How team safety stressors affect proactive and prosocial safety behaviors: felt safety responsibility and affective commitment as mediators

Abstract

Although research has thoroughly established that employees' safety citizenship behaviors (SCBs) are critical to workplace safety, less is known about the patterns by which team-level safety stressors affect SCBs. Extending work stress theories to the team level, this study employs a multilevel model and aims to assess two unique mediating mechanisms, felt safety responsibility and affective commitment, through which team safety stressors influence proactive and prosocial safety behaviors respectively. Data were collected from 408 construction workers and their supervisors from 28 project teams in China. Results showed that team safety stressors significantly and negatively predicted both types of SCB. Moreover, felt safety responsibility mediated the relationship between team safety stressors and proactive safety behavior, and affective commitment mediated the relationship between team safety stressors and prosocial safety behavior. This study contributes to workplace safety research by highlighting the important role of team safety stressors in predicting SCBs and different mediating mechanisms for the two types of SCB. Based on our findings, practical interventions aiming at improving workplace safety could be targeted at training managers to provide a supportive work environment where safety roles are clearly and consistently communicated, as well as to attend to potential interpersonal conflicts

within the work team. These strategies will encourage more SCBs by promoting workers' understanding of their responsibilities and enhancing their commitment to the organization.

Keywords: team safety stressors, proactive safety behavior, prosocial safety behavior, felt safety responsibility, affective commitment

1. Introduction

Safety citizenship behaviors (SCBs) are voluntary safety behaviors that have a positive value for organizational safety but are not typically recognized by the formal reward system (Curcuruto et al., 2015; Organ, 1988). Two types of SCB have been identified: proactive safety behavior (change-oriented SCB), such as safety voice, which seeks to engender positive changes in workplace safety practices; and prosocial safety behavior (affiliative-oriented SCB), such as stewardship, which manifests as helping colleagues and seeking to ensure their safety (Curcuruto et al., 2015; Hofmann et al., 2003). SCB has been emphasized as an important source of safety improvement and accident reduction in organizations (Curcuruto & Griffin, 2018; Laurent et al., 2018). Therefore, considerable research has been devoted to identifying factors that influence SCBs. In particular, work stressors have been identified as a major factor that inhibits employee SCBs (Parker, 2012; Wang et al., 2020).

Work stressors are “demands induced by the external environment that cannot be managed with the resources of the individual” (van den et al., 2016, p. 62). They occur frequently because the organizational environment generates various work demands and does not always provide sufficient resources to adequately meet these demands (Pooja et al., 2016; Savelsbergh et al., 2012). Safety research has recognized the importance of attending to workplace stressors (Sampson et al., 2014), in particular, stressors arising from employees’ vague perceptions of their roles, superiors’ and co-workers’ opposing views, and conflicts between people are referred to as safety

48 stressors, as they can lead to safety threats, including a reduction in employees' SCB
49 engagement (Sampson et al., 2014; Wang et al., 2020). These studies, however,
50 predominantly focused on employee perceptions of stressors at the individual level,
51 although scholars have advocated for more focus on team-level stressors and suggested
52 that team-level stressors have important implications for individual outcomes (Mañas
53 et al., 2018; Razinskas & Hoegl, 2020). More importantly, team stressors capture
54 important aspects of the social environment that are not reflected in individual
55 perceptions, thus their unique roles would be missed out if studying experience of
56 stressors only at the individual level (Bliese & Britt, 2001). Despite its importance,
57 research on SCBs has not considered stressors as a team-level phenomenon, and the
58 multilevel mechanisms underlying their effects on SCBs remain unclear.

59 We argue that conceptualizing safety stressors at the team level and examining
60 how they influence SCBs is a necessary extension to existing research on individual-
61 level safety stressors. Stressors at the collective level reflect shared experience of all
62 members, creating a common reality that workers must confront in their daily activities.
63 Researchers have suggested that employees' shared perceptions have important
64 implications for employees' affective responses and motivation levels (Kozusnik et al.,
65 2015; Rousseau, 1988; Schneider et al., 2002). Different from individual perceptions of
66 stressors, the existence of a shared perception of stressors reinforces the pressure of the
67 stressors and are thus more salient and evident (Kozusnik et al., 2015). In this regard,
68 the frequency and intensity of safety stressors induced by the social context should

influence individuals' feelings and behaviors in a "Gestalt" manner (Lewin, 1939), representing unique influence patterns that are not captured by perceptions of stressors at the individual level. More importantly, it is more appropriate to examine the various safety-related work stressors as team-level constructs, as these demands are induced by the external environment and all team members are likely to face similar situations (Consiglio et al., 2013; Razinskas & Hoegl, 2020; Savelsbergh et al., 2012). In sum, research on the association between safety stressors and SCBs needs to include team-level stressors, and the current study aims to contribute to this aspect.

In addition to extending conceptualizations of safety stressors to the team level, another goal of the current study is to provide a better understanding of the unique psychological mechanisms through which team safety stressors influence the two types of SCB. Work stress theories in organizational behavior (e.g., Bakker & Demerouti, 2007; Hobfoll, 1989; Karasek, 1979) have specified that experienced work stressors can evoke negative psychological states, in particular, reduced levels of organizational commitment and felt responsibility (Eatough et al., 2011; Pooja et al., 2016). These psychological states have been found to be important predictors of SCBs. Although existing work stress theories mainly focus on individual's experience of stressors, they could be extended to examine the implications of team level stressors, as researchers have argued that individuals who are exposed to stressful team environments will first process and internalize their perceptions and then react to their work environments (Joyce & Slocum, 1979; Kozusnik et al., 2015; Turner et al., 2005). In fact, multilevel

studies have started to extend work stress theories to the team level to examine the effects of some type of work stressors, such as team-level demands, on workplace outcomes (e.g., Razinskas & Hoegl, 2020; Savelsbergh et al., 2012). Adding to this line of research, this study is the first to extend work stress theories to the team level in applying to the safety domain, looking at the influence of team safety stressors on SCBs as well as the psychological pathways through which such effects take place.

Building upon previous research on individual-level safety stressors and SCBs (Curcuruto et al., 2019a; Curcuruto & Griffin, 2018), we specify two main psychological states, felt safety responsibility and affective commitment, as the mediating mechanisms between team safety stressors and two types of employee SCB, respectively. Previous research has shown that proactive and prosocial forms of SCB have different psychological antecedents: Felt safety responsibility has been argued to be a major determinant of proactive safety behavior (Curcuruto et al., 2019a), while affective commitment primarily promotes prosocial safety behavior (Curcuruto & Griffin, 2018). In addition, both felt safety responsibility and affective commitment have been found to be influenced by general work stressors (Fuller et al., 2006; Jex et al., 2003; Johari & Omar, 2019). Integrating the existing evidence and applying such linkages to the team level, we propose that team safety stressors hinder individuals' perception of felt safety responsibility, thereby reducing one's tendency to improve workplace safety in a proactive manner (i.e., proactive safety behavior). Team safety stressors also reduce individuals' affective commitment to the organization, thus

lowering one's motivation to be prosocial in protecting workplace safety (i.e., prosocial safety behavior). Figure 1 presents the proposed research model in this study.

[Insert Figure 1 here]

This study intends to make the following contributions. Specifically, this study extends existing work stress theories to the team level and is the first to look at the cross-level influence of team safety stressors on SCBs. The focus on team-level safety stressors complements previous studies that only looked safety stressors at individual level (e.g., Sampson et al., 2014; Wang et al., 2020), by demonstrating the vital role of shared perceptions of safety stressors within the work team in shaping employees' proactive and prosocial safety behaviors. In addition, this study specifies different psychological mediating mechanisms between team safety stressors and proactive safety behavior and prosocial safety behavior, respectively. By delineating the unique mechanisms through which team safety stressors influence the two types of SCB differently, our findings would allow managers to develop better-targeted interventions aimed at managing the negative consequences of team safety stressors.

2. Theoretical background and hypotheses

2.1. Team safety stressors and SCBs

Sampson et al. (2014) described safety stressors as safety-related stressors arising from employees' vague perceptions of their roles, superiors' and colleagues' opposing

views, and conflicts between people. Safety stressors usually include safety-role ambiguity, safety-role conflict, and interpersonal safety conflict. Safety-role ambiguity refers to cases where the available information and resources for a safety-related role are not transparent or adequate (Jackson & Schuler, 1985; Rizzo et al., 1970). Safety-role conflict refers to the presence of inconsistencies between expectations and criteria by which safety performance is evaluated (Kahn et al., 1964; Tuten & Neidermeyer, 2004). Interpersonal safety conflict arises when there are disagreements regarding safety issues between colleagues (Gittleman et al., 2010).

Work stress theories, especially the job demands-resources model (Bakker & Demerouti, 2007, 2017) and the job demands-control model (Karasek, 1979), have widely shown that work stressors can lead to negative psychological states and undermine motivation, which in turn trigger negative organizational behaviors and outcomes (Cooper et al., 2001; Lazarus, 1966). Specifically, a variety of research has shown that work stressors, role ambiguity and role conflict in particular, influence employees' organizational citizenship behaviors through influencing one's psychological perceptions and attitudes such as organizational commitment and job satisfaction (Eatough et al., 2011; Pooja et al., 2016; Turner et al., 2005). More relevant to workplace safety, research has shown that employee's perceived safety stressors negatively impact SCBs (e.g., Sampson et al., 2014; Wang et al., 2018). SCBs include behaviors such as taking an active approach to improve safety procedures, making innovative suggestions and recommendations to improve safety, engaging in

cooperative safety behaviors and altruistic behaviors to protect colleagues' safety, maintaining up-to-date knowledge of safety issues, and reporting safety violations (Hofmann et al., 2003). Building upon Hofmann et al. (2003), subsequent studies distinguished two types of SCB: *proactive safety behavior* and *prosocial safety behavior* (Curcuruto et al., 2015; Curcuruto & Griffin, 2018). The former includes *initiating safety-related change* and *safety voice* (Curcuruto et al., 2019b) and is described as "challenging in nature and seeks to bring about positive change for safety in workplace practices" (Curcuruto et al., 2015, p. 318). The latter consists of *helping*, *stewardship*, *civic virtue*, and *whistleblowing* (Curcuruto et al., 2019b), which is "affiliative in nature and typically manifests as helping colleagues and looking out for their welfare in safety" (Curcuruto et al., 2015, p. 318). The two-dimensional structure of proactive safety behavior and prosocial safety behavior have been verified by Curcuruto et al. (2019b) and Wang et al. (2020) in terms of criterion validity.

Extant research looking at the relationship between safety stressors and SCBs, however, predominantly focused on individual perceptions of stressors, while not sufficient research has been paid to the fact that stressors *can* and *should be* studied as a team-level phenomenon. We consider team-level safety stressors as a unique predictor of SCBs, the effects of which are not the same as those of individual-level stressors. Indeed, as researchers have noted, one should not assume that phenomena at one level readily generalize to another level (Rousseau, 1985). Team-level stressors capture aspects of the social environment that are not reflected in individual perceptions. Team

members' shared appraisals of demands as stressful functions as a climate of stress, which "emerges when the members of a particular group share perceptions about certain events and contexts as a source of distress" (Kozusnik et al., 2015, p. 1). The shared perceptions of stressors influence individual behavior in a "Gestalt" manner (Lewin, 1939) and reinforces the pressure of stressors, leading to more salient and evident influences on individual behaviors (Kozusnik et al., 2015).

In addition, researchers have noted that there exist inconsistencies in theory and data regarding the level issue (Klein et al., 1994), such that many team-level effects are examined as individual-level effects and vice versa. We argue that not only it is conceptually important to examine safety stressors at the team level, but it is also methodologically appropriate to do so. The various safety-related work stressors are induced by demands from the external environment that all team members are likely to face (Consiglio et al., 2013; Razinskas & Hoegl, 2020; Savelsbergh et al., 2012). As such, researchers have advocated for more research conceptualizing stressors at the team level. Some recent studies have started to examine the influence of team stressors on workplace outcomes. For example, Mañas et al. (2018) found that team role ambiguity negatively influences employees' extra-role performance and affective work engagement. Savelsbergh et al. (2012) demonstrated that team quantitative role overload can influence individual performance through a reduced level of team member's learning behaviors. These studies further supported the existence and importance of conceptualizing and examining team-level stressors. Even so, no

195 research to our knowledge has examined the implication of team-level stressors for
196 employee SCBs. In other words, we do not yet know whether a team environment that
197 is characterized with safety stressors has any impact on employees' SCBs and how such
198 effects take place.

199 Extending conceptualizations of team stressors to the workplace safety literature,
200 we argue that a team environment where members are faced with ample safety stressors
201 introduces a dilemma for employees. When one's work team is ambiguous in defining
202 safety roles for its members, employees do not know the correct way to operate safety
203 functions. Similarly, when the team manager provides conflicting orders regarding
204 safety roles, it is unclear for team members to know which rule to follow. In addition,
205 the existence of interpersonal safety conflicts within the team may take a toll on
206 cohesion and teamwork among team members, triggering negative feelings such as
207 confusion and lacking identity. Team members, therefore, would be unwilling to assist
208 others with their work or take safety initiatives. All of these reduce employees' capacity
209 to be concerned with bringing about organizational improvement and development
210 regarding safety (Curcuruto et al., 2019a), as well as make employees question whether
211 changes in organizational conditions are needed (Parker et al., 2010; 2019). Accordingly,
212 we hypothesized the following:

213 *Hypothesis 1:* Team safety stressors, including team safety-role ambiguity, team
214 safety-role conflict, and team interpersonal safety conflict, are negatively
215 associated with an employee's (*a*) proactive safety behavior and (*b*) prosocial

safety behavior.

2.2. Team safety stressors influencing felt safety responsibility/affective commitment

A small number of studies argue that team members' shared appraisals of the workplace as stressful tend to produce negative consequences for individuals and hamper the achievement of team goals (Kozusznik et al. 2015; Razinskas & Hoegl, 2020; Savelsbergh et al., 2012). The collective experience of safety stressors is likely to produce negative affective responses and reduce motivation levels, thereby influencing individual behavior and performance (Savelsbergh et al., 2012). Thus, we propose that felt safety responsibility serves as an intermediary between team safety stressors and proactive safety behavior, and affective commitment as an intermediary between team safety stressors and prosocial safety behavior. Felt safety responsibility refers to an individual "feeling personally in charge of setting and striving to ensure safe work conditions in all circumstances, even if it falls beyond the formal role accountabilities or technical tasks and requirements of a job position" (Curcuruto et al., 2016, p.146). Felt safety responsibility is largely influenced by the information and resources held by the work team (Fuller et al., 2006). Different from individual-level process involved in individual stressors, team safety stressors create a stressful climate that employees must confront in their daily activities (Kozusnik et al., 2015). When safety stressors such as role ambiguity exists in the work team, employees will feel confusion about whether organizational safety should be part of their duties. In this case,

237 they will be less likely to feel that their organization depends on them to improve its
238 safety (Fuller et al., 2006; Parker et al., 2010). Meanwhile, shared perceptions of safety
239 conflicts within the work team, another type of team safety stressor, are likely to reduce
240 employees' perceived responsibilities to promote safety issues in the workplace and
241 perceptions of the need for themselves to serve an example for others (Griffin et al.,
242 2007; Pooja et al., 2016). These collective-level stressors will further lead employees
243 to believe that it is pointless to take constructive actions toward organizational safety
244 (Pooja et al., 2016). Accordingly, the following hypothesis was proposed.

245 *Hypothesis 2:* Team safety stressors are negatively associated with an employee's
246 felt safety responsibility.

247 Affective commitment denotes an employee's affective attachment to the
248 organization that is derived from the acceptance of its goals and values (Ketchand &
249 Strawser, 2001; Meyer & Allen, 1997). Research has shown that safety stressors tend
250 to reduce employees' positive feelings of attachment to the organization (Bakker, 2015;
251 Crawford et al., 2010), primarily because positive attachment depends on positive
252 interactions and feedback from others (Yuan et al., 2015). Manas et al. (2018) found
253 that team-level job demands (i.e., role ambiguity climate) lead to a reduced level of
254 individual affective commitment. Thus, we argue that when a work team imposes safety
255 stressors on employees, they should experience lower levels of affective commitment.
256 Accordingly, the following hypothesis was proposed.

257 *Hypothesis 3:* Team safety stressors are negatively associated with an employee's

affective commitment.

2.3. Felt safety responsibility/affective commitment influencing SCBs

Felt safety responsibility and affective commitment serve as two important psychological states influencing employee SCBs (Curcuruto and Griffin, 2018; Curcuruto et al., 2019a), but in different ways. In fact, research on the two types of SCB draws upon different research paradigms. The literature on prosocial safety behavior highly draws upon research on work performance or organizational citizenship behavior in general (e.g., Podsakoff et al., 2000), in which affective commitment is identified as a major predictor. Specifically, Curcuruto and Griffin (2018) proposed that affective commitment should have a stronger relationship with prosocial than proactive safety behavior. In addition, employees are more likely to choose affiliative types of SCB (i.e., safety helping) to reciprocate the positive relationship with the organization as represented by affective commitment, from a social exchange perspective. In comparison, research on antecedents of proactive safety behavior is based on a different theoretical perspective, focusing on its motivational driver according to the general paradigm of proactive motivation (Parker et al., 2010). Whereas affective commitment is more relevant for triggering the reciprocal process, felt safety responsibility focuses more on one's perception of their role in striving to achieve organizational safety goals, like reducing accidents and avoiding critical hazards or achieving safety improvement targets (Curcuruto et al., 2016). Curcuruto et al. (2016) argued that felt safety responsibility will create the "reason-to" motivation for individuals to initiate and

279 persist with a proactive action for safety improvement. In comparison, felt safety
280 responsibility is especially important for proactive safety behavior, because engaging
281 in a proactive safety behavior is challenging and risky, hence individuals need to have
282 a strong urge to be proactive, define it as their job, and/or see value associated with
283 being proactive. In support of their distinctive prediction of different types of SCB,
284 Curcuruto et al. (2019a) found a decisive role of felt safety responsibility in predicting
285 proactive safety behavior and of affective commitment in driving prosocial safety
286 behavior. We adopt this notion and propose for felt safety responsibility to be a major
287 predictor of proactive safety behavior and for affective commitment to be a major
288 predictor of prosocial safety behavior. Below we provide more details regarding these
289 proposed relationships.

290 ***2.3.1 Felt safety responsibility and proactive safety behavior***

291 Team members' feelings of safety responsibility have been regarded as the
292 foundation of advanced safety culture systems (Geller, 2002). These feelings drive team
293 members to set safety goals and strive to reach these goals and bring about safety
294 improvements in work teams and department units regardless of their status
295 (Guldenmund, 2010; Reason, 2008). Felt safety responsibility represents not only a
296 willingness to expend more effort but also an inclination to exert effort more proactively,
297 such as making safety-related recommendations and improving safety procedures, with
298 the goal of improving workplace safety management (Curcuruto et al., 2016; Fuller et
299 al., 2006). Similarly, felt responsibility has been regarded as an important antecedent of

initiative and taking-charge behaviors in general (Fuller et al., 2006, 2012) and a typical "reason-to" motivation for proactive behavior (Parker et al., 2010). Individuals who take responsibility for their decisions and attitudes are more vigilant in handling information and thus have a more sophisticated understanding of their responsibilities (Fuller et al., 2006; Parker et al., 2010). Based on this argument, Curcuruto et al. (2016) defined felt safety responsibility as a major motivation driving proactive safety behavior. This leads to the following hypothesis.

Hypothesis 4: Felt safety responsibility is positively associated with an employee's proactive safety behavior.

2.3.2 Affective commitment and prosocial safety behavior

Affective commitment has been consistently linked to higher levels of citizenship behavior (Hoffmann, 2006; Lee & Allen, 2002; Meyer et al., 2002; O'Driscoll et al., 2006; Simosi, 2012) as well as prosocial behavior (Buch, 2015; Laurent et al., 2018). Notably, researchers have argued that affective commitment promotes prosocial safety behavior (Curcuruto & Griffin, 2018), more than proactive safety behavior (Curcuruto et al., 2019a). Affective commitment motivates employees to help colleagues and to provide emotional support for colleagues beyond their regular role within the organization (Paré & Tremblay, 2007). Employees with high levels of affective commitment are more likely to develop a sense of group honor and thus are more likely enthusiastic in helping colleagues perform more safely (Laurent et al., 2018; Yuan et al., 2015). Accordingly, the next hypothesis was proposed.

Hypothesis 5: Affective commitment is positively associated with an employee's prosocial safety behavior.

2.4. The mediating roles of felt safety responsibility and affective commitment

As argued above, team safety stressors are proposed to be reducing employee's felt safety responsibility, which is then related to employees' proactive safety behavior. We therefore propose for felt safety responsibility to be a mediator of the relationship between team safety stressors and proactive safety behavior. Similarly, affective commitment should mediate the relationship between team safety stressors and prosocial safety behavior. Thus, we hypothesized the following:

Hypothesis 6: Felt safety responsibility mediates the relationship between team safety stressors and an employee's proactive safety behavior.

Hypothesis 7: Affective commitment mediates the relationship between team safety stressors and an employee's prosocial safety behavior.

3. Method

3.1. Sample

Construction workers were chosen to be the research sample, because the construction industry has a high frequency of accidents and project teams often work in the presence of stressors (Bamel et al., 2020; Leung et al., 2012; Zhang et al., 2020). Data collection took place in China, and all survey items were translated into Chinese following Brislin's (1980) back-translation procedure. The investigation was conducted between October 2019 and January 2020 during which survey data were obtained from

342 frontline workers and supervisors from 28 project teams.

343 The frontline-worker questionnaire included items measuring safety stressors in
344 their work team, felt safety responsibility, affective commitment, and demographics. In
345 addition, safety supervisors, who were also the direct managers of the frontline-workers
346 in our sample, rated their subordinates' SCBs to provide multi-source data. These
347 supervisors have frequent and direct contact with the frontline workers, making them
348 the most suitable to provide ratings of workers' SCBs (Freitas et al., 2019). In total, 28
349 supervisors and 560 frontline workers responded. Among the responses, 73% of
350 frontline-worker surveys were successfully matched to supervisor surveys, resulting in
351 a final sample of 28 safety supervisors and 408 frontline workers from 28 work teams
352 (one supervisor per team). The overall response rate of the sample including both
353 supervisors and frontline workers was 74% (N = 436). Table 1 presented the
354 demographic characteristics of the respondents.

355

356 **[Insert Table 1 here]**

357

358 **3.2. Ethics statement**

359 The human research ethics committee of the university to which where one of the
360 authors is affiliated approved the research design and survey content to ensure that
361 ethical principles were properly applied and individual rights were protected
362 (HRE2020-0103, Curtin University). The approval was then submitted through the

363 ethics review board at all other authors' universities for reciprocal ethics approval. On
364 the first page of the questionnaire, we informed all participants of the research purpose
365 and assured the confidentiality of their responses. Survey participation was entirely
366 voluntary, and participants could choose to opt out at any time during the survey.

367 **3.3. Measures**

368 For all measures, responses were collected using a five-point Likert scale ranging
369 from 1 (*strongly disagree*) to 5 (*strongly agree*).

370 ***3.3.1. Safety stressors***

371 We used a 13-item scale to assess each worker's perceived safety stressors
372 (Sampson et al., 2014; Wang et al., 2018). Sample items include "there are no clear,
373 planned safety goals and objectives for my job" (safety-role ambiguity), "I have to
374 ignore a rule or policy to carry out an assignment safely" (safety-role conflict), and "I
375 get into arguments about safety with others at work" (interpersonal safety conflict).
376 Cronbach's alpha was .929 for the 13-item scale (.916, .899, and .876 for safety role
377 ambiguity, safety role conflict, and interpersonal safety conflict, respectively).

378 ***3.3.2. Proactive safety behavior***

379 Supervisors rated workers' proactive safety behavior using 4 items measuring
380 safety voice (Hofmann et al., 2003). An example item is "Making safety-related
381 recommendations about work activities". Cronbach's alpha was .941 for the 4-item
382 scale.

383 ***3.3.3. Prosocial safety behavior***

Supervisors assessed workers' prosocial safety behavior using 6 items measuring safety helping (Hofmann et al., 2003). A sample item is "Volunteering for safety committees". Cronbach's alpha was .957 for the 6-item scale.

3.3.4. Felt safety responsibility

Workers rated felt safety responsibility using a 4-item scale from Curcuruto et al. (2016), which was originally developed by Morrison and Phelps (1999). An example item is "I feel a sense of personal responsibility in trying to make changes for safety." Cronbach's alpha was .884 for the 4-item scale.

3.3.5. Affective commitment

Workers rated affective commitment using the 4-item scale from Curcuruto and Griffin (2018), which was initially developed by Vandenberghe et al. (2004). An example item is "I feel I belong to this organization." Cronbach's alpha was .892 for the 4-item scale.

3.4. Confirmatory factor analysis

Confirmatory factor analysis was conducted to examine the internal validity of all studied variables (Muthén & Muthén, 2017). Table 2 showed the fit indices for all measurement models. Our hypothesized seven-factor model showed a good fit (χ^2 = 1027.033, *df* = 413, RMSEA = .060, CFI = .948, TLI = .942, SRMR = .035) to the data, and a better fit than three alternative models (model 1 combining felt safety responsibility and affective commitment into one factor: χ^2 = 1485.293, *df* = 419, RMSEA = .079, CFI = .910, TLI = .900, SRMR = .047; model 2 combining proactive

and prosocial safety behavior into one factor: $\chi^2 = 1599.808$, *df* = 419, RMSEA = .083, CFI = .900, TLI = .889, SRMR = .043; model 3 combining safety-role ambiguity, safety-role conflict, and interpersonal safety conflict into one factor: $\chi^2 = 1212.371$, *df* = 424, RMSEA = .068, CFI = .933, TLI = .927, SRMR = .038; Browne & Cudeck, 1992; Hu & Bentler, 1999). Item loadings ranged from .693 to .936. Additionally, we performed Harman's single factor analysis to rule out the common method variance concern (Podsakoff et al., 2003). Results showed that fit indices were not adequate for the one-factor model ($\chi^2 = 4759.448$, *df* = 434, RMSEA = .156, CFI = .635, TLI = .609, SRMR= .106), indicating that CMV was not a substantive concern in our study.

[Insert Table 2 here]

3.5. Data aggregation

To substantiate the appropriateness of aggregating frontline worker reports of safety stressors up to the team level, we calculated $R_{wg(j)}$ values to indicate the extent of interrater agreement amongst team members (James et al., 1984). To justify the application of multilevel analysis, we calculated the ratio of between-team to total variance (ICC[1]) and the reliability of within-team average ratings (ICC[2]), and conducted the respective *F* tests (Biemann et al., 2012; Bliese, 1998). Higher $R_{wg(j)}$, ICC(1), and ICC(2) values as well as a significant *F* test would indicate that data aggregation and multilevel modeling methods are justified. The appropriateness of data

aggregation was supported (James et al., 1984). For safety-role ambiguity, ICC(1) = .42, ICC(2) = .91, and median $R_{wg(j)}$ = .80. For safety-role conflict, ICC(1) = .49, ICC(2) = .93, and median $R_{wg(j)}$ = .70. For interpersonal safety conflict, ICC(1) = .45, ICC(2) = .92, and median $R_{wg(j)}$ = .78. Moreover, ANOVA results showed that there was significant between-team variance with safety stressors ratings, $F = 11.60$, $p < .001$ (safety-role ambiguity); $F = 16.02$, $p < .01$ (safety-role conflict); $F = 12.82$, $p < .001$ (interpersonal safety conflict). Taken together, it was suitable to examine safety stressors at the team level with a multilevel model (LeBreton & Senter, 2008).

3.6. Analytic strategy

A 2-1-1 multilevel mediation model was proposed (Preacher et al., 2011). Therefore, we used multilevel modeling to test the hypothesized model with Mplus 8.1 (Muthén & Muthén, 2017). Safety stressors was a team-level variable, while individual-level variables included felt safety responsibility, affective commitment, and proactive and prosocial safety behaviors. In keeping up with the typical practice of multilevel modeling, at the team level we controlled for team size. We used the Monte Carlo method to estimate indirect effects using Selig and Preacher's (2008) online R tool. For all indirect effects, we reported 95% confidence intervals (CI) based on 20,000 repetitions.

4. Results

4.1. Preliminary analysis

Descriptive statistics, including means, standard deviations, and inter-correlations among the studied variables, are presented in Table 3. As shown in Table 3, safety stressors were negatively related to felt safety responsibility and affective commitment. Specifically, safety-role ambiguity was negatively related to felt safety responsibility (r = -.440, p < .01) and affective commitment (r = -.463, p < .01). Safety-role conflict was negatively related to felt safety responsibility (r = -.487, p < .01) and affective commitment (r = -.525, p < .01). Interpersonal safety conflict was negatively related to felt safety responsibility (r = -.445, p < .01) and affective commitment (r = -.490, p < .01). Further, safety stressors were negatively correlated with proactive safety behavior and prosocial safety behavior. Specifically, safety-role ambiguity was negatively associated with proactive safety behavior (r = -.591, p < .01) and prosocial safety behavior (r = -.558, p < .01). Safety-role conflict was negatively associated with proactive safety behavior (r = -.619, p < .01) and prosocial safety behavior (r = -.576, p < .01). Interpersonal safety conflict was negatively associated with proactive safety behavior (r = -.563, p < .01) and prosocial safety behavior (r = -.553, p < .01). Moreover, there were positive correlations between felt safety responsibility and proactive safety behavior (r = .609, p < .01), felt safety responsibility and prosocial safety behavior (r = .607, p < .01), affective commitment and proactive safety behavior (r = .481, p < .01), and affective commitment and prosocial safety behavior (r = .610, p < .01). It is worth

noting that the three types of safety stressors were strongly correlated with each other (r = .863, p < .01 for safety-role ambiguity and safety-role conflict; r = .749, p < .01 for safety-role ambiguity and interpersonal safety conflict; r = .833, p < .01 for safety-role conflict and interpersonal safety conflict). These correlations became even stronger at the team level: safety-role ambiguity was positively related to safety-role conflict (r = .919, p < .01) and interpersonal safety conflict (r = .909, p < .01). Correlation between safety-role conflict and interpersonal safety conflict was also significantly positive (r = .960, p < .01). These results provided preliminary support for our hypotheses.

[Insert Table 3 here]

4.2. Hypotheses testing

Multilevel path analysis was used to examine the research hypotheses. Because the three types of team safety stressors were strongly correlated with each other, including the three antecedents simultaneously in the statistical model renders multicollinearity issues. Hence, we entered each type of stressor in a separate path analysis. First, the two types of SCB were regressed onto team safety stressors. Results showed that all the three types of team safety stressors had significantly negative effects on proactive safety behavior and prosocial safety behavior, supporting H1a and H1b. Specifically, team safety-role ambiguity had significantly negative effects on proactive safety behavior (β = -.696, p < .001) and prosocial safety behavior (β = -.764, p < .001).

Team safety-role conflict had significantly negative effects on proactive safety behavior (β = -.813, p < .001) and prosocial safety behavior (β = -.856, p < .001). Team interpersonal safety conflict had significantly negative effects on proactive safety behavior (β = -.849, p < .001) and prosocial safety behavior (β = -.893, p < .001).

To test Hypotheses 2–7, following Mathieu and Taylor (2006), we first tested a model in which felt safety responsibility and affective commitment fully mediated the effects of team safety stressors on the corresponding outcome variable. This model was then compared to a partial mediation model that specified the direct effects of the independent variable, team safety stressors, on both dependent variables (Anderson & Gerbing, 1988). In both cases, the effects of the other predictor on the outcome variable (i.e., prosocial safety behavior on felt safety responsibility, proactive safety behavior on affective commitment) were controlled for. Results showed that the partial mediation model with direct effects provided superior fit to the data (for safety-role ambiguity: $\triangle\chi^2$ (2) = 11.362, p < .005; for safety-role conflict: $\triangle\chi^2$ (2) = 13.11, p < .005; for interpersonal safety conflict: $\triangle\chi^2$ (2) = 13.086, p < .005). Path coefficients and indirect effect sizes were presented in Figure 2 and Table 4.

[Insert Figure 2 and Table 4 here]

Figure 2 shows that team safety stressors had significantly negative effects on felt safety responsibility and affective commitment, supporting H2 and H3. Specifically,

team safety-role ambiguity has significantly negative effects on felt safety responsibility (β = -.601, p < .001) and affective commitment (β = -.565, p < .001). Team safety-role conflict has significantly negative effects on felt safety responsibility (β = -.668, p < .001) and affective commitment (β = -.639, p < .001). Team interpersonal safety conflict has significantly negative effects on felt safety responsibility (β = -.696, p < .001) and affective commitment (β = -.661, p < .001). Meanwhile, felt safety responsibility had a positive effect on proactive safety behavior (β ranges from .236 to .237, p < .01) and affective commitment had a positive effect on prosocial safety behavior (β ranges from .234 to .243, p < .01), supporting H4 and H5. It was worth noting that the controlled path, affective commitment predicting proactive safety behavior, was insignificant (p > .05). In comparison, the controlled path of felt safety responsibility predicting prosocial safety behavior was significant (β ranges from .146 to .147, p < .001), but weaker than the proposed effect on affective commitment (β ranges from .234 to .243, p < .01).

As shown in Table 4, the indirect effect of team safety stressors on proactive safety behavior via felt safety responsibility and the indirect effect of team safety stressors on prosocial safety behavior via affective commitment were both significantly different from zero, supporting H6 and H7. Specifically, the indirect effect of team safety-role ambiguity on proactive safety behavior via felt safety responsibility (95% CI: lower bound = -.237; upper bound = -.048) and the indirect effect of team safety-role ambiguity on prosocial safety behavior via affective commitment (95% CI: lower

bound = -.215; upper bound = -.049) were both significantly different from zero. The indirect effect of team safety-role conflict on proactive safety behavior via felt safety responsibility (95% CI: lower bound = -.237; upper bound = -.048) and the indirect effect of team safety-role conflict on prosocial safety behavior via affective commitment (95% CI: lower bound = -.215; upper bound = -.049) were both significantly different from zero. The indirect effect of team interpersonal safety conflict on proactive safety behavior via felt safety responsibility (95% CI: lower bound = -.270; upper bound = -.046) and the indirect effect of team interpersonal safety conflict on prosocial safety behavior via affective commitment (95% CI: lower bound = -.234; upper bound = -.066) were both significantly different from zero.

5. Discussion

Stressors are an important feature of the workplace that can have a negative impact on multiple outcomes. Although safety stressors have attracted researchers' attention, how such stressors are linked to two types of SCB (i.e., proactive and prosocial safety behaviors) has not been empirically examined. This study identified the mediating roles of felt safety responsibility and affective commitment in the relationships between team safety stressors and proactive and prosocial safety behaviors. Our study not only demonstrates the value of looking at team-level stressors, but also provides evidence for the distinct ways by which team safety stressors hinder proactive and prosocial safety behaviors.

5.1. Theoretical implications

This study extends work stress theories that links individual perceptions of workplace stressors with SCBs to the team level. Specifically, this study showed that team safety stressors exerted a negative effect on proactive and prosocial safety behaviors, consistent with Wang et al.'s (2018) research wherein the detrimental influences of individual safety stressors on individual SCBs was found. Furthermore, our findings differentiate mediating mechanisms of two types of SCB, that is, employees experiencing safety stressors within their work team will conduct less proactive safety behaviors because of a reduced level of felt safety responsibility and less prosocial safety behaviors because of reduced affective commitment. Comparing findings from the current study with findings from Wang et al.'s (2020) empirical study, the effects of team safety stressors on the two types of SCB are much stronger than individual-level safety stressors predicting SCBs: In Wang et al. (2020), the β coefficients of individual safety stressors predicting SCBs ranged from -.246 to -.223, while this study showed that safety stressors conceptualized at a shared experience at the team level contributed substantially in predicting individual SCBs (β ranges from -.893 to -.696). The larger effect magnitudes further prove the importance of theorizing and examining team-level stressors.

Notably, the magnitudes of effects of all the three types of team safety stressors were quite comparable, all of them are in the strong range based on Cohen's standard (Cohen, 1988). Although the effects of team interpersonal safety conflict on felt safety

responsibility, affective commitment, and the two types of SCB were slightly stronger than team safety-role ambiguity and team safety-role conflict, and team safety-role conflict is also slightly stronger than team safety-role ambiguity. Our results showed that all the three types of team safety stressors can significantly impact worker's felt safety responsibility, affective commitment, and SCBs and are worth research attention.

This study further showed that the effects of team safety stressors on SCBs can be explained in terms of changes in the psychological state of individual employees. More specifically, the findings confirmed that felt safety responsibility and affective commitment have distinct functions and are critical mechanisms linking team safety stressors and proactive and prosocial safety behaviors. Our findings supported arguments from prior research (Curcuruto and Griffin, 2018; Curcuruto et al., 2019a) regarding the distinct internal psychological processes underlying these two types of SCB. Together with previous studies looking at collective-level stressors within a team (Kozusznik et al., 2015; Savelsbergh et al., 2012), the cross-level mediation process examined in the current study further supports that work stress theories could be extended to the team level, by revealing the top-down influence of team safety stressors on individual SCBs through negatively impacting individual's psychological states. As Razinskas and Hoegl (2020) advocated in their meta-analysis for more studies specifying cross-level influencing processes of team-level stressors on individual performance, this study responded to this advocate by providing empirical evidence in this regard.

590 Specifically, felt safety responsibility was found to mediate the relationship
591 between all three types of team safety stressors and proactive safety behavior. This
592 finding offers new insights into theories related to proactive role orientation (Curcuruto
593 et al., 2016), a topic empirically investigated in our study via the variable "felt safety
594 responsibility," and extends past research on proactivity in organizations (Chiaburu et
595 al., 2013; Parker et al., 2010). Compared with Curcuruto et al. (2019a), we validated
596 the role of felt safety responsibility as a transmitter of the impact of the three team safety
597 stressors on proactive safety behavior. Employees who experience a higher level of
598 team safety stressors tend to develop narrower safety-role boundaries, thereby
599 decreasing their feelings of responsibility to initiate changes to the organization's
600 policies and procedures to improve safety (Axtell et al., 2000; Griffin et al., 2007).
601 Additionally, a lack of affective commitment was shown to be a critical mechanism
602 linking team safety stressors and prosocial safety behavior. This finding concurs with
603 recent scholarly discussions of the role of affective commitment between distal
604 antecedents and prosocial safety behavior (Curcuruto & Griffin, 2018). Compared with
605 Curcuruto et al. (2019a), we further highlighted that safety stressors could and should
606 be examined at the team level and found a mediating role of affective commitment in
607 the relationship between team safety stressors and prosocial safety behavior. Higher
608 levels of team safety stressors tend to impede employees' affective commitment,
609 leading to a diminished tendency to perform helping behaviors, such as protecting
610 colleagues from hazards and telling them to follow safety procedures.

To conclude, research evidence on how stressors, especially team-level stressors, influence employee SCBs has been scarce. The mediating roles of felt safety responsibility and affective commitment identified in the current study provide an explanation for why such effects take place. These findings showed that the patterns through which team safety stressors affect proactive and prosocial safety behaviors are relatively sophisticated and nuanced. Thus, extending the forming model of SCBs is an essential theoretical subject that should be more thoroughly explored.

5.2. Practical implications

This study offers important insights for managers. Primarily, managers who want to design interventions to promote employee SCBs should target such interventions at reducing safety stressors in the work team—team safety-role ambiguity, team safety-role conflict, and team interpersonal safety conflict are all worth of attention. Managers should conduct appropriate safety training within the work team to enhance team members' safety knowledge and professional operations, because improved professional skills are likely to reduce the occurrence of safety-role ambiguity (Wang et al., 2020). Managers could also organize safety campaigns and contests between different work teams (López-Ruiz et al., 2013; Mullan et al., 2015), as these team-based competitions would reinforce employee awareness via a proactive channel of information and communication about safety issues, enhancing their role cognition and removing potential safety conflicts within the work team. We also recommend that managers communicate with employees openly and share organizational safety goals,

632 to create openness and suitable working environments, thereby eliminating potential
633 team stressors like interpersonal safety conflicts (Curcuruto & Griffin, 2018; Kines et
634 al., 2013).

635 Another important finding of this study is that when employees perceive that they
636 are not adequately equipped with the ability to resolve a safety stressor induced by the
637 work team, they may experience negative psychological states that directly relate to the
638 organization. Therefore, managers could carefully plan activities that could help team
639 members build a good social relationship with each other; such activities could be a
640 part of the job training, informal entertainment projects, or both (Leung et al., 2014;
641 Pooja et al., 2016). Good within-team social relationships enhance team members'
642 interdependence and team cohesion, which makes employees feel more attached to the
643 organization. As a result, the improved affective commitment improves their desire to
644 actively consider other team members' safety (Bakker & Demerouti, 2007; Curcuruto
645 & Griffin, 2018). Moreover, interventions could be oriented towards giving employees
646 sufficient care and work support, demonstrating that the organization cares about their
647 well-being and safety and values their contribution, thereby promoting an
648 organizational atmosphere of mutual help (Lyubovnikova et al., 2018). This could make
649 employees feel proud of and emotionally connect with their teams, which would in turn
650 suppress potential team stressors and promote employees' desire to reciprocate such
651 favorable treatment.

5.3. Limitations and future research

This study has several limitations, including three major issues. First, the data were obtained from construction companies operating in China; thus, generalizability to other contexts may be limited. Although this specific setting supports our proposed model, we recognize that future research should expand sample size and diversity by including additional geographical areas and industries, as these factors might influence the applicability of the model. Second, this study only includes a limited number of variables as antecedents of employee SCBs. Although the explanatory power of the proposed model reached the recommended value (Chin & Newsted, 1999), there could exist other individual-level variables besides felt safety responsibility and affective commitment that likely link safety stressors and SCBs, such as job satisfaction and job engagement (Jou et al., 2013; Yuan et al., 2015). Thus, future studies should consider a more comprehensive research framework for assessing how other individual-level variables influence the relationship between safety stressors and proactive safety behavior and that between safety stressors and prosocial safety behavior. Finally, due to the cross-sectional design of this study, we could not draw strong causal inferences regarding the effects of team safety stressors on felt safety responsibility and affective commitment and the two SCBs. Therefore, we highlight the need for future studies to utilize longitudinal designs to further validate the relationships examined in this study.

6. Conclusion

Our empirical results highlight two distinct pathways through which team safety

673 stressors relate to SCBs: via felt safety responsibility to proactive safety behavior and
674 via affective commitment to prosocial safety behavior. The study not only serves as the
675 first study to extend work stress theories to the team level in linking team stressors to
676 SCBs, but also establishes a detailed understanding of psychological factors that link
677 team safety stressors to different types of SCB. Specifically, this study shows that a lack
678 of positive attitudes towards safety responsibility and towards the organization
679 explained why team safety stressors reduce both forms of SCB, respectively. Managers
680 can therefore develop interventions based on findings of this study to promote workers'
681 initiative to engage in proactive and prosocial safety behaviors, hence achieving better
682 organizational safety outcomes.
683
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Table 1

Demographic characteristics of frontline workers (N =408) and safety supervisors (N = 28)

Characteristics	Items	Frequency	Percentage (%)
Frontline workers			
Age	Less than 30 years	52	12.7
	31–40 years	133	32.6
	41–50 years	168	41.2
	More than 50 years	55	13.5
Work experience	Less than 5 years	86	21.1
	5–10 years	126	30.9
	More than 10 years	196	48.0
Education level	Junior middle school or below	316	77.4
	Senior high school	77	18.9
	Junior college or above	15	3.7
Safety supervisors			
Age	Less than 30 years	10	35.7
	31–40 years	6	21.4
	41–50 years	7	25.0
	More than 50 years	5	17.9
Work experience	Less than 5 years	5	17.9
	5–10 years	10	35.7
	More than 10 years	13	46.4

Table 2

Fit indices for measurement models

Model	χ^2	*df*	RMSEA	CFI	TLI	SRMR	$\triangle\chi^2$ ($\triangle df$)
Proposed: Seven-factor model	1027.033	413	.060	.948	.942	.035	–
Alternative 1: Six-factor model (felt safety responsibility and affective commitment as one factor)	1485.293	419	.079	.910	.900	.047	458.26 (6)***
Alternative 2: Six-factor model (proactive safety behavior and prosocial safety behavior as one factor)	1599.808	419	.083	.900	.889	.043	572.775 (6)***
Alternative 3: Five-factor model (safety-role ambiguity, safety-role conflict, and interpersonal safety conflict as one factor)	1212.371	424	.068	.933	.927	.038	185.338 (11)***
One-factor model	4759.448	434	.156	.635	.609	.106	3732.415 (21)***

Note: χ^2 = chi-square, *df* = degrees of freedom. ***$p < .001$.

Table 3

Descriptive statistics and Pearson's correlations among variables

Variable	Mean	*SD*	1	2	3	4	5	6
Individual level	–	–	–	–	–	–	–	–
1. Safety-role ambiguity	2.34	1.03	–	–	–	–	–	–
2. Safety-role conflict	2.40	.97	.863**	–	–	–	–	–
3. Interpersonal safety conflict	2.40	.95	.749**	.833**	–	–	–	–
4. Felt safety responsibility	3.76	.86	-.440**	-.487**	-.445**	–	–	–
5. Affective commitment	3.82	.88	-.463**	-.525**	-.490**	.568**	–	–
6. Proactive safety behavior	3.92	.81	-.591**	-.619**	-.563**	.609**	.481**	–
7. Prosocial safety behavior	3.91	.81	-.558**	-.576**	-.553**	.607**	.610**	.795**
Team level								
1. Safety-role ambiguity	2.35	.75	–	–	–	–	–	–
2. Safety-role conflict	2.42	.73	.919**	–	–	–	–	–
3. Interpersonal safety conflict	2.43	.68	.909**	.960**	–	–	–	–
4. Team size	14.75	14.71	-.019, *n.s.*	-.024, *n.s.*	-.038, *n.s.*	–	–	–

Note: n = 408 for individual-level variables, n = 28 for team-level variables, SD = standard deviation. Individual-level correlations were below the diagonal.

**$p < .01$, *$p < .05$, *n.s.* means nonsignificant, all tests two-tailed.

Table 4

Indirect effects

Path	Hypothesis Supported	Estimate	Lower CI	Upper CI
Team safety-role ambiguity → Felt safety responsibility → Proactive safety behavior	H6	-.143	-.237	-.048
Team safety-role conflict → Felt safety responsibility → Proactive safety behavior	H6	-.143	-.237	-.048
Team interpersonal safety conflict → Felt safety responsibility → Proactive safety behavior	H6	-.158	-.270	-.046
Team safety-role ambiguity → Affective commitment → Prosocial safety behavior	H7	-.132	-.215	-.049
Team safety-role conflict → Affective commitment → Prosocial safety behavior	H7	-.132	-.215	-.049
Team interpersonal safety conflict → Affective commitment → Prosocial safety behavior	H7	-.150	-.234	-.066

Note: Indirect effects were tested using a Monte Carlo method (20000 repetitions, 95% confidence intervals [CI]).

Figure captions

- **Figure 1.** The hypothesized model.
- **Figure 2.** Path coefficients of the multilevel partial mediation model.

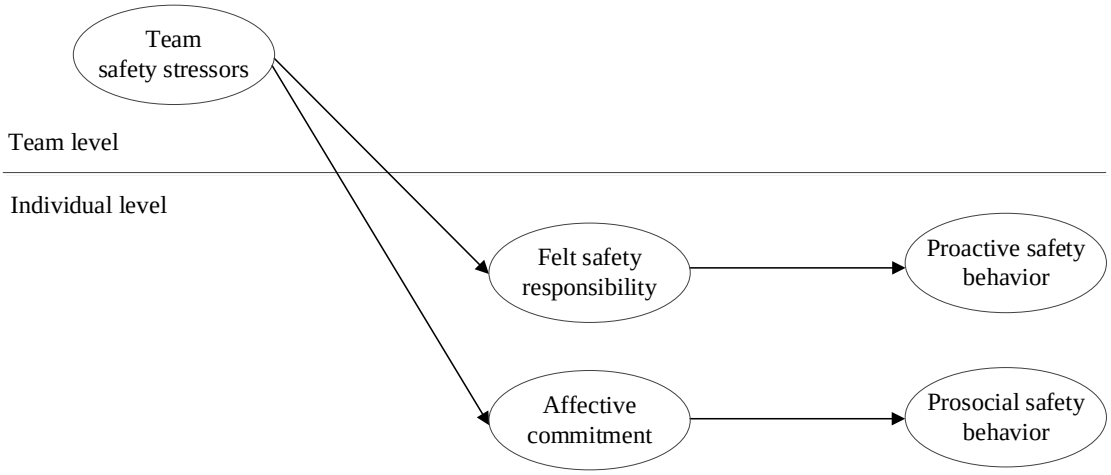

Figure 1. The hypothesized model.

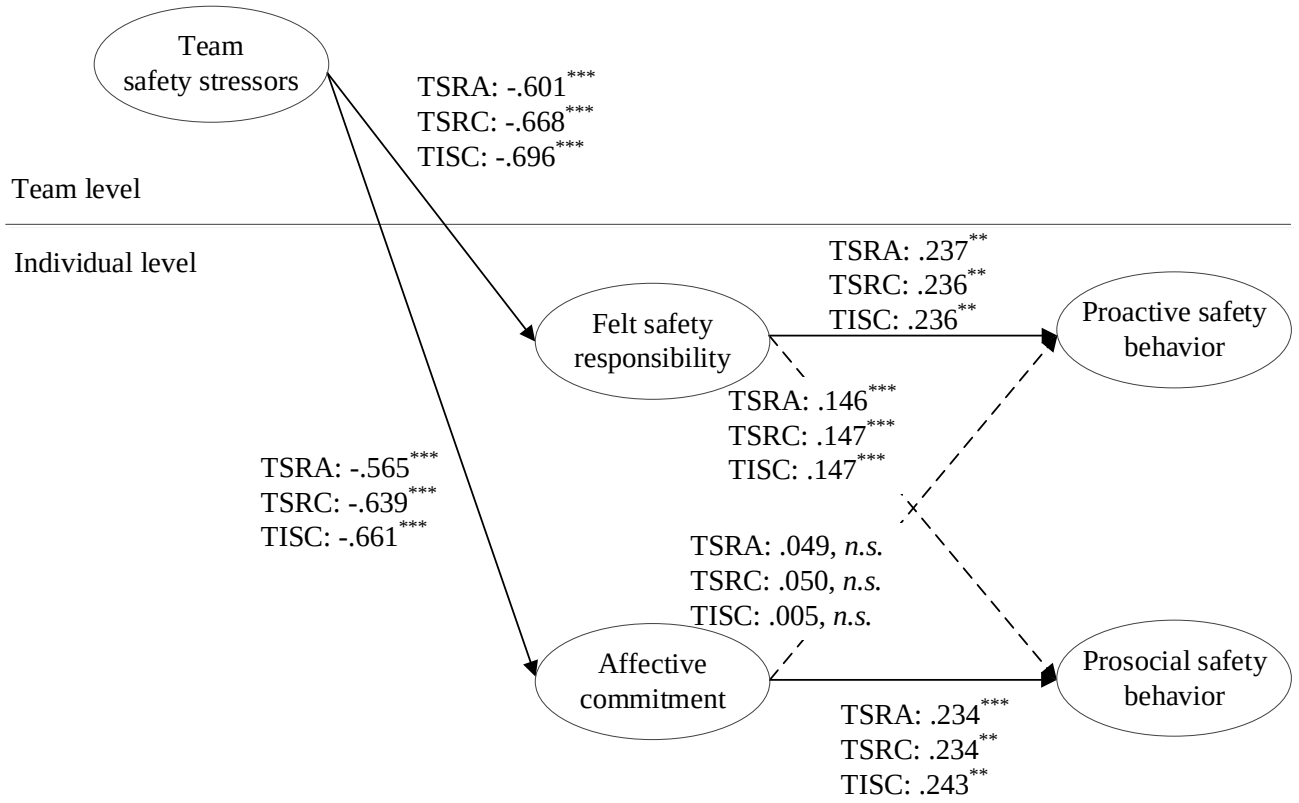

Figure 2. Path coefficients of the multilevel partial mediation model. Solid lines represented hypothesized relationships, dotted lines indicated the controlled paths. For brevity, we did not present the effects of team size on dependent variables. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$, *n.s.* means nonsignificant, all tests two-tailed, n = 408. TSRA = team safety-role ambiguity, TSRC = team safety-role conflict, TISC = team interpersonal safety conflict.