Interaction effect between attitude toward vaccination and psychological safety on intention to get vaccinated, controlling for perceived norm. PS = psychological safety. For calculation of the plotted valued, perceived norm was set to the mean.

Levels of psychological safety are displayed in Table 7.4. Conditional indirect effects increased with higher levels of psychological safety, although all of the indirect effects were significant. However, there was no significant moderated mediation effect for perceived norm on vaccination as the predictor (0.03, 95% CI [−0.05, 0.14]). Thus, Hypothesis 7a was supported, but Hypothesis 7b was not.

Discussion

In this paper, we argued that it is important to look at psychological safety as a climate variable which exerts contextual influence on individual behavior (see Sanner & Bunderson, 2015). Drawing
Table 7.4

*Conditional Indirect Effects of Attitude Through Intention to Get Vaccinated on Vaccination Behavior*

<table>
<thead>
<tr>
<th>Psychological safety</th>
<th>Indirect effect</th>
<th>SE</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (-1 SD)</td>
<td>0.86</td>
<td>0.22</td>
<td>[0.52, 1.38]</td>
</tr>
<tr>
<td>Medium (M)</td>
<td>0.99</td>
<td>0.25</td>
<td>[0.60, 1.59]</td>
</tr>
<tr>
<td>High (+1 SD)</td>
<td>1.08</td>
<td>0.28</td>
<td>[0.64, 1.75]</td>
</tr>
</tbody>
</table>

*Note.* $N = 203$. Standard errors and 95% confidence intervals are based on 10,000 bootstrap samples.

on the RAM and the concepts of social pressure and conformity, we suggested a model which specifies the moderating role of psychological safety in the prediction of individual behavior as it occurs in a team context. We hypothesized that psychological safety would strengthen the effect of individuals’ attitude on intention to show a behavior and weaken the effect of their perceived norm on intention to show a behavior. The intention, in turn, should predict the likelihood of the individual to actually perform the behavior. We tested our model in the medical field and focused on physicians’ influenza vaccination behavior.

We found support for the hypothesized relationships based on the RAM: We found significant positive main effects for physicians’ attitude toward getting vaccinated and their perceived norm on vaccination in the physicians team on their intention to get vaccinated. Physicians’ intention, in turn, had a positive effect on their likelihood to get vaccinated. Regarding our main research question about the moderating effect of psychological safety, we found that the effect of attitude on intention was strengthened by psychological safety experienced by physicians in their team. Physicians with a positive attitude toward getting vaccinated were even more inclined to actually get vaccinated when they worked in a team in which they felt psychologically safe. Thus, psychological safety strengthened the effect of a positive attitude towards...
a desirable behavior. In the same way, psychological safety also strengthened the effect of a negative attitude towards a desirable behavior: Physicians with a negative attitude toward getting vaccinated were even less inclined to get vaccinated when they worked in a team in which they felt psychologically safe. This illustrates that psychological safety (i.e., the individual’s perception of the climate) enhances the effect of the individual’s attitude—regardless of whether that attitude is positive or negative. In psychologically safe teams, individuals feel comfortable and safe to be who they are (Edmondson, 1999; Kahn, 1990). Our results provide first evidence that in teams with high psychological safety, individuals feel more comfortable and safer to act in accordance with their attitudes than in teams with low psychological safety. Therefore, increasing psychological safety can facilitate both positive and negative consequences, depending on whether the individual’s attitude is in line with an organization’s goals or ethical values.

Our results are less conclusive when it comes to the interaction between individuals’ perceived norm and psychological safety. In our sample, we did not find a significant interaction effect between the two on physicians’ intention to get vaccinated. We see two plausible reasons for this finding. First, attitude and perceived norm are interrelated. If individuals hold a strong positive or negative attitude toward a behavior, they might assume that other individuals who are important to them have a similar attitude, which translates into an attitude-congruent perceived norm (Oliver & Bearden, 1985). Also, if there is a strong positive or negative norm on a behavior in a team, individuals might assimilate their personal attitude to be in line with the perceived norm (Terry & Hogg, 1996). These crossover effects, as this phenomenon has been termed in the literature (e.g., Oliver & Bearden, 1985; Terry & Hogg, 1996), make it difficult to look at interaction effects with psychological safety separately, possibly leading to non-significant results. An experimental design with attitude and perceived norm
manipulated as independent variables could be used to isolate the two interaction effects.

Second, perceived norm and psychological safety in a team might interact in contradicting ways, which could, in combination, lead to a weak or non-significant effect. Following our hypotheses, psychological safety should reduce the effect of perceived norm on intention: with a reduced fear of negative consequences, individuals feel safer to deviate from the norm. However, psychological safety could also coincide with a generally positive team climate and a higher group cohesion. This could lead individuals to more strongly identify with the team and be more willing to accept team norms (Hogg & Reid, 2006). In these situations, the effect of perceived norms could actually be *enhanced* instead of weakened. Future research must be conducted to better understand how psychological safety and perceived norm interact and, for example, test under which conditions psychological safety weakens or strengthens the perceived norm’s effect on intention.

**Theoretical Implications**

We follow Sanner and Bunderson’s (2015) suggestion that psychological safety might be better conceptualized as a contextual, moderating variable rather than as a causing factor of, for example, learning. With our theoretical model, we illustrate how psychological safety can act as such a moderating variable in the prediction of individual behavior. It can help to better understand psychological safety’s effect mechanisms and provides a new perspective on previous research.

For example, Pearsall and Ellis’ (2011) finding that psychological safety strengthens the positive relationship between utilitarianism and cheating behavior is readily compatible with our model: If students have a utilitarian approach, this should mean that they have a positive attitude towards cheating if this behavior leads to benefits such as a higher grade. Students with
high utilitarianism (and thereby positive attitude towards cheating) should therefore be more inclined to and subsequently more likely to cheat in teams with high compared to low psychological safety.

The new perspective can enrich our understanding also in scenarios in which psychological safety has been considered to directly affect behaviors such as employee voice (Walumbwa & Schaubroeck, 2009). According to our model, psychological safety in teams should make individuals feel comfortable to act according to their personal attitudes. Therefore, especially those employees who have a positive attitude towards voice should show voice behavior in the context of high psychological safety. However, employees with a neutral or negative attitude towards voice might be largely unaffected in their voice behavior by the climate or even be encouraged to remain silent. Assuming that the majority of individuals in a group or organization has positive attitudes toward voice, psychological safety will lead to more voice, resulting in a positive relationship between psychological safety and voice behavior. However, the strength of this relationship is expected to vary across teams and organizations, since the composition of individuals with positive, neutral or negative attitudes toward voice will vary. This might illustrate and give an alternative explanation for the observation that the effect of psychological safety on learning behavior varies between studies (Edmondson & Lei, 2014; Sanner & Bunderson, 2015). Of course, future studies will need to investigate if these assumptions hold true.

A reiterated observation in the psychological safety literature is that there is little theorizing on the underlying work mechanisms of psychological safety and how it affects behaviors (Newman et al., 2017). The proposed theoretical model shows on a very basic level how psychological safety can act as a moderator in the prediction of behavior performed in a social environment. It is therefore applicable to beneficial as well as detrimental behavior, the latter of which is largely absent from the literature (Edmond-
son & Lei, 2014; Newman et al., 2017). The model can thus be used in future research on possible detrimental effects that might be facilitated by psychological safety. Also, studies investigating psychological safety’s consequences might want to consider potential unintended effects which could counteract or outweigh the beneficial consequences they are focusing on.

**Practical Implications**

In practice, our model enables the prediction of potential positive and negative consequences facilitated by enhancing psychological safety. An overwhelming majority of the current literature focuses on psychological safety’s beneficial impacts such as increased speaking up or learning behavior (Newman et al., 2017). Therefore, potential detrimental effects of increasing psychological safety in teams might be of special practical interest for supervisors in work teams. Our model and empirical findings suggest that by enhancing psychological safety, individuals will feel safer to act according to their attitudes. If these attitudes are detrimental or not in line with the organizational goals, this could have unanticipated negative effects on employees’ behavior. To counteract these unintended effects, it will be important for managers to uncover relevant attitudes and take measures to bring employees’ attitudes in line with organizational goals before enhancing psychological safety. For example, in physicians teams, enhancing psychological safety could lead to a decrease in influenza vaccination if a majority of physicians had a negative attitude towards vaccination. Thus, team leaders would have to take measures to make sure physicians’ attitudes are in line with the hospital’s recommendations, which is to increase influenza vaccination of health-care workers. For example, such encouragement could be achieved by issuing an information campaign or other educational interventions targeted at physicians’ detrimental beliefs about the vaccination (e.g., Heininger, Bächler, & Schaad, 2003;
Moreover, the model suggests that positive effects of psychological safety—like increases in error reporting and speaking up—might be boosted by taking measures to get employees’ attitudes in line with these goals. Reducing barriers to speak up, as an example, might only be one step towards getting employees to speak up. Employees also need to exhibit a positive attitude towards speaking up in order to form an intention to do it and, subsequently, perform the behavior. Therefore, if managers seek to enhance psychological safety in order to improve team performance, for example by enhancing learning behaviors, they should seek to promote employees’ attitudes towards these behaviors as well. Thereby, increasing psychological safety should be even more effective.

Limitations and Future Research

Our study has several limitations, which we want to discuss in the following. First, we conducted a study in a specific context and on a specific behavior, thus the generalizability of our results might be limited. Even though this context was particularly suitable to test our model, future studies still need to examine whether our model holds in other contexts and with other behaviors. With regard to the behavior studied, it will be important to better understand what types of behavior our model can be applied to (i.e., with which behaviors does psychological safety exert its moderating effect). For example, it will be interesting to see if our model can only be applied to overt individual behaviors which are easily spotted by other team members or if it also holds for more covert individual behaviors. To give an example, if we were to look at nurses’ hand hygiene when handling patients—would psychological safety in the healthcare team only play a role for hand hygiene which is observable by other healthcare workers, or would it also
affect covert hand hygiene behavior where no one would notice its execution (or omission). It could be argued that the moderating effect of psychological safety would be stronger in overt behaviors because social pressure (in the form of a lack of psychological safety) should be greater and therefore more effective if the behavior occurs in public rather than in private (Argyle, 1957). Whether the model can only be applied to behaviors that are permitted or if it also holds for behaviors which are prohibited is also worth examining. This question could be asked with regard to permission or acceptance in the team, the organization, or the society. For example, with an organizational focus, it would be interesting to see whether psychological safety plays a role in counterproductive work behavior. The findings of Pearsall and Ellis (2011) could suggest that psychological safety does not only facilitate permitted but also prohibited behaviors. Future studies could investigate the type of behavior as a moderator of the effect of psychological safety, translating into a three-way interaction between the type of behavior, psychological safety, and attitude or perceived norm for predicting intentions and behavior.

Second, we could not collect objective behavioral measures, because the hospital could not provide data on the individual vaccination status of physicians based on ethical reasons. Although self-reported vaccination behavior comes close to actual vaccination behavior, physicians may have answered our question in a socially desirable way. This might be reflected in the higher reported vaccination rate in our study compared to the overall vaccination rate of physicians in the hospital. Then again, these differences could also be due to a sampling bias with physicians who encourage influenza vaccination being more interested in the topic and more inclined to participate in a study about vaccination than physicians who do not encourage influenza vaccination. Since physicians know that the hospital tracks who is getting vaccinated and who is not, the effect of social desirability might be weakened. Also, our study was completely anonymous and the
participating hospital did not receive any data that would allow to match answers with participants. Nevertheless, future studies could prevent social desirability biases by gathering data on actual, objective behavior.

Third, our study is based on data provided by a single source: All model constructs were measured using self-report ratings by the same individual—the physician. This can lead to a common method bias, which can inflate or deflate associations (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Certainly, attitude, perceived norm and intention are individual and subjective in nature and thereby best captured by self-report. However, psychological safety, actual work team norm, and behavior could also be measured using ratings by other team members or, in the case of behavior, objective data. Future studies could therefore try to incorporate additional data sources to further strengthen the design and assess the relationship between model variables with less common method variance. It would also be interesting to incorporate ratings of all or several members per team, for example for psychological safety and team norm. This would allow to test a multilevel model, where attitude, intention, and behavior are measured at the individual level and team norm and psychological safety are measured at the team level. This would provide a better understanding of how individual perceptions of the team and measures on the team level interact and which variables are more important when it comes to predicting individual team members’ behavior.

Fourth, with our field study, we were not able to support our hypothesis regarding the interaction between psychological safety and perceived norm. Further studies need to be conducted in order to either gain evidence for that part of our proposed model or else to gain insights into how to modify the model to accurately predict individual behavior. Given that some of the model’s constructs might be related in intricate ways, as explained above, it could be beneficial to conduct psychological experiments to disentangle the constructs in order to look at their effects separately.
Conclusion

Our theorizing and empirical evidence on differential effects of psychological safety will hopefully constitute a starting point for a new research stream within the psychological safety literature. The current, mostly one-sided view on psychological safety needs to be calibrated through a more nuanced understanding of both opportunities and risks that psychological safety might facilitate in teams and organizations as a contextual factor. Given that much of the psychological safety research has been conducted in high-risk environments such as healthcare, this new stream of research might not only help to make organizations a psychologically safer place, but also promote physical safety.

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Psychological Safety’s Role in the Prediction of Risk Taking in Teams: Interaction Effects with Team Members’ Attitude and Perceived Team Norm

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Abstract

Psychological safety is known to facilitate interpersonal risk taking (e.g., speaking up). However, we do not know if and how it affects individual, task-related risk taking in a team, where the behavior could have negative consequences for all members. We propose that psychological safety functions as a contextual factor which interacts with individuals’ attitudes and perceived norms in predicting risk taking. In two scenario-based online experiments, we tested whether participants' intention to take risk in an online game depended on their attitude, perceived norm and psychological safety in a fictitious team. A third study examined a student sample’s actual risk-taking behavior in an online game. We found that psychological safety interacted with individuals’ attitude toward risk taking, with psychological safety mainly weakening the effect of attitude on risk taking. This effect can be beneficial or detrimental for teams, depending on the role and desirability of risk taking as part of the task.
Introduction

A large part of the work that is performed in organizations today cannot be carried by single individuals, but rather needs to be tackled by a team of employees. With increasing practical relevance, teams have also become an integral part of research in the field of organizational psychology and related fields (Kozlowski, 2018). Inter alia, the research seeks to understand what leads to successful teamwork and good team performance (Mathieu, Hollenbeck, van Knippenberg, & Ilgen, 2017). Among many factors, psychological safety seems to play an important role—a team climate which promotes team learning behavior (Edmondson & Lei, 2014; Frazier, Fainshmidt, Klinger, Pezeshkan, & Vracheva, 2017; Newman, Donohue, & Eva, 2017).

Psychological safety makes team members feel safe to take interpersonal risks (Edmondson, 1999). Generally, risk taking refers to any behavior that can potentially lead to a loss or negative outcome for the individual (Byrnes, Miller, & Schafer, 1999; Furby & Beyth-Marom, 1992). For interpersonally risky behaviors—for example, speaking about an error one committed—the risk lies in potential negative reactions by other team members in the form of social disapproval or even tangible consequences such as getting punished (Edmondson, 1999; Nembhard & Edmondson, 2006). While many studies show that psychological safety enhances interpersonally risky behaviors such as speaking up (Bienefeld & Grote, 2014), error reporting (Leroy et al., 2012), or knowledge sharing (Mu & Gnyawali, 2003; Siemsen, Roth, Balasubramanian, & Anand, 2009), we currently do not know how the team climate affects task-related risk taking. Specifically, we are interested in individual task-related risk taking that is enacted in the team environment and where the behavior involves risk for the whole team. In this case, the task-related risk taking also involves interpersonal risk because team members could disapprove of the risk-taking behavior. Psychological safety has many positive ef-
fects, which is why many practitioners seek to promote it in their teams. Therefore, it is important to better understand how psychological safety is (if at all) related to task-related risk taking, which by definition includes the possibility of positive as well as negative consequences. In our study, we investigate the role that psychological safety plays in individual risk taking performed in a team context which has consequences for the whole team.

To our knowledge, there are very few studies that look at psychological safety and risk-taking behavior that is potentially harmful. Pearsall and Ellis (2011) found that psychological safety strengthened the positive effect of utilitarianism on cheating behavior in student teams. Thus, psychological safety presented a context which facilitated cheating that involves potentially harmful consequences. However, in the study, the risk of suffering those consequences was very low for students, because they cheated with respect to the grade they gave themselves and they must have been certain that their cheating would not be detected. Stühlinger, Schmutz, Schlegel, Nicca, and Grote (2019) found that psychological safety strengthened the effect of physicians’ attitude toward vaccination on their intention to get vaccinated and subsequent reported influenza vaccination behavior. Here, psychological safety facilitated vaccination but also its omission, depending on the physician’s attitude. Both the behavior as well its omission involve risk of negative consequences—either a risk of suffering side-effects from the vaccination, or an increased risk of acquiring influenza and spreading it to patients. However, the influenza vaccination behavior of physicians is “positive” in a way that its performance is in line with the organizational recommendation and socially desirable, because it presumably helps to decrease hospital acquired infections (Kuster et al., 2011).

With our study, we want to contribute to the literature on psychological safety in three ways. First, we aim to investigate whether psychological safety exerts a moderating effect on individual task-related risk taking involving consequences for the whole
team. Based on the reasoned action model (Fishbein & Ajzen, 2010), Stühlinger et al. (2019) proposed a general model to predict individual behavior in a team context, in which psychological safety interacts with individuals’ attitudes and perceived norms. We apply this model to risk-taking behavior and test the theoretical assumptions. One difficulty in testing the proposed model is that attitudes and perceived norms are related (e.g., Hogg & Reid, 2006; Oliver & Bearden, 1985). Therefore, an experimental design is needed in order to disentangle the proposed interaction effects of psychological safety with attitude and perceived norm. Experimental manipulation of the independent variables as well as psychological safety as the moderator will allow us to look at the individual interaction effects separately.

Second, our experimental design allows us to test causal relationships. To date, there is very little work on psychological safety involving experiments (for a recent exception, see Deng, Leung, Lam, & Huang, 2019). Experimental studies offer unique methodological benefits over correlational designs such as increased internal validity and the possibility to test the causal direction of relationships. We contribute to the literature by offering an experimental paradigm for manipulating psychological safety and also by providing experimental results on the causal workings of psychological safety.

Third, the findings of our study may have important practical implications. Knowing if and how psychological safety affects individual risk taking in teams can inform practitioners what to look out for if they seek to enhance psychological safety in their teams. Moreover, if they should seek to promote or demote risk taking in their teams—depending on their field of work—psychological safety could be an important facilitator to make use of.

In the following, we will first provide theoretical and empirical background on the reasoned action model and risk taking, which will serve as a basis for our research model. Then, we will link this
foundation to the psychological safety literature and describe how psychological safety affects the previously outlined relationships.

**Reasoned Action in Risk Taking**

Risk taking usually involves potential gains or positive consequences as well as potential losses or negative consequences (Ben-Zur & Zeidner, 2009). Decision makers may see risk as an opportunity for gain and choose to take it (Highhouse & Yuce, 1996). If individual risk taking occurs in a team environment, the behavior can also entail positive and negative consequences for the team. For example, if an employee violates safety regulations to get a task done more quickly, this might entail safety hazards not only for the employee alone, but also for other team members. Individual, task-related risk taking in a team can therefore include a risk that the whole team suffers negative consequences as well as a chance that it gains positive consequences.

In the vast literature on risk taking, several studies have looked at risky behavior from the perspective of the reasoned action model. The reasoned action model states that an individuals’ attitude, perceived norm, and perceived behavioral control lead to an intention to perform a behavior and the intention, in turn, is associated with the individuals’ actual behavior (Ajzen, 1991; Fishbein & Ajzen, 2010). Individuals’ attitudes correspond to their evaluation of a given behavior—for example, if they think a behavior is good vs. bad, comfortable to perform vs. uncomfortable, or useful vs. useless. Perceived norm (also referred to as subjective norm) stands for individuals’ belief that other people who are important to them perform the behavior themselves and that they think it is the right thing to do. These normative aspects correspond to what is known as the descriptive norm and injunctive norm, respectively (Cialdini, Kallgren, & Reno, 1991; Cialdini, Reno, & Kallgren, 1990). Perceived behavioral control is
in accordance with individuals’ belief that they have what it takes to perform their behavior, that the behavior is completely under their control. Finally, individuals’ intention corresponds to their planning or willingness to perform the behavior in question.

Several studies and meta-analytic reviews have found evidence that the reasoned action model (or at least parts of it) can be used to predict risk-taking behaviors such as alcohol consumption and binge drinking (Cooke, Dahdah, Norman, & French, 2016; Norman, 2011; Norman, Armitage, & Quigley, 2007; Norman & Conner, 2006), smoking (Topa & Moriano, 2010), cannabis and ecstasy use (Conner & McMillan, 1999; Orbell, Blair, Sherlock, & Conner, 2001), risky behaviors in driving such as speeding and dangerous overtaking (Parker, Manstead, Stradling, Reason, & Baxter, 1992), use of pirated software (Liao, Lin, & Liu, 2010), and gambling (Martin et al., 2010; Sheeran & Orbell, 1999; Walker, Courneya, & Deng, 2006; Zeelenberg & Pieters, 2004).

Based on this research, we postulate that, on a general level, individuals’ attitude toward risk taking as well as their perceived norm have a direct impact on their risk-taking behavior. This should also be true in the case where the individual acts in a team environment and where the individual’s task-related risk taking might have potential negative effects for the team. Additionally, when working in a team, team members are an important source for social norms. The individual team member observes whether other members take risks themselves and may also learn whether they think it is right to engage in risk-taking behaviors. These perceptions are part of what is coined the perceived norms in the reasoned action model (Fishbein & Ajzen, 2010). We refer to the perceptions of the norm within the team as the perceived team norm. Based on the reasoned action model, we postulate that the perceived team norm acts as an individual’s normative belief and is predictive of the individual risk-taking behavior.
Hypothesis 1: Individuals’ attitude toward risk taking has a main effect on their risk taking in the team: Risk taking will be higher for positive (vs. negative) attitude.

Hypothesis 2: Individuals’ perceived team norm on risk taking has a main effect on their risk taking in the team: Risk taking will be higher for positive (vs. negative) perceived team norm.

The Role of Psychological Safety in Risk Taking

In this paper, we want to clarify psychological safety’s role when it comes to individual risk taking in a team environment. In teams with high psychological safety, members feel comfortable to be who they are, because they do not fear that their team mates would react negatively towards them (Kahn, 1990; Nemhard & Edmondson, 2006). Thus, psychological safety nurtures team members’ belief that they can engage in behaviors that they consider the right thing to do, but which could also spark negative reactions by challenging the status quo (Edmondson & Lei, 2014), such as speaking up or voice (Bienefeld & Grote, 2014; Detert & Burris, 2007).

In contrast, low psychological safety in a team manifests itself with an amplified concern about or fear of negative reactions by other team members. Generally, negative social reactions should be especially likely if an individual’s behavior goes against team norms. This relationship should be even more pronounced when it comes to individual risk taking in teams: Individual risk taking in a team context can include both possible gains and losses for the whole team. Engaging in a risky behavior even though the
team norm states otherwise—or not taking risks to achieve potential gains although the team norm supports it—should lead to negative reactions by team members. Already the fear of negative reactions make team members conform to the team norm (Spitzer, Fischbacher, Herrnberger, Gron, & Fehr, 2007). Therefore, low psychological safety in a team basically exerts social pressure on the individual team members to adhere to team norms (Stühlinger et al., 2019). Conversely, high psychological safety in a team should alleviate the fear of negative reactions, thereby reducing social pressure and attenuating the effect of the team’s norm. With high psychological safety, team members feel safe to be themselves (Kahn, 1990). Thus, they feel safe to act according to their own personal attitude—even if that means to take risks which could potentially affect the team.

**Hypothesis 3:** The effect of individuals’ attitude toward risk taking on their risk-taking behavior is moderated by psychological safety in the team: Higher psychological safety strengthens the effect of the attitude.

**Hypothesis 4:** The effect of individuals’ perceived team norm on their risk-taking behavior is moderated by psychological safety in the team: Higher psychological safety weakens the effect of the perceived team norm.

To test our hypotheses, we conducted three experiments. In Study 1a and 1b, we ran scenario-based online experiments. We tested whether a participants’ hypothetical risk taking (i.e., their intention to take risk) in a fictitious online team game depended on their experimentally manipulated attitude, perceived team norm and psychological safety. In Study 2, participants’ actual risk-taking behavior was assessed. Specifically, we tested whether a student sample’s risk-taking behavior in an actual team game de-
pended on their manipulated attitude, perceived team norm and psychological safety in a virtual team.

**Study 1a: Scenario-Based Online Experiment on Intention to Take Risk**

**Method**

**Research design and participants**

Our scenario-based online experiment used a 2 (attitude toward risk taking: negative vs. positive) × 2 (perceived team norm on risk taking: negative vs. positive) × 2 (psychological safety in the team: low vs. high) between-subjects design. Via Amazon Mechanical Turk, we recruited 220 participants who were paid $1.50 for taking part in our study. They were randomly assigned to one of the eight experimental groups with group sizes ranging between 27 and 28. On average, participants were 25.61 years of age ($SD = 11.07$), 40.2% were female, 51.8% had a Bachelor’s degree or higher, and 88.2% were currently working, either as paid employee (71.8%) or self-employed (16.4%).

**Procedure and materials**

The experiment was run online. Participants provided informed consent before starting with the experiment. First, participants read a scenario on playing a smartphone game with other people. They then answered several questions on their perceptions of the game and the other players and indicated how they would behave in that scenario. Finally, participants answered the manipulation checks and gave some personal information like their gender, age, education level and employment status.
Smartphone game scenario. Participants were asked to imagine playing an online smartphone game in a virtual team together with two unknown players. The game consisted of quiz and chat phases. During the quiz phase, they answered several knowledge questions by choosing the right out of four given answers. All players answered on their own. If they chose the right answer, they would gain +1 point, if they chose a wrong answer, they would get 0 points. In addition, each player had the opportunity to use a risk option (called “Joker” in the study), which deleted some of the wrong answers. After using the risk option, if they chose the right answer, they would still gain +1 point, but if they chose a wrong one, they would lose −1 point for the team. Afterwards, it was revealed to the whole team who chose which answer, if the risk option was used and what points were gained or lost for the team. The goal of the game was to defeat an opposing team by gaining more points than they do. Between quiz phases, there were chat phases, where team members sent each other messages on their strategy. After the chat phase, a new quiz phase started.

Attitude manipulation. Participants’ attitude toward risk taking was manipulated by providing them with different instructions on the risk option in the game. According to the reasoned action model, an individual’s attitude toward a behavior depends on their behavioral beliefs—i.e., their perception of the likelihood that a specific outcome of the behavior occurs and the outcome’s desirability (Fishbein & Ajzen, 1975, 2010). In our setting, participants’ attitudes toward risk taking depends on what they perceive to be relevant outcomes of using the risk option and how likely and desirable these are. In the game scenario, the most relevant outcome is the risk options’ effect on gaining or losing points and ultimately winning or losing the game. We manipulated participants’ perceived likelihood of gaining points through using the risk option by instructing them that it either deleted one wrong answer (negative attitude condition) or two wrong answers (positive
attitude condition). Additionally, to manipulate participants’ perceived desirability of losing points by using the risk option, they read that choosing a wrong answer after using the risk option lead to the team losing either a full point (negative attitude condition) or half a point (positive attitude condition).

**Perceived team norm manipulation.** To mimic a chat phase, participants were shown fictitious chat messages of their imagined team members. We manipulated participants’ perceived team norm on risk taking within the chat messages. According to the reasoned action model, an individual’s perceived norm depends on their normative beliefs—i.e., their perception of approval of the behavior by a certain individual or group (Fishbein & Ajzen, 2010). In our setting, the imagined team members were the reference group. We manipulated participants’ normative belief on risk taking by showing a chat message where the members either stated that they will not use the risk option (descriptive norm) and that it is too risky to do so (injunctive norm) in the negative perceived team norm condition, or that they will use the risk option (descriptive norm) and that this will help the team gain points (injunctive norm) in the positive perceived team norm condition.

**Psychological safety manipulation.** In another quiz phase, additional fictitious chat messages were shown in order to manipulate perceived psychological safety in the imagined team. As described, psychological safety is a team climate where team members do not fear negative reactions of other members (Edmondson, 1999). Based on the questionnaire scale by Edmondson (1999)—the most widely used instrument to measure psychological safety in the literature (Newman et al., 2017)—we chose “making errors” and “making suggestions” as typical behaviors that would help distinguish between low and high psychological safety teams. We
manipulated the level of perceived psychological safety by showing messages where a fictitious team member either complained to the participant about making too many mistakes and refused another team member’s offered strategy (low psychological safety) or where the team member remarked the whole team made many mistakes and they should learn from them and embraced another team member’s offered strategy (high psychological safety).

**Intention to take risk (dependent variable).** After the manipulation of all independent variables, participants were asked about their intention to use the risk option in the described scenario. Participants had to rate for how many questions out of ten they would use the risk option given that they did not know the answer to any of the questions (scale ranging from 0 to 10).

**Manipulation checks.** After measuring our dependent variable, we asked the participants several questions to be able to check if our manipulations had the intended effects.

**Attitude manipulation check.** We assessed participants’ attitude toward risk taking with five items generated based on recommendations by Fishbein and Ajzen (2010). The general question read “Imagine you’ve finished the game. Looking back on your experiences with the game, how do you feel about using the Joker? Using the Joker during the game seems . . . ,” followed by five semantic differentials, for example useless vs. useful and bad vs. good ($\alpha = .90$).

**Perceived team norm manipulation check.** We measured participants’ perceived team norm on risk taking with three items generated based on recommendations by Fishbein and Ajzen (2010). Sample items were “The members of the team think that I should use the Joker in the game,” and “The members of the
team would use the Joker themselves”. Participants answered on a 7-point scale ranging from $1 = \text{strongly disagree}$ to $7 = \text{strongly agree}$ ($\alpha = .96$).

**Psychological safety manipulation check.** We assessed participants’ perceived psychological safety in the team with the seven items by Edmondson (1999), slightly adapted to better fit our setting. Two sample items read “If you make a mistake on this team, it is often held against you,” and “Playing with members of this team, my unique skills and talents are valued and utilized”. Participants answered on a 7-point scale ranging from $1 = \text{strongly disagree}$ to $7 = \text{strongly agree}$ ($\alpha = .82$).

**Results**

**Preliminary analyses**

First, we checked whether the manipulations were successful. We used independent t-tests to examine mean differences of the manipulation check scales between experimental groups. We found that participants in the negative attitude condition did not have a significantly lower attitude toward risk taking than participants in the positive attitude condition, $M = 4.39$ ($SD = 1.33$) vs. $M = 4.55$ ($SD = 1.42$), $t(218) = -0.84$, $p = .404$. Further, participants in the negative perceived team norm condition indeed perceived a significantly weaker team norm on risk taking than did participants in the positive perceived team norm condition, $M = 2.07$ ($SD = 1.09$) vs. $M = 5.60$ ($SD = 1.02$), $t(218) = -24.74$, $p < .001$. Similarly, participants in the low psychological safety condition perceived a significantly lower psychological safety in the fictitious team than participants in the high psychological safety condition, $M = 3.44$ ($SD = 0.90$) vs. $M = 4.71$ ($SD = 0.84$), $t(218) = -10.81$, $p < .001$. 
Test of hypotheses

Since our dependent variable is a proportion measure, the data are most accurately analyzed using a generalized linear model (GzLM) with a binomial distribution and logit link (see Smithson & Merkle, 2014). Therefore, to check for mean differences in participants’ intention to take risk between conditions, we analyzed our data using a GzLM with attitude, perceived team norm, and psychological safety conditions as predictors and we included the interaction terms of attitude and psychological safety as well as perceived team norm and psychological safety.

We found that participants in the positive attitude condition reported significantly higher intention to take risk than participants in the negative attitude condition, estimated marginal means ($M_{EM}$) = 0.40 vs. $M_{EM}$ = 0.34, Wald $\chi^2(1, N = 220) = 7.63$, $p = .006$. Similarly, participants in the positive perceived team norm condition reported significantly higher intention to take risk than participants in the negative perceived team norm condition, $M_{EM}$ = 0.45 vs. $M_{EM}$ = 0.30, Wald $\chi^2(1, N = 220) = 49.54$, $p < .001$. The average reported intention to take risk did not differ significantly between high and low psychological safety conditions, $M_{EM}$ = 0.35 vs. $M_{EM}$ = 0.39, Wald $\chi^2(1, N = 220) = 2.64$, $p = .104$. Therefore, Hypothesis 1 and 2 were supported.

Furthermore, there was a significant interaction effect between attitude and psychological safety (see Figure 8.1): The mean difference of participants’ reported intention to take risk between negative and positive attitude was larger for high rather than low psychological safety, Wald $\chi^2(1, N = 220) = 5.05$, $p = .025$. Pairwise comparisons using Bonferroni correction revealed that attitude had a significant effect on intention to take risk when psychological safety was high ($M_{EM}$ = 0.41 vs. $M_{EM}$ = 0.30, $\Delta M_{EM} = 0.10$, 95% Wald confidence interval [CI] [0.03, 0.18], $p = .002$), but not when psychological safety was low ($M_{EM}$ = 0.39 vs. $M_{EM}$ = 0.38, $\Delta M_{EM} = 0.01$, 95% Wald CI [−0.07, 0.09],
Thus, Hypothesis 3 was supported. However, no support was found for Hypothesis 4—the interaction effect between perceived team norm and psychological safety was not significant, Wald $\chi^2(1, N = 220) = 0.00, p = .989$.

![Interaction effect on intention to take risk by attitude toward risk taking and psychological safety in Study 1a.](image)

**Figure 8.1.** Interaction effect on intention to take risk by attitude toward risk taking and psychological safety in Study 1a.

**Discussion**

In Study 1a, as a first step to investigate psychological safety’s contextual role in predicting task-related risk taking, we looked at its interaction effects with participants’ attitude and perceived team norm on the intention to take risk in a fictitious online game. The results in Study 1a provide first experimental evidence of an interaction effect between psychological safety and attitude on individuals’ intention to take risk: Psychological safety strengthened
the effect of participants’ attitude toward risk taking on their intention to take risk. This finding is compatible with what has been found previously (Stühlinger et al., 2019). Similar to those previous findings, psychological safety did not moderate the effect of perceived team norm on individuals’ intention to take risk.

Our preliminary analyses showed that the manipulation check for the attitude manipulation was not successful, even though the conditions led to significant mean differences in participants’ intention scores. It is thus possible that the attitude manipulation did not affect participants’ conscious attitude toward risk taking or that the effect had faded off by the end of the experiment. In addition, we found that the perceived team norm manipulation had a significant effect on psychological safety: Participants’ reported psychological safety was higher in the positive perceived team norm condition than in the negative perceived team norm condition. This effect might be due to the referencing to risk in the manipulation: In the negative perceived team norm condition, one of the chat messages read that it is too risky to use the risk option, which might have had a priming effect on participants and their perception of (interpersonal) risk within the team, thereby lowering their perceived psychological safety. To address the shortcomings of the attitude and perceived team norm manipulations, we adapted them and ran a second online experiment.
Study 1b: Scenario-Based Online Experiment with Adapted Attitude and Perceived Team Norm Manipulations

Method

Participants

As in Study 1a, we employed a scenario-based online experiment with a 2 (attitude toward risk taking: negative vs. positive) × 2 (perceived team norm on risk taking: negative vs. positive) × 2 (psychological safety in the team: low vs. high) between-subjects design. Via Amazon Mechanical Turk, we recruited 302 participants who were paid $1 for taking part in our study. They were randomly assigned to one of the eight experimental groups with group sizes ranging between 37 and 39. On average, participants were 37.79 years of age (SD = 11.00), 43.4% were female, 50.0% had a Bachelor’s degree or higher, and 83.0% were currently working, either as paid employee (62.0%) or self-employed (21.0%).

Procedure and materials

Study procedure and materials mirrored those in Study 1a: First, participants gave informed consent. Next, they read the scenario on the online smartphone game and then answered questions on their perceptions, how they would behave in that scenario, and gave personal information such as their gender and age. While we used the same psychological safety manipulation as in Study 1a, manipulations of attitude and perceived team norm were adapted in order to strengthen the effect of attitude and to prevent the unintended main effect of perceived team norm on psychological safety.
**Attitude manipulation.** To increase the effect of the attitude manipulation, we added a summarizing statement about the usefulness of the risk option (again called “Joker” in the study) to the instruction after its function was explained. In the negative attitude condition, the statement read: “Therefore, using the Joker can be detrimental,” whereas in the positive attitude condition, it read: “Therefore, using the Joker can be beneficial.” By giving additional information about the usefulness of the risk option, participants should develop stronger attitudes. Also, for participants who may have difficulties or lack motivation to estimate the probabilities of gaining and losing points in order to make a judgment about the usefulness of the risk option, the summary statements represented a convenient shortcut.

**Perceived team norm manipulation.** The perceived team norm manipulation was changed to minimize its main effect on psychological safety by rephrasing the fictitious chat messages. In the negative perceived team norm condition, the imagined team members stated that they *will not* use the risk option (as in Study 1a) and that the team can make it without using the risk option (new), omitting the sentence about it being too risky. In the positive perceived team norm condition, the fictitious team members stated that they *will* use the risk option (as in Study 1a), and that it is good to use any help the team can get (new), omitting the sentence that the risk option will help to gain points.

**Intention to take risk (dependent variable).** As in Study 1a, the intention to take risk was measured by asking how many out of ten times they would use the risk option in the described scenario, with the answering scale ranging from 0 to 10.

**Manipulation checks.** At the end of the online experiment, after assessing the dependent variable, we asked the participants
the same questions as in Study 1a to assess their attitude, perceived team norm and psychological safety in order to check if our manipulations had the intended effects.

Results

Preliminary analyses

First, we checked if the experimental manipulations were successful by employing independent t-tests. We found significant mean differences in the corresponding scale measures for attitude conditions, $M = 3.94$ ($SD = 1.23$) vs. $M = 5.11$ ($SD = 1.25$), $t(300) = -8.25, p < .001$, perceived team norm conditions, $M = 2.36$ ($SD = 1.33$) vs. $M = 5.73$ ($SD = 1.08$), $t(300) = -24.16, p < .001$, and psychological safety conditions, $M = 3.53$ ($SD = 0.88$) vs. $M = 4.76$ ($SD = 0.80$), $t(300) = -12.65, p < .001$.

Test of hypotheses

As in Study 1a, we analyzed our data using a GzLM with binomial distribution and logit link to check for hypothesized mean differences and interaction effects. We found that participants in the positive attitude condition reported significantly higher intention to take risk than participants in the negative attitude condition, $M_{EM} = 0.49$ vs. $M_{EM} = 0.23$, Wald $\chi^2(1, N = 302) = 205.18, p < .001$. Also, participants in the positive perceived team norm condition reported significantly higher intention to take risk than participants in the negative perceived team norm condition, $M_{EM} = 0.44$ vs. $M_{EM} = 0.27$, Wald $\chi^2(1, N = 302) = 82.86, p < .001$. Contrary to what we found in Study 1a, the average reported intention to take risk differed significantly between high and low psychological safety conditions, $M_{EM} = 0.32$ vs. $M_{EM} = 0.38$, Wald $\chi^2(1, N = 302) = 9.71, p = .002$. Still, Hypothesis 1 and 2 were supported.
Moreover, there was a significant interaction effect between attitude and psychological safety (see Figure 8.2): The mean difference of participants’ reported intention to take risk between negative and positive attitude was larger for low rather than high psychological safety, Wald $\chi^2(1, N = 302) = 7.56, p = .006$. Pairwise comparisons using Bonferroni correction showed that attitude had a significant effect on intention to take risk when psychological safety was low ($M_{EM} = 0.55$ vs. $M_{EM} = 0.23$, $\Delta M_{EM} = 0.32$, 95% Wald CI [0.25, 0.38], $p < .001$) as well as when psychological safety was high ($M_{EM} = 0.43$ vs. $M_{EM} = 0.23$, $\Delta M_{EM} = 0.20$, 95% Wald CI [0.14, 0.27], $p < .001$). Though we found support that psychological safety moderates the effect of attitude, the impact of psychological safety was in the opposite direction than we predicted in Hypothesis 3: Higher psychological safety weakened rather than strengthened the effect of attitude.

Finally, there was a significant interaction effect between perceived team norm and psychological safety (see Figure 8.3): The mean difference of participants’ reported intention to take risk between negative and positive perceived team norm was larger for high rather than low psychological safety, Wald $\chi^2(1, N = 302) = 7.44, p = .006$. Pairwise comparisons using Bonferroni correction revealed that perceived team norm had a significant effect on intention to take risk when psychological safety was high ($M_{EM} = 0.43$ vs. $M_{EM} = 0.23$, $\Delta M_{EM} = 0.21$, 95% Wald CI [0.14, 0.27], $p < .001$), as well as when psychological safety was low ($M_{EM} = 0.44$ vs. $M_{EM} = 0.32$, $\Delta M_{EM} = 0.12$, 95% Wald CI [0.05, 0.19], $p < .001$). Even though the finding again supported that psychological safety moderates the effect of perceived team norm, also in this case, the impact of psychological safety was in the opposite direction than we predicted in Hypothesis 4: Higher psychological safety strengthened rather than weakened the effect of perceived team norm.
Discussion

In Study 1b, we replicated the main effects of attitude and perceived team norm on the intention to take risk. By adjusting the manipulations of attitude and perceived team norm, we found that psychological safety moderated the effects of attitude and perceived team norm on intention in unexpected ways. The results provide evidence that in a controlled experimental setting, psychological safety in a team appears to weaken the effect of attitude and to strengthen the effect of perceived team norm on intention to take risk. In teams with higher psychological safety, a positive attitude toward risk taking seems to have less impact on individuals’ intention to take risk, which would make risk taking less likely. Also, in teams with higher psychological safety,
a negative perceived team norm seems to have greater influence on individuals’ intention to take risk, which should further reduce risk taking.

Using the risk option in Study 1a and 1b represented a form of risk taking, because it entailed potential gains as well as potential losses for the team in the scenario. By manipulating the usefulness of the risk option, we also manipulated its risk probability. In the positive attitude condition, more wrong answers were deleted compared to the negative attitude condition. Coupling point loss with giving a wrong answer meant that participants in the positive attitude condition perceived a higher risk of losing points than participants in the negative attitude condition. In addition, psychological safety had an unintended significant main
effect on intention to use the risk option in Study 1b. This effect might have occurred due to the manipulation being coupled with the quiz and the mentioning of making too many mistakes. The latter was especially salient in the low psychological safety condition, where the participant was accused directly. This could have led participants to consider taking the risk option more often. Therefore, we sought to further improve on these manipulations in Study 2.

Moreover, Study 1a and 1b were both conducted on the platform Amazon Mechanical Turk and in both we looked at participants’ behavioral intentions based on a scenario. To gain more insight into which of the diverging results from study 1a and 1b are more valid and how they generalize to a real situation with real behavior, we conducted a third experiment where participants engaged with a simulated team task to assess actual risk-taking behavior.

**Study 2: Online Experiment on Actual Risk-Taking Behavior**

**Method**

**Research design and participants**

In our third online experiment, we again employed a 2 (attitude toward risk taking: negative vs. positive) \( \times \) 2 (perceived team norm on risk taking: negative vs. positive) \( \times \) 2 (psychological safety in the team: low vs. high) between-subjects design. We recruited 267 participants who were currently enrolled at a Swiss university, via e-mail lists and online platforms. Participants received about $20 for taking part in our study. They were randomly assigned to one of the eight experimental groups. Following the recommendations by Aguinis, Gottfredson, and Joo (2013), we
conducted outlier analyses using multiple criteria (i.e., deviance residual, Cook’s distance, leverage value). Based on the analyses, we excluded two cases, which were consistently identified as outliers. This left us with a total sample of 265 participants with 31 to 35 per experimental group. On average, participants were 24.02 years of age ($SD = 4.29$), and 70.3% were female.

**Procedure and materials**

Following Study 1a and 1b, we designed an online experiment around an actual quiz game performed in a virtual team. In the recruitment process, prospective participants were told they were going to play an online quiz where they would be teamed up with two other participants, who were in fact preprogrammed. First, participants gave informed consent. Initial information included deception on the preprogrammed team members. Our study was approved by the institutional ethics committee (2017-N-11). To make our cover story about the team members believable, participants had to register for a time slot. They were subsequently contacted at their chosen date and time via e-mail and led to an online platform, where they started with the actual experiment.

In the online experiment, participants first had to answer questions about their usual behavior when working in a team. Subsequently, they were shown the preprogrammed answers of their team members. Different answering patterns were used to manipulate psychological safety within the virtual team. Second, participants were instructed on the online quiz. Similar to the scenario in Study 1a and 1b, participants had to answer 20 questions and gain points for the team by choosing the right out of five presented answers. To further motivate the participants to gain points, they were told to get a monetary bonus for the team if the final team score was high enough (without specifying a threshold). Furthermore, participants could use a button termed “cheat”, which eliminated some of the wrong answers, but also entailed a
predefined risk of 30% that they would get caught by the computer and lose one point. Involving both possible gains and losses for the team, using the button represented risk taking in our experiment. Different instructions on the usefulness of the button were used to manipulate participants’ attitude toward risk taking. After selecting an answer, a scoring screen was shown displaying each team members’ chosen answers, whether they cheated and if they earned or lost any points for the team. Participants were further instructed that after the quiz, the team members would decide via voting which team member would receive how much of the gained monetary bonus. Therefore, participants knew they could be made accountable for their behavior and that this could have real-life negative consequences, thus rendering psychological safety within the team relevant.

Third, participants had to write down, which strategy they were going to follow during the quiz. Subsequently, the team members’ preprogrammed answers were shown, differing in content to manipulate perceived team norm on risk taking. Fourth, participants ran through the quiz game answering 20 questions in total. After the quiz, participants filled in the manipulation checks and answered some questions on their person and the experiment. Finally, they were debriefed and thanked for their participation. All in all, the study took about 20–30 minutes to complete.

**Quiz.** The quiz consisted of 20 questions, which were developed for this experiment. Questions ranged over a variety of topics such as geography, history, arts, sports and philosophy. They were broadly categorized into three different difficulty levels with 10 difficult questions, 5 moderate, and 5 easy questions. The easy and moderate questions were employed to maintain participants’ interest and motivation, while the dependent variable was derived from participants’ risk taking during the difficult questions. The questions were qualitatively pretested with five participants, where comprehensibility of the questions and the five specified answers
were examined. Based on the results, some of the questions and answers were slightly tweaked. In a second, quantitative pretest with 32 participants, the participants’ answering behavior (i.e., right answers and number of times the risk option was used per question) was assessed and the results matched the intended difficulty levels of the questions (see Appendix). Participants ran through the 20 questions in random order.

**Psychological safety manipulation.** In Study 1b, the psychological safety manipulation had a main effect on intention to use the risk option. To minimize this unintended effect, we developed a new psychological safety manipulation based on the psychological safety measure by Edmondson (1999). We created a questionnaire, where participants answered questions in relation to how they usually behave when they work with a team. Edmondson’s (1999) items were adapted and complemented to become poles of a continuum, where participants had to place themselves. Sample item were, “I do not like it if members of my team bring up problems and tough issues” vs. “I think it is good if members of my team bring up problems and tough issues,” and “If members of my team make a mistake, I often held it against them” vs. “If members of my team make a mistake, I do not hold it against them”. After answering the questionnaire, the screen depicted a summary of the preprogrammed answers of the team members. That way, participants got an impression of how their virtual team members behave in teams, making them feel more or less safe for their collaboration in the quiz game, depending on their team members’ answers.

The summary included a short statement about the team members’ behaviors. It either read “The other two members of your team reported that they hold mistakes against their team members and that they prefer them to do their job without bringing up problems or asking for help” (low psychological safety condition), or “The other two members of your team reported that
they think it is good if their team members speak openly about problems and that they do not mind if others make mistakes or ask for help” (high psychological safety condition). In addition, to add depth and realism, the answers of the team members were depicted individually by showing the items and red lines to indicate their preprogrammed answers. Like the quiz questions, the psychological safety manipulation was pretested (see Appendix).

**Attitude manipulation.** The attitude manipulation was similar to the one used in Study 1a and 1b. Based on Fishbein and Ajzen (2010), we manipulated participants’ attitude toward risk taking (i.e., using the “cheat” button) during the quiz by giving different instructions on the usefulness of using the button. Participants were either told that using the button would eliminate one wrong answer (negative attitude condition) or three wrong answers (positive attitude condition). Therefore, unlike the attitude manipulation in Study 1a and 1b, this time only the possible gain was manipulated, not the possible loss—pressing the button had a predefined and actually programmed risk of 30% to result in a point loss. The attitude manipulation, too, was pretested (see Appendix).

**Perceived team norm manipulation.** The perceived team norm manipulation was similar to Study 1a and 1b. But instead of implementing a chat, participants were asked to openly write a short text in which they explained their strategy for the upcoming quiz with regard to risk taking. Subsequently, the preprogrammed answers of the team members were revealed. They either stated that they did not want to cheat and that they will probably not cheat to not lose points (negative perceived team norm condition), or that the members wanted to cheat and that they will probably cheat even if it meant losing points (positive perceived team norm). Again, the manipulation was pretested (see Appendix).
Risk taking (dependent variable). We assessed how many times the participants used the “cheat” button during the quiz. Individuals’ risk taking should be greatly dependent on whether they know the answer to the question or not. Therefore, to reduce the influence of knowledge on our risk taking measure, we only considered the usage of the cheat button for the ten difficult questions.

Manipulation checks. At the end of the online-experiment, we assessed participants’ attitude, perceived team norm and psychological safety using similar items to Study 1a and 1b in order to check if our manipulations had the intended effects.

Results

Preliminary analyses

We checked if the experimental manipulations were successful by employing independent t-tests. We found that participants in the negative attitude condition had a significantly lower attitude toward risk taking than participants in the positive attitude condition, \( M = 3.04 \) (SD = 0.99), \( M = 3.65 \) (SD = 1.07), \( t(263) = -4.84, p < .001 \). Participants in the negative perceived team norm condition had a significantly weaker team norm on risk taking than participants in the positive perceived team norm condition, \( M = 3.32 \) (SD = 1.15) vs. \( M = 5.14 \) (SD = 1.00), \( t(263) = -13.78, p < .001 \). Finally, participants in the low psychological safety condition had a significantly lower psychological safety in their team than participants in the high psychological safety condition, \( M = 4.25 \) (SD = 0.93) vs. \( M = 5.26 \) (SD = 0.75), \( t(263) = -9.64, p < .001 \).
Test of hypotheses

Similar to Study 1a and 1b, our dependent variable is a proportion measure. Therefore, we analyzed our data using a GzLM with a binomial distribution and logit link and tested for main effects of our independent variables as well as hypothesized interaction effects. We found that participants in the positive attitude condition showed significantly more risk taking than participants in the negative attitude condition, $M_{EM} = 0.18$ vs. $M_{EM} = 0.07$, Wald $\chi^2(1, N = 265) = 60.97, p < .001$. Similarly, participants in the positive perceived team norm condition showed significantly more risk taking than those in the negative perceived team norm condition, $M_{EM} = 0.17$ vs. $M_{EM} = 0.08$, Wald $\chi^2(1, N = 297) = 48.60, p < .001$. The average risk taking did not differ significantly between high and low psychological safety conditions, $M_{EM} = 0.12$ vs. $M_{EM} = 0.11$, Wald $\chi^2(1, N = 297) = 0.07, p = .795$. Thus, Hypothesis 1 and 2 were supported.

Further, there was a significant interaction effect between attitude and psychological safety on risk taking (Figure 8.4): The differences in risk taking between negative and positive attitude were larger when psychological safety was low rather than high, Wald $\chi^2(1, N = 265) = 4.66, p = .031$. Pairwise comparisons using Bonferroni correction showed that attitude had a significant effect on risk taking when psychological safety was low ($M_{EM} = 0.20$ vs. $M_{EM} = 0.07, \Delta M_{EM} = 0.13, 95\%$ Wald CI [0.08, 0.18], $p < .001$), as well as when psychological safety was high ($M_{EM} = 0.15$ vs. $M_{EM} = 0.08, \Delta M_{EM} = 0.07, 95\%$ Wald CI [0.03, 0.12], $p < .001$). Thus, although we found support that psychological safety moderates the effect of attitude, the impact of psychological safety was in the opposite direction than we predicted in Hypothesis 3: Higher psychological safety weakened rather than strengthened the effect of attitude. Additionally, contradicting Hypothesis 4, there was no significant interaction effect between perceived team norm and psychological safety on risk taking, Wald $\chi^2(1, N = 265) = 0.01,$
p = .932. A summary of the results of Study 1a, 1b and 2 is presented in Table 8.1.

![Graph showing the interaction effect on risk taking by attitude toward risk taking and psychological safety in Study 2.](image)

*Figure 8.4.* Interaction effect on risk taking by attitude toward risk taking and psychological safety in Study 2.

**Discussion**

In Study 2, we tested how attitude, perceived team norm and psychological safety interact and affect actual risk-taking behavior. Study 2 thereby replicates and extends our previous studies and tests how previous findings generalize to actual behavior. In addition, we overcame some of the difficulties we faced in the preceding studies. By adjusting the attitude manipulation, it was no longer confounded with the risk to lose points. Also, adjusting the psychological safety manipulation helped to minimize its un-
Table 8.1

Summary of Main Results Based on GzLMs with Intention to Take Risk (Study 1a and 1b) and Risk Taking (Study 2) as Dependent Variables.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Study 1a</th>
<th>Study 1b</th>
<th>Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude</td>
<td>7.63</td>
<td>9.67</td>
<td>7.63</td>
</tr>
<tr>
<td>Perceived team norm</td>
<td>4.66</td>
<td>9.71</td>
<td>4.14</td>
</tr>
<tr>
<td>Psychological safety</td>
<td>0.07</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Note: Higher psychological safety weakens effect in Study 1b and 2, strengthens effect in Study 1a, but strengthens effect in Study 1b and 2. Positive main effect in all three studies. Higher psychological safety strengthens effect in Study 1a, but weakens effect in Study 1b and 2.
intended effect on risk taking, making the interaction results more interpretable.

The results of Study 2 mainly resemble the results from Study 1b, namely that attitude toward risk taking and perceived team norm on risk taking affected subsequent risk-taking behavior in an online quiz: Negative attitudes and negative perceived team norms lead to less risk-taking behaviors compared to positive attitudes and positive perceived team norms. Opposite to our hypothesis, psychological safety weakened the effect of attitude on risk taking. In teams with high psychological safety, a positive attitude toward risk taking seems to lead to risk-taking behavior less frequently.

**General Discussion**

In this paper, we aimed to look at psychological safety as a contextual factor when it comes to individual task-related risk taking in teams. Drawing on the reasoned action model, we hypothesized that the effect of both an individual’s attitude toward risk taking and perceived norm on risk taking within a team (i.e., perceived team norm) will be moderated by psychological safety in predicting risk taking. We postulated that psychological safety will strengthen the effect of attitude and weaken the effect of perceived team norm on risk-taking behavior. To test our hypotheses, we conducted three experiments in which participants were involved in either a scenario or a real online game and the dependent variable was either intention to take risk or actual risk-taking behavior in the game.

In all three experiments, we found support for the main effects of attitude and perceived team norm on risk taking. Both independent variables had a significant positive effect on either the intention to take risk or actual risk taking. Our results provide evidence that individuals who have a positive attitude toward risk
taking and individuals who work in a team where task-related risk taking is the norm are more likely to take risk themselves.

Also, all three experiments supported the hypothesis that psychological safety interacts with an individual’s attitude in predicting risk taking. But the studies differed in the direction of the interaction effect. In Study 1a, we found—consistent with our hypothesis—that psychological safety strengthened the effect of attitude on the intention to take risk. In the high psychological safety condition, participants’ experimentally manipulated attitude had a significantly higher effect on their reported intention to take risk in the described scenario. This finding is consistent with the previous finding by Stühlinger et al. (2019), where psychological safety enhanced the effect of physicians’ attitude toward getting vaccinated on their intention and subsequent vaccination behavior. However, after adapting the attitude and perceived team norm manipulations, the moderating effect of psychological safety was reversed: In both Study 1b and Study 2, we found that psychological safety significantly reduced the effect of attitude on the intention to take risk and actual risk taking, respectively. Having used improved manipulations in these studies strengthens our belief that these latter results are more valid and reliable than what we found in Study 1a.

Compared to the previous study on the interaction between psychological safety and individuals’ attitude (Stühlinger et al., 2019), the studies of this paper differ in a number of ways, which could all have contributed to the divergent findings. For example, they differed in study design (experimental vs. correlative design), study setting (student teams in online experiment vs. physicians teams in field setting), and focal behavior (risk taking in an online quiz vs. safety-relevant influenza vaccination behavior). Moreover, one important difference may lie in the consequences of the behaviors. Whereas the influenza vaccination behavior primarily affected the individual, the risk-taking behavior in our experiments had a clear risk to adversely affect the whole team. While psycho-
logical safety may strengthen attitudes toward behaviors affecting the actor, psychological safety may weaken attitudes toward behaviors affecting the whole team.

Social identity theory (Tajfel & Turner, 1979) and self-categorization theory (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987) may provide a possible explanation for our unexpected finding that psychological safety weakened the effect of attitude on risk taking. In the experiments, participants were part of a team—either hypothetically in a scenario or supposedly in a real team. This situation provides social cues as a basis to develop a social identity. In the high psychological safety condition, the fictitious team members reacted clearly more positively toward the participant (Study 1b) or it was stated that they endorse supportive behaviors in teams such as speaking about one’s problems (Study 2). Therefore, participants may have been more willing to accept the fictitious team members as their ingroup in the high psychological safety condition, while participants’ social identification with the team in the low psychological safety condition may have been weak or non-existent. Stronger identification with the team should lead to a higher degree of conformity to the team norm (Christensen, Rothgerber, Wood, & Matz, 2004). Under high psychological safety, this conformity effect may have overridden the effect of the attitude in those conditions, where the norm differed from the attitude. A lower psychological safety, on the other hand, should have led participants to develop a weaker identification with the team, and to abide by their personal attitude. Picking up the point raised above, depending on whether or to what extent the individual behavior has consequences for the whole team (as opposed to for the actor alone), the saliency of the membership with the social group may vary which could lead to the differing moderating effects of psychological safety.

Finally, we found mixed results on the interaction effect between psychological safety and perceived team norm on risk taking. In Study 1a and 2 we did not find any significant inter-
action effect. However, in Study 1b we found—contrary to our hypothesis—that psychological safety strengthened the effect of the perceived team norm on the intention to take risk. This finding is actually consistent with our alternative explanation that we outlined above, which is based on social identity and social categorization theory. Higher psychological safety may have resulted in a stronger identification with the fictitious team, which in turn led participants to develop intentions consistent with the perceived team norm. However, our studies provide only limited evidence for this claim since we could not find a similar effect in our other two experiments.

Theoretical Implications

We contribute to the psychological safety literature by providing insights into the moderating effect of psychological safety in predicting task-related risk-taking behavior that is potentially harmful for the whole team. Previous studies have looked at psychological safety’s direct relationship with interpersonally risky behavior (Edmondson & Lei, 2014; Newman et al., 2017). In our studies, psychological safety was shown to influence individuals’ decision making. Our findings show that the construct also affects task-related risk-taking behavior—by strengthening or weakening the effect of individuals’ personal attitudes. The findings demonstrate a key effect mechanism of psychological safety—that of a contextual factor that facilitates or impedes individuals’ enactment of their beliefs. We provide evidence for previous claim that psychological safety might better be understood as a facilitating contextual factor (Sanner & Bunderson, 2015). Future studies on psychological safety should therefore consider its moderating effects—also in cases where it was previously proposed to have direct effects.

Previous studies have looked at psychological safety’s moderating role in the prediction of cheating behavior in student teams
(Pearsall & Ellis, 2011), and influenza vaccination behavior in physicians teams (Stühlinger et al., 2019), which either did not include a clear task-related risk or was a desirable behavior. Our findings depict novel insights into the causal workings of psychological safety that can advance the literature. Our studies provide evidence that psychological safety interacts with an individual’s attitude toward risk taking in the prediction of task-related risk taking. The findings indicate that the attitude of individuals should be taken into account when looking at psychological safety’s effects, and that also safety-relevant outcomes that are not directly related to learning behavior should be considered. These safety-relevant outcomes have been largely neglected in the literature so far, and should gain more attention. Further, the results suggest that psychological safety does not interact with perceived team norm in the suggested way. However, given that attitude and norm are linked (Terry & Hogg, 1996), we think that there might be more to the connection between psychological safety and perceived team norm than we were able to capture with our studies. As outlined above, there might be effects based on social identity and social categorization which counteract the hypothesized effects. Future studies could try to unravel these effects to shed light on the triangle relationship between attitude, perceived norm, and psychological safety.

Our studies further provide evidence on causal effects surrounding psychological safety due to our application of the experimental method. This allowed us to manipulate attitude and perceived team norm separately, and to look at their interaction effects with psychological safety in an isolated manner. Moreover, we also manipulated psychological safety and thereby provide two possibilities of creating different levels of psychological safety in an experimental environment. Fictitious chat messages (Study 1a and 1b) and fictitious test results (Study 2) both proved successful in our experiments and could be used in future experimental studies.
Practical Implications

Gaining insights into what facilitates or impedes individual risk taking, can be valuable for organizations. Depending on the organization, the team within an organization or the specific task a team or individual is working on, risk-taking behaviors might be desirable or undesirable. While risk taking is kept at a minimum in organizations and areas where safety is critical (e.g., hospitals, aircraft, nuclear power plants), other work might depend on employees to engage in certain risk-taking behavior in order to gain profit (e.g., stock exchange trading, sales). In our studies, we found that individuals’ risk taking is affected by their attitude toward risk taking as well as the perceived team norm on risk taking. Therefore, in teams where members already engage in risky behaviors, this descriptive norm will impact the individual behavior. This could lead to a reinforcing effect and also make new members assimilate to the norm.

While our findings are inconclusive when it comes to psychological safety’s moderating effect on the impact of perceived team norms on risk taking, our result point into the direction that psychological safety in a team weakens the effect of attitude on risk taking. Specifically, in Study 1b and 2, the positive attitude condition was less effective, meaning that high psychological safety mitigated the effect of positive attitude toward risk taking. Hence, inducing psychological safety in work teams might have the effect that individuals with a positive attitude toward risk taking will take less risk than they would if psychological safety was low. This buffering effect can be desirable or undesirable, depending on the work but also the specific risk, and should be considered in those cases, where risk taking is actually part of the job or might lead to better performance.
Limitations and Future Research

There are several limitations with our studies that we want to address. First, some of the manipulations in Study 1a and 1b did not work out as expected. For example, in Study 1a, the attitude manipulation did not have a significant effect on the corresponding manipulation check scale, which could impair its effect on the dependent variable. Or the attitude manipulations in Study 1a and 1b also created differing risk probabilities. These imperfections may have had unintended effects on the relationships we looked at. Especially, they may be the reason why we found inconsistent results with regard to the interaction effect of attitude and psychological safety between Study 1a and the other two studies. However, we sought to improve on all these imperfections with each subsequent study and in Study 2, we did not find any of the previous unintended effects of the manipulations.

Second, we looked at individuals’ risk taking in a particular and constrained context. All our participants were students and we created a specific setting, which involved an online game (in which they either took hypothetical or real decisions). As is true for most laboratory studies, the external validity of our experiments might be limited and future studies need to investigate whether our findings will generalize to different populations and different risk-taking behaviors. For example, data could be gathered from a working sample on specific risk-taking behaviors that can occur in the work environment to test how psychological safety in work teams promotes or demotes those behaviors. Related to this, it would be important to learn about potential characteristics of risk taking which moderate the contextual effect of psychological safety. Psychological safety’s effect might depend on risk taking to be visible in the team and to be attributable to the actor, or it might be dependent on the magnitude of risk (i.e., the probability of a negative outcome to occur or the severity of the negative outcome). It is also conceivable that psychological
safety has different effects when risk taking is part of a given work task and is—to a certain extent—desired by the organization compared to when it is completely undesired and, for example, involves safety hazards. Also, psychological safety’s moderating effect may depend on whether the risk-taking behavior (or indeed any individual behavior) has potential negative consequences mainly for the actor or the whole team. Future studies could employ an experimental design where characteristics of psychological safety or risk-taking behavior are manipulated, in order to see under which circumstances psychological safety unfolds its moderating effect.

Third, our studies could not provide clear evidence on the interaction between psychological safety and perceived team norm. The majority of our results did not show a significant interaction effect. Nevertheless, based on our theoretical reasoning, we believe there is an important connection between (perceived) team norms and psychological safety, though it might be more complex than we anticipated. The relationship might depend on the type of norm or, more precisely, the behavior the norm is concerned with. For example, psychological safety might be closely related to perceived team norms with regard to learning behaviors. Psychological safety can be construed as a team norm stating that learning behaviors are favorable and welcome in the team. Perceived psychological safety on the individual level might therefore be congruent with perceived team norm on learning behaviors. This could explain the main effects that are frequently found in the literature on learning behaviors such as making suggestions (Detert & Burris, 2007; Liang, Farh, & Farh, 2012) or reporting errors (Leroy et al., 2012). However, psychological safety and perceived team norm do not seem to overlap in all other behaviors—for example, psychological safety did not correlate with perceived team norm on getting vaccinated (Stühlinger et al., 2019). It remains open for future research to gain a better understanding on how exactly psychological safety relates to team norms concerned with learning and other types of behaviors.
Conclusion

This paper suggests that psychological safety is an important contextual factor in the prediction of individual risk taking in the team environment. In three experiments, we found evidence that psychological safety moderates the effect of an individual’s attitude toward risk taking on the intention to take risk and on actual risk-taking behavior. Therefore, it is important to consider psychological safety within a team when it comes to individual risk-taking behaviors that might include safety hazards. Acquiring an even better understanding of psychological safety’s contextual effects—especially when it comes to risk taking—will be important for the promotion of physically and psychologically safe work places.

References


Appendix

We pretested the quiz questions of our online-experiment (Study 2) as well as the experimental manipulations using a sample of 32 students. The participants’ answering behavior of the quiz questions matched our intended question difficulty. On average, the difficult questions were correctly answered by 11.5 participants (35.9%, $SD = 3.77$), the moderate questions by 19.4 participants (60.6%, $SD = 3.98$), and the easy questions by 27.2 participants (85%, $SD = 1.72$). Solving the difficult questions, 4.6 participants (14.4%, $SD = 2.42$) chose the risk option on average, while it was 2.2 participants (6.9%, $SD = 1.72$) for the moderate questions, and 0.8 participants (2.5%, $SD = 0.75$) for the easy questions.

The attitude manipulation included differing instructions on the functionality of the risk option as described in the main text. Using an independent t-test, we found that participants did not differ significantly in their reported attitude toward risk taking between negative and positive attitude conditions, $M = 3.01$ ($SD = 1.20$) vs. $M = 3.58$ ($SD = 1.14$), $t(30) = -1.36$, $p = .184$. However, there was a clear difference in the attitude ratings between conditions and the lack of statistical power due to small sample size was the main reason the result was not significant. To try to enhance the manipulation effect slightly, we chose to write the manipulation instruction (i.e., how many wrong answers would get eliminated when using the risk option) in bold in the final version of the experiment presented in the main text.

The perceived team norm included differing answers by the preprogrammed team members with regard to their strategy during the quiz, as described in the main text. Using an independent t-test, we found that participants differed significantly in their reported perceived team norm on risk taking between negative and positive perceived team norm conditions, $M = 3.44$ ($SD = 1.24$) vs. $M = 5.18$ ($SD = 0.79$), $t(30) = -4.55$, $p < .001$. There-
fore, the manipulation was retained for the final version of the experiment.

Finally, the psychological safety manipulation included differing answers of the preprogrammed team members with regard to their usual behavior in a team, as described in the main text. However, in the pretest, only the answers of the team members were shown to create differences in psychological safety between conditions (i.e., without giving short summaries). Using an independent t-test, we found that participants did not differ significantly in their reported psychological safety between the low and high psychological safety conditions, $M = 4.54$ ($SD = 1.01$) vs. $M = 4.56$ ($SD = 1.03$), $t(30) = -0.05$, $p = .961$. To enhance the effect of the psychological safety manipulation in the final version of the experiment, we therefore made the preprogrammed answers more extreme and added the short summaries of the answers, which would allow participants to quickly get a picture of the other team members without having to analyze their answers in detail.