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Temporal leadership, attentiveness, and safety behaviors: The moderating roles of abusive supervision and safety consciousness

Abstract:

Construction safety has drawn increasing attention from both researchers and practitioners. The relationships between safety-specific leadership behaviors and safety behaviors are well-documented. However, less is known about whether and how other leadership behaviors such as temporal leadership, which focuses on managing time-related resources for task achievement, might impact construction workers' safety-specific attitudes and behaviors. In this study, social information processing theory is applied to examine how and when temporal leadership influences individual safety behaviors. Specifically, attentiveness is considered to be a mediator in the relationship between temporal leadership and individual safety behaviors, and the moderating roles of team abusive supervision and individual safety consciousness are examined. Using a sample of 535 workers nested in 120 teams engaged in construction projects in China, the hypothesized moderated mediation model was examined using multilevel modeling analysis and bootstrapping methods. The results identify a positive effect of temporal leadership on safety compliance and safety participation mediated through attentiveness. This indirect effect is weaker when there is more team-level abusive supervision, and stronger when there is a higher individual safety consciousness. This study contributes to emerging research on safety management and temporal management by showing how the affective mechanism of temporal leadership influences individual safety behaviors. Moreover, the boundary

conditions under which temporal leadership influences safety behaviors are also identified.

Keywords: temporal leadership, safety behavior, attentiveness, abusive supervision, safety consciousness

Temporal leadership, attentiveness, and safety behaviors: The moderating roles of abusive supervision and safety consciousness

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Temporal leadership, attentiveness, and safety behaviors: The moderating roles of abusive supervision and safety consciousness

1. Introduction

Working on site in construction projects has been identified as a stressful and highly risky occupation (Leung et al., 2012). Developing individual safety behavior and avoiding unsafe behaviors for reducing injuries and accidents have been increasingly emphasized by both scholars and practitioners (Fang et al., 2015). Over the last two decades, leadership has been shown to exert a crucial role in enhancing the safety behaviors of employees and decreasing workplace accidents (Hofmann et al., 2003; Mullen and Kelloway, 2009). Thus, leaders are expected to perform certain acts to enhance safety in a time-pressured setting. Such temporal challenges (e.g., tight schedule and imposed deadlines) might be related to employees' safety behaviors, it is therefore necessary to explore how leaders can orchestrate employees to adapt to high job demands and facilitate safety behaviors in this time-pressured context.

A multitude of studies demonstrated the impacts of constructive leadership behaviors on safety behaviors. For example, safety-focused transformational leadership and transactional leadership have been shown to positively impact individual safety compliance and safety participation through safety climate (Barling et al., 2002; Clarke, 2013; Lingard et al., 2019; Martínez-Córcoles and Stephanou, 2017). Morality leadership facilitates safety behaviors through safety motivation (Chen and Chen, 2014), while ethical leadership facilitates safety behaviors via self-efficacy and job autonomy (Chughtai, 2015). Moreover, several studies focused on the effects of destructive supervisory behaviors. Significantly, passive leadership can influence safety behaviors or injury levels by reducing the safety climate (Kelloway et al.,

2006; Smith et al., 2016). Abusive supervision has been shown to influence safety behaviors through increasing emotional exhaustion (Yuan et al., 2020). The evidence provided in these studies indicates that leaders can either motivate or hinder individuals from engaging in safety activities by affecting the recognition or motivation of employees or by influencing the organizational safety climate.

Although the extant literature has documented how constructive or destructive leadership behaviors influence safety, critical questions need to be addressed comprehensively and deeply to better understand how leader practices can affect employees' safety behaviors. First, traditionally studied leadership styles, such as transformational and transactional leadership, are too vague to address this complex and dynamic context (Hughes et al., 2018). Leaders should engage in specific behaviors that align with this complex and dynamic environment (Rosing et al., 2011). Particular leadership styles may have stronger impacts than other well-documented general leadership styles (Hughes et al., 2018). Furthermore, the effectiveness of constructive leadership has not been examined simultaneously and empirically with destructive leadership styles to demonstrate their roles in safety management. Second, distinct mechanisms (cognitive, motivational, and climate enhancement mechanisms) have been identified as core mechanisms explaining the mediating paths from leadership styles to safety behaviors (Barling et al., 2002; Chen and Chen, 2014; Lingard et al., 2019). Nonetheless, further potential mediators (e.g., affective variables) may also explain the mechanism linking leadership styles to employee behaviors (Ashkanasy and Jordan, 2008). Thus, research is needed focusing on more specific and nuanced leadership behaviors and other mediators and mechanisms when examining the impact of leadership on safety behaviors (Yuan et al., 2020).

Thus, this study addresses the calls for studying the impacts of specific leadership behaviors on individual safety behaviors by incorporating the interplay between temporal leadership and abusive supervision. Temporal leadership refers to a set of task-oriented behaviors focused on scheduling, synchronizing, and allocating temporal resources, such as establishing milestones, decreasing conflicts by adjusting task flows, and coordinating team members (Mohammed and Nadkarni, 2011). These specific leadership behaviors might be related to employees' in-role behavior in time-pressured settings but remain understudied in the safety management literature. In this context, we suggest that the specific constructive leadership behaviors—temporal leadership that focuses on securing and managing resources (e.g., time) to accomplish tasks (Mohammed and Nadkarni, 2011) — positively affect safety behaviors. Moreover, abusive supervision might negatively influence safety behaviors. Abusive supervision is defined as the perception of the extent to which leaders present hostile verbal behaviors (Tepper, 2000). Moreover, considering that team-based structures are common in the construction project context, such destructive leadership behaviors may impact the team as a whole. As individuals are more sensitive to destructive leadership behaviors (Schmid et al., 2018), abusive supervision is more likely to affect all team members than temporal leadership (Rousseau and Aubé, 2018). Thus, this study explored the potential effect of the interaction between temporal leadership at the individual level and abusive supervision at the team level on workers' safety behaviors, as well as the underlying mechanism.

To understand the mechanism, this paper draws upon social information processing (SIP) theory (Salancik and Pfeffer, 1978), as it is particularly helpful for understanding the influences of supervisory practices on employees' behaviors. The core content of this theory is that

individuals construct their perceptions and attitudes by processing social cues in the workplace. These perceptions and attitudes then affect their behaviors (Salancik and Pfeffer, 1978). Building from SIP theory, temporal leadership and abusive supervision may exert impacts in providing information cues in time-pressured contexts (e.g., construction projects); these cues may influence safety behaviors of individuals. However, the dominant paradigm that explains how information cues influence employees' behaviors focuses on their cognitive process. The emotion-related process can also be activated in SIP, and integrated with cognitive process (Arsenio, 2010). Thus, based on SIP theory, the underlying mechanism through which engaging in temporal leadership and abusive supervisory behavior indirectly impacts individual safety behaviors was examined by introducing attentiveness as an affective mediator. Temporal leadership can urge and maintain an adequate level of attentiveness, which refers to feelings of alertness, concentration, and determination (Watson, 2000), through acts of temporal resource management (e.g., providing reminders about tight deadlines or coordinating scheduled activities). Such positive emotional experiences, in turn, aid safety behaviors.

Moreover, regarding the integration of emotional and cognitive processes, a cognitive factor (i.e., safety consciousness as well as personal beliefs about safety issues and hazards (Barling et al., 2002)) is identified that moderates the benefits of attentiveness on safety. Specifically, this study examined whether the emotional response to safety may vary from the beliefs among different individuals (Meng and Chan, 2020) to test the potential to integrate emotional and cognitive variables in SIP for construction safety.

Figure 1 summarizes the theoretical model of this study, in which a multi-source survey with samples of construction workers and team leaders or supervisors was employed. This

research makes several contributions to the extant literature. First, this study expands the research scope of the factors that influence safety behaviors to a narrower set of leadership behaviors (e.g., temporal leadership), which differ from general broader leadership styles (e.g., transformational leadership). This study extends the idea of temporal leadership styles into safety research based on SIP theory and examines the relationship between temporal leadership and safety behaviors in a time-pressured context (e.g., construction projects). Second, the affective mechanism between temporal leadership and safety behaviors is identified. The mediating role of attentiveness is explored to expand understanding of the internal mechanism connecting temporal leadership and safety behaviors from an affective lens rather than the cognitive mechanism. Third, this study offers insight into competitive and different boundary conditions under which temporal leadership may encourage or inhibit safety behaviors. By introducing team abusive supervision as a moderator, this study validates the detrimental effects of abusive supervision on safety outcomes (Yuan et al., 2020), broadens the range of abusive supervision to also incorporate the team level, and identifies the potential constructive impact of limited abusive supervision. By incorporating individual safety consciousness as moderator, this study answers the call for exploring the personal conditions that function in the effects of antecedents on individuals' safety behaviors (Meng and Chan, 2020). This study also contributes to SIP theory by verifying the integration of emotional and cognitive processes in SIP when exploring the interaction of attentiveness and safety consciousness.

[Insert Figure 1 about here]

2. Theoretical background and hypothesis development

2.1. Temporal leadership and attentiveness

In a turbulent environment, a leader has to face challenges such as managing multiple timeframes and adapting to different pacing styles (Ancona et al., 2001). To address these temporal challenges, the concept of temporal leadership was coined in the team context, which refers to the task-oriented behaviors of team leaders that emphasize temporality. Examples are reminding people of deadlines and coordinating and managing the pacing of task accomplishment (Mohammed and Nadkarni, 2011). Prior studies have provided evidence that this temporal leadership (e.g., scheduling task activities, allocating time resources to relevant tasks, and monitoring team members' use of time (Aeon and Aguinis, 2017; Mohammed and Nadkarni, 2011)) positively affected team performance (Santos et al., 2016) and organizational performance (Chen and Nadkarni, 2017). Hence, temporal leadership represents recognition of the time significance and helping employees tackle temporal tasks under tight deadlines (Halbesleben et al., 2003; van der Erve, 2004). This might also exert a role in affecting individuals' practices and outcomes. At the individual level, temporal leadership focuses on helping and monitoring employees to complete tasks and achieve goals through effectively allocating, coordinating, and managing employees' time resources in the leader-member exchange process under tight deadlines (Gevers and Demerouti, 2013).

In the present study, the relationship between a leader's temporal behaviors and employees' behavioral outcomes are assessed at the individual level. SIP theory (Salancik and Pfeffer, 1978) states that individuals apply information from their work context to interpret events, evaluate their work environment, and decide how to respond and behave to certain cues (Piccolo and Colquitt, 2006). Leaders are critical providers of informational cues in the work context, and influence followers' job perceptions, resources, and career development (Griffin et al., 1987;

Hu and Shi, 2015). Informational cues from leaders may lead to different perceptions in employees (Griffin, 1981), who tend to act based on the situational desirability of specific leadership behaviors (Lu et al., 2019). This study assesses the relationship between temporal leadership and attentiveness.

Attentiveness is a specific kind of positive emotional experience or state, which is defined as feelings of alertness, concentration, and determination (Watson, 2000). Temporal leadership may enable team members to tackle task-related temporal problems, because they receive help with the effective structuring and coordinating of time resources (Mohammed and Alipour, 2014; Mohammed and Nadkarni, 2011). Furthermore, temporal leadership enhances the significance of temporal goals and motivates team members to engage in specific tasks (Gevers and Demerouti, 2013). Hence, temporal leadership behaviors can help ameliorate individual time pressure and balance the challenges imposed by time goals and the application of skills to trigger individual positive experience (i.e., attentiveness).

Construction projects are often associated with significant time pressure and work overload (Liu and Low, 2011). As such, time-related leadership behaviors can help workers overcome temporal problems and guide workers to adapt to temporal challenges (J. Zhang et al., 2020). If temporal leadership mitigates these challenges by appropriately allocating temporal resources, team members or workers are likely to be more attentive and committed to task and goal accomplishment (Gevers et al., 2001; Mohammed and Nadkarni, 2011). Thus, based on social-information-processing theory and the above arguments, it was assumed that temporal leadership offers the opportunity for workers to be attentive at work. The following hypothesis was tested:

Hypothesis 1. Temporal leadership by leaders is positively related to team members' attentiveness.

2.3. The mediating role of attentiveness

There are two forms of safety behaviors: safety participation and safety compliance (Griffin and Neal, 2000). Safety participation refers to voluntary participation in safety activities for the development of a supportive safety environment, such as participating in safety meetings and raising safety concerns (Griffin and Hu, 2013; Griffin and Neal, 2000). Safety compliance refers to behaviors associated with the following of safety rules, procedures, and regulations, such as wearing safety equipment (Griffin and Neal, 2000; Neal and Griffin, 2006).

Previous studies highlighted the possible role of leadership in influencing employees' safety behaviors or performance (Hofmann et al., 2003; Mullen and Kelloway, 2009), and further incorporated cognitive and motivational variables as mediators (Barling et al., 2002; Chen and Chen, 2014; Lingard et al., 2019). However, the affective mechanism underlying the association between leadership and safety behaviors was underexplored. This study incorporates attentiveness as an affective mediator in the relationship between temporal leadership and safety behaviors. Attentiveness captures positive and pleasant feelings as well as engagement (Watson and Tellegen, 1985); as such, it can be considered to activate positive emotional experience (Parker et al., 2010) and can enable proactive behaviors (Bindl and Parker, 2011). SIP theory (Salancik and Pfeffer, 1978) proposes that leadership plays an important role in providing informational cues that influence employees' responses, attitudes, and behaviors. Under a turbulent and stressful environment, individuals can gather cues from what their

leaders or supervisors say and do and apply this information to regulate their behaviors (Peng et al., 2019). Therefore, when interacting with temporal leadership, individuals might gather and process the temporal information provided by their leader. These individuals might also gather cues from their leaders' temporal behaviors in an environment of time pressure and adjust their behaviors accordingly.

In this case, the authors propose that attentiveness serves as an affective mediator to translate temporal leadership into employees' safety behaviors. Attentiveness can serve as an activated positive emotional response for translating leadership variables into proactive behaviors by employees. The individual affect can "bridge" workplace cues (i.e., temporal leadership) and individual behavior (i.e., safety behaviors) (Xiao et al., 2020). Specifically, temporal leadership can lower team members' sense of time pressure and alleviate the negative experience imposed by time shortage by effectively managing time resources (Mohammed and Alipour, 2014; Mohammed and Nadkarni, 2011). This may increase the sense of security and attentiveness at work (Parker et al., 2010; J. Zhang et al., 2020), thus increasing team members' responsibilities with respect to proactive and in-role behaviors (e.g., engaging in safety-related activities and following safety-related rules). Consequently, the following hypotheses are proposed:

Hypothesis 2a. Team members' attentiveness mediates the relationship between temporal leadership and team members' safety compliance.

Hypothesis 2b. Team members' attentiveness mediates the relationship between temporal leadership and team members' safety participation.

2.3. Moderating role of team-level abusive supervision

Previous studies have mostly focused on the role of positive leadership styles in occupational safety, while few studies in the safety field have focused on the possible effect of destructive supervisory behaviors (Nielsen et al., 2016). However, destructive supervision, especially abusive supervision, has attracted considerable attention in other fields because of its negative impacts in the workplace (Aryee et al., 2007; Martinko et al., 2013; Tepper, 2007). Abusive supervision refers to subordinates' perceptions of the extent to which supervisors engage in the sustained display of hostile verbal and nonverbal behaviors and physical contact (Tepper, 2000). In a construction project, abusive supervision mostly reflects a set of supervision practices, including aggression, workplace bullying, incivility, and negative mentoring (Gallagher et al., 2015). When leaders are very task and time driven and operate in a high stress and demanding environment (e.g., long work hours, cost cuts, and the need for increased productivity as often the case in construction projects), they may become forceful and engage in over-zealous management practices their team members perceive as abusive (Gallagher et al., 2015). Thus, a high-pressure and risk-associated project environment may support abusive supervision behaviors (Tepper, 2007).

In a team context, abusive supervision may be perceived as the experience of a group of team members rather than someone's personal experience (Rousseau and Aubé, 2018). Accordingly, abusive acts of team leaders can directly impact all members in a team as a whole (Priesemuth et al., 2014). Although a leader may abuse a single member or a small group of team members, all team members can be influenced by this abusive leader because other members witness the abuse or interact with the victim in the team (Giacalone and Promislo, 2010). Prior research has focused on the impacts of individual abusive supervision in the

project setting (Gallagher et al., 2015; Ju et al., 2020). The role of team-level abusive supervision remains underestimated in this field. Accordingly, in the present study, the impacts of abusive supervision were examined at the team level.

Abusive supervision provides informational cues related to resource threats or loss, resulting in deleterious outcomes for individuals and organizations. Tepper et al. (2017) demonstrated that working for an abusive leader may deplete employee resources. Abusive supervision may trigger individuals' negative affect and emotional responses (Tepper et al., 2008; Yuan et al., 2020). According to SIP theory, individuals' common interpretation can be developed through cues provided by team-level abusive supervision and interactions with the victims. Considering the common occurrence of exposure to abusive behaviors within a team (Priesemuth et al., 2014; Rousseau and Aubé, 2018), the team member might be affected by such team-level abusive supervision.

In the case of team-level abusive supervision, when these shared experiences of abuse are prominent, project members may perceive a high level of abusive supervision as a harmful and negative signal, leading to lower attentiveness levels and exhaustion (Whitman et al., 2014; Xu et al., 2015). Individuals experiencing a high level of abusive supervision may feel uncertain about how to cope with complex tasks or challenges using resources from temporal leadership behaviors (Lian et al., 2012). However, in a challenging project setting, a low level of abusive supervision may also be perceived as stressful events, examples of which are branding a team member as incompetent, identifying their work as unsatisfactory, and imposing high expectations (Zhu and Zhang, 2019). Team members may be stimulated to focus more exclusively on tasks or be attentive to their work to meet the expectations and achieve goals.

Hence, when leaders or supervisors exhibit a high level of team abusive supervision, the relationship between temporal leadership and team members' attentiveness may weaken. Nevertheless, this relationship may be strengthened if the team experiences a low level of team abusive supervision. Thus, the following hypothesis is proposed:

Hypothesis 3. Team-level abusive supervision moderates the relationship between temporal leadership and team member attentiveness. This relationship is less positive when team-level abusive supervision is high and more positive when team-level abusive supervision is low.

Combined with the proposed mediation by attentiveness, temporal leadership is proposed to affect team members' attentiveness, which can influence safety behaviors. Thus, project members experiencing a high level of team abusive supervision from supervisors or managers may deplete their own emotional resources and may provide fewer valuable resources from temporal leadership behaviors compared to members experiencing a low level of team abusive supervision. Resource depletion makes it difficult for project members to be attentive in the workplace, which may decrease their engagement, thus lowering safety behaviors. Following this logic, team abusive supervision is argued to weaken the positive effects of temporal leadership on safety behaviors by decreasing positive affect (i.e., attentiveness). Therefore, possible moderated mediation hypotheses are proposed as follows:

Hypothesis 4a. Team abusive supervision moderates the indirect individual positive effect of temporal leadership on team members' safety compliance through team members' attentiveness. This indirect positive relationship is weakened under high levels of abusive supervision.

Hypothesis 4b. Team abusive supervision moderates the indirect individual positive effect of temporal leadership on team members' safety participation through team members' attentiveness. This indirect positive relationship is weakened under high levels of abusive supervision.

2.4. Moderating role of safety consciousness

Safety consciousness focuses on individual attitudes, awareness, and beliefs about safety issues and hazards (Barling et al., 2002; Westaby and Lee, 2003). Safety consciousness also focuses on the ability of individuals to effectively address potentially dangerous circumstances (Forcier et al., 2001), reflecting the individual safety cognition in the workplace. Moreover, safety consciousness is assessed chiefly at the individual level (Barling et al., 2002; Westaby and Lee, 2003), focusing on individual safety knowledge and awareness of safety issues. Safety-conscious individuals are resilient when facing unsafe situations and hazards, are more likely to engage in safety behaviors, and are less likely to participate in risky or dangerous behaviors (Forcier et al., 2001). Previous studies found that safety consciousness was significant and critical for enhancing safety behaviors and outcomes in construction workers (Barling et al., 2002; Wong et al., 2020).

SIP theory posits that individual cognitions, as a function of information processing, are available (Salancik and Pfeffer, 1978). In the mediation hypotheses proposed above (Hypothesis 2a and 2b), both the emotional and non-cognitive function in the informational processing process have been proposed. The emotion-related variable (e.g., attentiveness) is also a type of cue for information processing, and differs from the cognition-related variable (e.g., consciousness) (Lemerise and Arsenio, 2000). Furthermore, it is possible to integrate

emotion and cognition in social information processing (Izard, 1984; Lemerise and Arsenio, 2000). Therefore, the authors propose that attentive individuals with different levels of safety consciousness may react differently when facing safety-related situations. This leads to the expectation of the moderation of safety consciousness integrated into the emotional response process for construction safety.

Given the complex nature of construction projects, safety consciousness is a highly salient feature for reducing accidents and injuries. Construction workers with high safety consciousness may have a higher awareness of safety-related issues. The behaviors of construction workers with high levels of safety consciousness may be oriented around preventing unsafe behaviors or accidents (de Koster et al., 2011; Kelloway et al., 2006). This also facilitates the positive impact attentiveness has on safety behaviors. Accordingly, construction workers with a high level of safety consciousness are more likely to engage in safety-related tasks and activities than workers with a low level of safety consciousness. As such, the emotion-cognition interaction for construction safety is proposed as follows:

Hypothesis 5a. Individual safety consciousness moderates the positive relationship between attentiveness and safety compliance. This relationship is stronger under high levels of safety consciousness.

Hypothesis 5b. Individual safety consciousness moderates the positive relationship between attentiveness and safety participation. This relationship is stronger under high levels of safety consciousness.

When combined with the mediation hypotheses, the authors argue that safety consciousness facilitates the positive effects of temporal leadership on safety behaviors by

309 increasing attentiveness in the workplace. After processing information provided by temporal
310 leadership, individuals with high safety consciousness tend to be more engaged in specific
311 tasks and more likely to be vigilant regarding safety issues. As such, the possible
312 moderated mediation hypotheses are proposed as follows:

313 Hypothesis 6a. Individual safety consciousness moderates the indirect positive effect of
314 temporal leadership on team members' safety compliance through team member attentiveness.
315 This indirect positive relationship is stronger under high levels of safety consciousness.

316 Hypothesis 6b. Individual safety consciousness moderates the indirect positive effect of
317 temporal leadership on team members' safety participation through team member attentiveness.
318 This indirect positive relationship is stronger under high levels of safety consciousness.

319 # 3. Method

320 ## *3.1. Participants and procedure*

321 To clarify the research aims, a pilot study was conducted. Preliminary questionnaires
322 were distributed to nine workers and two team leaders at a construction site in Kunming to
323 identify potential confusing items and ensure the readability and accuracy of the
324 questionnaire. According to previous studies concerning construction safety in China
325 (Wang et al., 2020, 2018), the number of sampled practitioners was adequate for a
326 preliminary questionnaire. The final questionnaires were modified and simplified based on
327 the feedback obtained from the pilot study. A formal investigation was conducted to
328 survey construction workers and team leaders in construction projects in South China
329 between October 8, 2019, and December 4, 2019. Specifically, multilevel data were
330 collected from teams working on construction sites. These teams, consisting of 4–6 team
members each, were invited to participate in the survey

and participated voluntarily. Within different teams, construction workers performed tasks such as civil construction, installation, or decoration. Within each team, the team leader or the manager responsible for site or safety management was also recruited and was asked to evaluate workers' behaviors.

Surveys were distributed to 130 team leaders or managers of work teams and their associated 650 construction workers. Ultimately, 120 team leaders provided ratings for their workers or team members, and 535 construction workers completed self-report surveys and assessed their leaders or managers (response rate = 82.31%). The final construction worker sample included 518 males (96.8%) and 17 females (3.2%). The average age was 33.13 years (*SD* = 8.19) and the average tenure in the current project was 1.18 years (*SD* = 0.78). Worker types included civil construction workers (N = 160; 29.9%), installing workers (N = 180; 33.6%), decorating workers (N = 158; 29.5%), and other workers (N = 37; 6.9%). The team size was 4–6 people, and the average team size was 4.46.

3.2. Measures

A back-translation procedure from English to Chinese was conducted using Brislin's method (1980). Five-point measures were used to assess studied constructs. The appendix describes the items for all studied constructs.

Temporal leadership. Construction workers were asked to assess temporal leadership using a six-item scale developed by Mohammed and Nadkarni (2011), with responses ranging from 1 ("not at all") to 5 ("a great deal") regarding the leader's or supervisor's leadership approach. A sample item is: "To what extent does your team leader or direct supervisor remind you of important deadlines?" Cronbach's alpha was 0.86.

Abusive supervision. Construction workers were also asked to assess abusive supervision using a five-item scale developed by Mitchell and Ambrose (2007), with responses ranging from 1 ("not at all") to 5 ("a great deal") regarding the leader's or supervisor's leadership approach. A sample item is: "Your team leader or direct supervisor makes negative comments about you to others." Cronbach's alpha was 0.93. To obtain information on the team-level abusive supervision, each member's perceived abusive supervision rating was aggregated, and the group mean was centered to obtain a score of the team-level abusive supervision. To justify the aggregation, $r_{wg(j)}$ was computed using RStudio to evaluate the interrater agreement. The value was 0.86 ($p < 0.05$) across 120 teams, representing a high level of within-team agreement (James et al., 1984). The average deviation indices $AD_{M(j)}$ and $AD_{Md(j)}$ were calculated as 0.48 and 0.40, respectively. This evidence indicates that member ratings indicate the existence of team-level abusive supervision.

Attentiveness. Attentiveness was assessed using a four-item scale developed by Watson et al. (1988), adapted from Rodell and Judge (2009), with responses ranging from 1 ("not at all") to 5 ("a great deal"). A sample item is: "In the past 30 days, to what extent have I been alert?" Cronbach's alpha was 0.83.

Safety consciousness. Safety consciousness was assessed using a six-item scale developed by Barling et al. (2002), with responses ranging from 1 ("strongly disagree") to 5 ("strongly agree"), using a self-reported approach. A sample item is: "I always wear the protective equipment or clothing required by my job." Cronbach's alpha was 0.81.

Safety behavior. Safety behavior was a two-dimensional construct, including safety compliance and safety participation, which was developed by Griffin et al. (2013; 2000). Safety

compliance and safety participation were reported by the team leader or supervisor using three items for each variable. The total Cronbach's alpha was 0.81, and Cronbach's alpha coefficients of the two dimensions safety compliance and safety participation were 0.79 and 0.90, respectively.

Control variables. Several variables were controlled to consider the potential influence of demographic information. These included: construction workers' gender (0 = female, 1 = male); age (years); educational level (1 = junior high school or below, 2 = senior high school, 3 = college or bachelor degree, 4 = master's degree or above); job type (1 = civil construction workers (including concrete workers, steel fixers, scaffolders, or woodworkers), 2 = assembly workers (including welders, plumber, or electricians), 3 = decorator (including painters or plasterers), and 4 = others). A high correlation was found between age and work experience (Holland et al., 2017; Z. Zhang et al., 2020); therefore, the age variable was used to control for multicollinearity. At the team level, team size was controlled as it may have an impact on individual outcomes (Dong et al., 2017). Team size was calculated from the valid responses in the sample data.

3.3. Analytic strategy

Confirmatory factor analysis (CFA) was used first to confirm the discriminant validity and dimensionality of the studied variables. Next, the data contained a hierarchical data structure in which the valid answers of the study variables were nested within teams. Thus, the multilevel data modelling methods of hierarchical linear modelling (HLM) and multilevel structural equation modelling (MSEM) were applied.

The direct effects hypothesis (i.e., Hypothesis 1), the cross-level relationship hypothesis

(i.e., Hypothesis 3), and the moderation hypotheses at the individual level (i.e., Hypotheses 5a and 5b) were estimated using HLM through RStudio software with the packages of BruceR and lmerTest. The mediation hypotheses (i.e., Hypotheses 2a and 2b) were examined using the Monte Carlo method with 20,000 Bootstrapping and 95% confidence interval (CI) through RStudio software (Preacher et al., 2010). The moderated mediation hypotheses (i.e., Hypotheses 4 and 6) were examined using MSEM with Bootstrapping approach through MPLUS (Edwards and Lambert, 2007; Muthén and Muthén, 2012). The significance examination was also conducted using the Monte Carlo method and 95% CI.

4. Results

4.1. Preliminary analysis

The results of CFA were used to examine the validity of the conceptual six-factor model. Table 1 shows that the hypothesized six-factor model achieved the best fit for the data. This is demonstrated by the increased of χ^2, root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) values, as well as the decreased comparative fit index (CFI) and Tucker-Lewis index (TLI) values compared to alternative models. The CFA results also indicated that the model had good discriminant validity among the different studied variables, including temporal leadership, abusive supervision, attentiveness, safety consciousness, safety compliance, and participation.

[Insert Table 1 about here]

Table 2 presents the descriptive statistics for the study variables at both individual and team levels, including means, standard deviations, and inter-correlation coefficients. As expected, temporal leadership and attentiveness were positively related (r = 0.13, p < 0.01),

and attentiveness was positively related to safety compliance and safety participation ($r = 0.31$, $p < 0.001$; $r = 0.17$, $p < 0.001$).

[Insert Table 2 about here]

4.2. Hypothesis testing

4.2.1. Examining direct, mediation, and moderation effects

The results of HLM analysis using the BruceR package are presented in Table 3. Temporal leadership was positively related to workers' attentiveness ($\gamma = 0.06$, $p < 0.01$; Model 1), verifying Hypothesis 1. Workers' attentiveness was positively related to both safety compliance ($\gamma = 0.50$, $p < 0.001$; Model 3) and safety participation ($\gamma = 0.36$, $p < 0.001$; Model 5). These results demonstrate that when team leaders demonstrated temporal leadership, construction workers were more likely to be attentive to their work and perform safety behaviors.

[Insert Table 3 about here]

Hypotheses 2a and 2b proposed that attentiveness exerts a mediating role between temporal leadership and safety behavior. Mediation effects were assessed using Bootstrap and Monte Carlo methods, and were considered against the established CI. Table 4 showed that the indirect effect of temporal leadership on safety compliance through attentiveness was positive and significant (Effect = 0.03, $p < 0.01$; 95% CI [0.010; 0.057]). The indirect effect of temporal leadership on safety participation through attentiveness was also positive and significant (Effect = 0.02, $p < 0.05$; 95% CI [0.006; 0.046]), thus verifying Hypotheses 2a and 2b.

[Insert Table 4 about here]

To test Hypothesis 3, Model 2 in Table 3 shows that the interaction of temporal leadership and abusive supervision on worker attentiveness was significant ($\gamma = -0.13$, $p < 0.01$). The

results of Bootstrapping and Monte Carlo with 95% CI in Table 4 show the moderation effect of team-level abusive supervision at different levels. Temporal leadership had a positive effect on attentiveness when team-level abusive supervision was low (Effect = 0.24, $p < 0.001$; 95% CI = [0.123; 0.358]), and a negative effect when team-level abusive supervision was high (Effect = -0.13, $p < 0.05$; 95% CI = [-0.246; -0.009]). The difference was also significant (Effect = -0.37, $p < 0.001$; 95% CI = [-0.578; -0.156]), thus verifying Hypothesis 3. To demonstrate the moderation effect of team-level abusive supervision, Figure 2 was plotted following Cohen et al. (2003). Figure 2 indicates that when abusive supervision was high, the effect of temporal leadership on attentiveness was significant and decreased, and this effect was also significant and increased under a low level of abusive supervision.

[Insert Figure 2 about here]

To assess the moderating variables in Hypotheses 5a and 5b, the interaction of attentiveness and safety consciousness on safety compliance was assessed and found to be positive and significant ($\gamma = 0.11$, $p < 0.001$; Model 4 in Table 3); the same was found for this interaction on safety participation ($\gamma = 0.09$, $p < 0.01$; Model 6 in Table 3). These results verify Hypotheses 5a and 5b. The interactions were also plotted following Aiken and West (1991) as shown in Figure 3. The results of Boostrapping and Monte Carlo in Table 4 show that the relationship between attentiveness and safety compliance was stronger when safety consciousness was high (Effect = 0.52, $p < 0.001$; 95% CI [0.306; 0.727]), and the relationship was significant at a low level of safety consciousness (Effect = 0.21, $p < 0.05$; 95% CI [0.001; 0.427]). The difference was significant (Effect = 0.31, $p < 0.001$; 95% CI [0.139; 0.468]). Moreover, the relationship between attentiveness and safety participation was stronger when

safety consciousness was high (Effect = 0.53, $p < 0.001$; 95% CI [0.306; 0.759]) compared to when it was low (Effect = 0.19, *n.s.*; 95% CI [-0.041; 0.414]). The difference was significant (Effect = 0.34, $p < 0.01$; 95% CI [0.147; 0.545]). These findings indicate that safety consciousness strengthens the relationships between attentiveness and safety compliance or safety participation.

[Insert Figure 3 about here]

4.2.2 Integrative moderated mediation effects testing

To test the integrative moderated mediation model, MSEM was applied (using MPLUS), which was combined with Monte Carlo bootstrapping analysis (using RStudio). The results of the hypothesized integrative model through MSEM are shown in Figure 4.

[Insert Figure 4 about here]

Hypotheses 4a and 4b predicted that team-level abusive supervision moderates the indirect effects of temporal leadership on safety compliance and safety participation through attentiveness. The results reported in Table 4 show that the indirect effect of temporal leadership on safety compliance through worker attentiveness was significantly and negatively moderated both by team-level abusive supervision ($\gamma\Delta$ = -0.14, $p < 0.001$; 95% CI [-0.256; -0.041]) and by safety participation ($\gamma\Delta$ =-0.14, $p < 0.01$; 95% CI [-0.260; -0.038]). These results verify Hypotheses 4a and 4b.

Hypotheses 6a and 6b predicted that individual safety consciousness moderates the indirect positive effect of temporal leadership on safety behaviors through attentiveness. The results presented in Table 4 show a significant moderating effect of safety consciousness on the indirect relationships of temporal leadership on worker safety compliance and safety

485 participation through worker attentiveness ($\gamma\Delta$ = 0.02, p < 0.05, 95% CI [0.002; 0.037]; $\gamma\Delta$ =
486 0.02, p < 0.01, 95% CI [0.002; 0.043]). These results verify Hypotheses 6a and 6b.

487 # 5. Discussion

488 ## *5.1. Findings*

489 This study applied SIP theory to explore the positive effect of temporal leadership on the
490 safety behaviors of construction workers. Temporal leadership was found to be
491 positively related to attentiveness, and attentiveness was found to mediate the effect
492 of temporal leadership on safety behaviors. This study further investigated the detrimental
493 effect of team-level abusive supervision on the relationship between temporal leadership and
494 attentiveness of construction workers. The positive relationship between temporal leadership
495 and attentiveness was weaker when workers faced a high level of team-level abusive
496 supervision compared to when they faced a low level. In contrast, at a low level of team-level
497 abusive supervision, the effect of temporal leadership on worker attentiveness was
498 positive and significant (see moderation test results of team-level abusive supervision
499 shown in Table 4, and Figure 2). This result shows that suitable or limited levels of abusive
500 supervision may not be only detrimental. These results are consistent with a previous study
501 showing that in construction projects, abusive supervision can actually improve individual
502 work efficiency (Lindebaum and Fielden, 2011).

503 Combined with the mediating effect of attentiveness, the moderated mediation results
504 indicate that the positive indirect effects of temporal leadership on safety behaviors through
505 attentiveness were significantly diminished in the presence of high team-level
506 abusive supervision. In other words, team-level abusive supervision weakened the positive
indirect effect of temporal leadership on safety compliance and safety participation by
negatively

impacting attentiveness. These clear results indicate that a high level of team-level abusive supervision exerts a detrimental role as a negative information cue and workplace event for safety behaviors. Moreover, a limited level of team-level abusive supervision was again demonstrated to be beneficial in the time-pressured construction projects environment. The indirect effects of temporal leadership on safety behaviors via attentiveness were also strengthened or improved under a low level of team abusive supervision.

Additionally, this study examined the positive moderating effect of individual safety consciousness on the relationships between attentiveness and safety behaviors in construction workers. The effects of attentiveness on safety compliance and safety participation were strengthened more for workers with high safety consciousness compared to those with low safety consciousness. Whether the positive indirect effect of attentiveness would be strengthened across different levels of safety consciousness was also investigated. The moderated mediation results showed that for workers with a high level of consciousness towards safety, the positive indirect effects of temporal leadership on safety behaviors through attentiveness were significant and stronger than the insignificant conditional indirect effect for workers with a low level of safety consciousness.

5.2. Theoretical implications

This study has several theoretical contributions. First, this study extends the existing research scope about the factors influencing individual safety behaviors and the potential impact of temporal leadership in the construction project context. Previous studies focused on the impacts of general leadership variables, such as transformational leadership (Barling et al., 2002; Conchie, 2013), transactional leadership (Clarke, 2013), and safety leadership (Lu and

529 Yang, 2010; Wu et al., 2017). However, more specific and nuanced leader behaviors have not
530 been assessed to date. This study fills this gap by incorporating temporal leadership, i.e.,
531 leadership related to managing time resources to complete tasks (Claessens et al., 2007;
532 Mohammed and Nadkarni, 2011), from an information-processing perspective. Temporal
533 leadership has received attention for its role in facilitating innovative outcomes (e.g.,
534 innovative performance (J. Zhang et al., 2020) and innovative behavior (Xiao et al., 2020)) and
535 team performance (Mohammed and Nadkarni, 2011; Santos et al., 2016). The present study
536 highlights the critical role temporal leadership plays in influencing employee safety behaviors,
537 which is understudied in this field. Thus, the theoretical model of temporal leadership (Ancona
538 et al., 2001; Mohammed and Alipour, 2014) is extended by highlighting its positive effect in
539 promoting safety compliance and safety participation in the construction project domain. This
540 study validated the positive impacts of temporal leadership behaviors in the complex
541 environment of construction projects, where leaders or supervisors face temporal challenges
542 because of strict and inflexible schedule constraints. This study sheds new light on how
543 temporal leadership can facilitate safety behaviors in team members. Specifically, this study
544 demonstrated that temporal leadership behaviors (e.g., managing and coordinating different
545 tasks simultaneously (Miterev et al., 2016; Zheng et al., 2020)) can help team members better
546 adapt to the time-pressured setting and job demands, and effectively meet project goals (e.g.,
547 safety).

548 Second, this study introduced attentiveness as mediator to explore the affective mechanism
549 between temporal leadership and safety behaviors. On the one hand, limited attention has been
550 directed to the mediation process in temporal leadership (Mohammed and Nadkarni, 2011;

Sonnentag, 2012; Xiao et al., 2020). By focusing on the positive emotional experience of construction workers (i.e., attentiveness), this study provided a new perspective on the affective mechanism of temporal leadership. The mediating effect of attentiveness identified in this study provides empirical support for the temporal reminders-absorption linkage reported by Gevers et al. (2013) and the temporal leadership-vigor linkage reported by Zhang et al. (2020). The presented finding on the mediation of attentiveness complements previous studies (e.g., leadership-proactive behavior linkage) demonstrate that attentiveness is significantly influenced by the linkage between temporal leadership and other proactive behaviors (i.e., safety behaviors).

On the other hand, this study also contributes to the safety behavior literature by extending prior theoretical frameworks for exploring the mediating mechanism underlying the linkage between leadership and safety behaviors. Previous studies examining the relationships between leadership behaviors and employees' safety behaviors primarily focused on cognitive mechanisms, such as self-efficacy (Chen and Chen, 2014) and safety climate (Wu et al., 2008). The affective mechanism remains understudied in explanations of the relationship between leadership and safety behaviors. Drawing on SIP theory (Salancik and Pfeffer, 1978), this paper complements the extant literature by exploring how temporal leadership motivates individuals to perform safety behaviors via the mediation role of affective factor (i.e., attentiveness). Being attentive to one's work has been argued to play a crucial role in translating informational cues from temporal leaders into own safety behaviors. It might be worthwhile to further investigate other mechanisms underlying the linkage between leadership and safety behaviors in addition to cognitive and affective mechanisms.

573 Third, this study also contributes to the abusive supervision literature by considering the
574 impacts of team-level abusive behaviors. Few prior studies have investigated the detrimental
575 effects of abusive supervision in organizations, by focusing on the potential impact on
576 occupational safety in the workplace (Yuan et al., 2020) and occupational health in construction
577 projects (Ju et al., 2020). These findings verified the harmful impacts perceived abusive
578 supervision exerts on workers' safety behaviors, as well as psychological outcomes at the
579 individual level (Ju et al., 2020; Yuan et al., 2020). Construction work always requires team
580 efforts (Odusami et al., 2003). Hence, this study extends the range of abusive supervision from
581 the individual level to the team level. Investigating the effects of team-level abusive supervision
582 can yield a more comprehensive understanding of leadership behavior. Applying multi-level
583 methods, this study identified the significant moderation effects of team-level abusive
584 supervision on the relationship between other specific leadership types (i.e., temporal
585 leadership) and individuals' affective response and behaviors. The results verify that team-level
586 abusive supervision generates a negative team environment, where workers react with
587 weakening positive emotions, possibly leading to unsafe behavioral tendencies. These findings
588 are consistent with other studies conducted at the individual level corroborating the detrimental
589 effects of abusive supervision (e.g., Ju et al., 2020; Yuan et al., 2020). However, potential
590 positive effects induced by abusive supervision cannot be ignored (Zhu and Zhang, 2019), as
591 low levels of team abusive behaviors may benefit workers (e.g., by facilitating attentiveness)
592 in a time-pressured work context. Hence, the degree and appropriateness of abusive supervision
593 practices in construction projects should be further explored.
594 Furthermore, this study makes another critical contribution by enriching the function of

595 safety consciousness. Previous studies mainly focused on the mediation role of safety
596 consciousness (Barling et al., 2002; de Koster et al., 2011; Westaby and Lee, 2003), which
597 translates the impacts of leadership behaviors into safety outcomes. However, the present study
598 showed that individual safety consciousness had a moderating effect towards workplace safety,
599 indicating that attentive construction workers implement safety behaviors depending on their
600 own safety consciousness level. Specifically, this study shows that individual safety
601 consciousness, which reflects an awareness of safety issues, strengthens the relationship
602 between temporal leadership and safety behaviors by facilitating attentiveness. This highlights
603 the importance of individual knowledge, understanding, and cognition towards safety, thus
604 strengthening the argument that safety consciousness plays a significant role in facilitating
605 safety in construction workers (Meng and Chan, 2020). These findings answer the question of
606 whether the effect of contextual factors (e.g., leadership) on employees' behaviors (e.g., safety
607 behaviors) varies from person to person (Yuan et al., 2020). Moreover, this study also
608 contributes to the SIP theory literature, by confirming the integration of emotional and
609 cognitive processes in SIP (Arsenio, 2010; Lemerise and Arsenio, 2000). The effects of the
610 interaction of safety consciousness and attentiveness on safety behaviors demonstrate that
611 emotional and cognitive processes can be integrated when processing cues from leaders.

612 *5.3. Practical implications*

613 The results presented in this study have several implications for managing leaders,
614 supervisors, and workers. First, the results emphasize the potential and positive value of
615 temporal leadership for safety management. Temporal leadership behaviors can help workers
616 improve their ability to efficiently use time, make schedules, allocate time resources, and

617 coordinate teams (Mohammed and Nadkarni, 2011). Furthermore, temporal leadership can
618 positively impact and create favorable conditions for individuals to be attentive at work, which
619 may, in turn, encourage safety behaviors. Organizations should consider developing leadership
620 training programs to enhance temporal leadership behaviors (Xiao et al., 2020) and identify
621 time-related behaviors when selecting managers (J. Zhang et al., 2020).

622 Second, the results of this study indicate that team-level abusive supervision negatively
623 impacts both the emotions and safety behaviors of construction workers. In labor-intensive
624 industries or environments (e.g., construction projects), such abusive supervision may be
625 common (Gallagher et al., 2015; Ju et al., 2020). Therefore, these findings have important
626 implications for organizations or firms wanting to discourage abusive behaviors by team
627 leaders or supervisors. For example, organizations could implement a zero-tolerance policy to
628 prevent abusive behaviors (Ju et al., 2020; Wheeler et al., 2013), and detect such behavioral
629 tendencies already at the personnel selection stage but also at the promotion stage (Kiazad et
630 al., 2010; Yuan et al., 2020).

631 Third, the results identify the effect of individual safety consciousness on safety behaviors
632 and the enhancing effects on the relationships between attentiveness and safety behaviors (e.g.,
633 safety compliance and safety participation). Therefore, assigning workers with a high safety
634 consciousness in a setting that prioritizes safety (e.g., construction projects) may help to
635 strengthen the positive impacts of temporal leadership and attentiveness on workplace safety.
636 Organizations can develop safety-related cognition training to strengthen workers' sensitivity
637 and awareness of safety-specific issues and situations (Yuan et al., 2020).

638 *5.4. Limitations and future directions*

The limitations of this study and directions for future research are presented in the following. First, temporal leadership represents a specific set of task-oriented leadership behaviors that can aid construction workers in facilitating safety behaviors; however, this study is only a first step in the exploration of the impact of temporal leadership in safety management. There are different types of temporal leadership, such as relationship-oriented temporal leadership (Myer and Mohammed, 2012). Moreover, other contemporary leadership variables, such as authentic leadership (Cavazotte et al., 2021), can also improve employee safety outcomes. Future research could therefore compare the effects of different leadership variables with temporal leadership on safety outcomes, such as broader leadership variables (e.g., transformational leadership) and narrower leadership constructs (e.g., authentic leadership and safety leadership).

Second, this study tested limited constructs, by exploring the affective mechanism underlying the linkage between temporal leadership and safety behaviors from an information-processing perspective. However, other potential mechanisms may also link leadership factors to safety behaviors. These may include a cognitive mechanism, such as temporal cognition (Mohammed and Alipour, 2014; Santos et al., 2016), and a motivational mechanism, such as intrinsic motivation (Conchie, 2013). Furthermore, other potential moderators could be incorporated to test the effect of temporal leadership on safety behaviors. Examples of these include contextual variables such as power distance (Tear et al., 2020), organizational support (Cheung and Zhang, 2020), and project characteristics (Müller et al., 2012), as well as individual differences, such as time urgency and pacing style (Mohammed and Alipour, 2014; Mohammed and Nadkarni, 2011), trait self-control (Yuan et al., 2020), and preferences (Xiao

et al., 2020). Thus, future studies can integrate further variables to develop a more comprehensive framework for leadership behaviors and safety behaviors according to different theoretical perspectives.

Third, this study has certain methodological limitations. While data were collected from different sources and at different levels, causality cannot be fully inferred using cross-sectional data. Future studies could apply longitudinal data or experimental approaches to obtain more robust results and increase the ability to detect causality (J. Zhang et al., 2020). Moreover, the external validity of the results might be limited. On the one hand, data were collected from only one country (i.e., China). The constructs and impacts of this study should be validated across different cultural backgrounds (e.g., western culture), and cultural differences in the results should be further explored.

On the other hand, the sample in the construction project context may not be representative of other settings. Specifically, in this sample of construction workers, the proportion of men was above 90%. Although this proportion is an underrepresentation for good external validity, this sample is still beneficial for an enhanced internal validity of this study to explore the affective mechanism and behavioral outcomes of individuals working at the construction site. Future research could focus on other settings (e.g., gender-balanced industries or industries with predominantly women) to examine the replicability of the findings of this study.

6. Conclusions

This study applied SIP theory to establish a theoretical framework and provide empirical data for the link between temporal leadership and safety behaviors. Temporal leadership facilitates safety behaviors of construction workers through attentiveness. Team-level abusive

683 supervision and individual safety consciousness played significant moderating effects at
684 different stages. Specifically, team-level abusive supervision attenuated the positive
685 relationship between temporal leadership and attentiveness and buffered the positive indirect
686 effects of temporal leadership on safety compliance and safety participation. The relationship
687 between attentiveness and safety behaviors, and the effect of temporal leadership on safety
688 behaviors, were stronger among workers with high safety consciousness. Better understanding
689 the affective and moderated mediation mechanisms can elucidate the relationship between
690 constructive and destructive leadership and safety behaviors. These findings help project team
691 leaders and supervisors to implement measures aimed at boosting the impacts of temporal
692 leadership on workplace safety. These may include facilitating positive emotions and safety
693 consciousness and reducing the application of abusive supervision.

694 **Appendix. The scale items applied in the current study**

695 **Temporal leadership**

696 (*To what extent does/is your team leader or direct supervisor…*)

697 1. remind you of important deadlines?

698 2. prioritize tasks and allocate time to each task?

699 3. prepare and build in time for contingencies, problems, and emerging issues?

700 4. pace the team so that work is finished on time?

701 5. urge us to finish subtasks on time?

702 6. set milestones to measure progress on the project?

703 7. effective in coordinating the team to meet client deadlines?

704 **Abusive supervision**

(*Your team leader or direct supervisor would … in the workplace*.)

1. tells you your thoughts or feelings are stupid.

2. puts you down in front of others.

3. makes negative comments about you to others.

4. tells you you're incompetent.

5. is rude to you.

Attentiveness

(*In the past 30 days of work, to what extent have I been*…)

1. Alert

2. Attentive

3. Strong

4. Determined

Safety consciousness

1. I always wear the protective equipment or clothing required by my job.

2. I am well aware of the safety risks involved in my job.

3. I do not use equipment that I feel is unsafe.

4. I inform management of any potential hazards I notice on the job.

5. I know where the fire extinguishers are located in my workplace.

6. I would know what to do if an emergency occurred on my shift (e.g., fire).

Safety behavior

Safety compliance

1. He/she uses all the necessary safety equipment to do his/her job.

2. He/she uses the correct safety procedures for carrying out his/her job.

3. He/she ensures the highest level of safety when he/she carry out his/her job.

Safety participation

1. He/she puts in extra effort to improve the safety of the workplace.

2. He/she helps the co-workers when they are working under risky or hazardous conditions.

3. He/she voluntarily carries out tasks or activities that help improve workplace safety.

Compliance with Ethical Standards

All procedures conducted in this study were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration. Informed consent was gained from all respondents who participated in this study.

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Figures

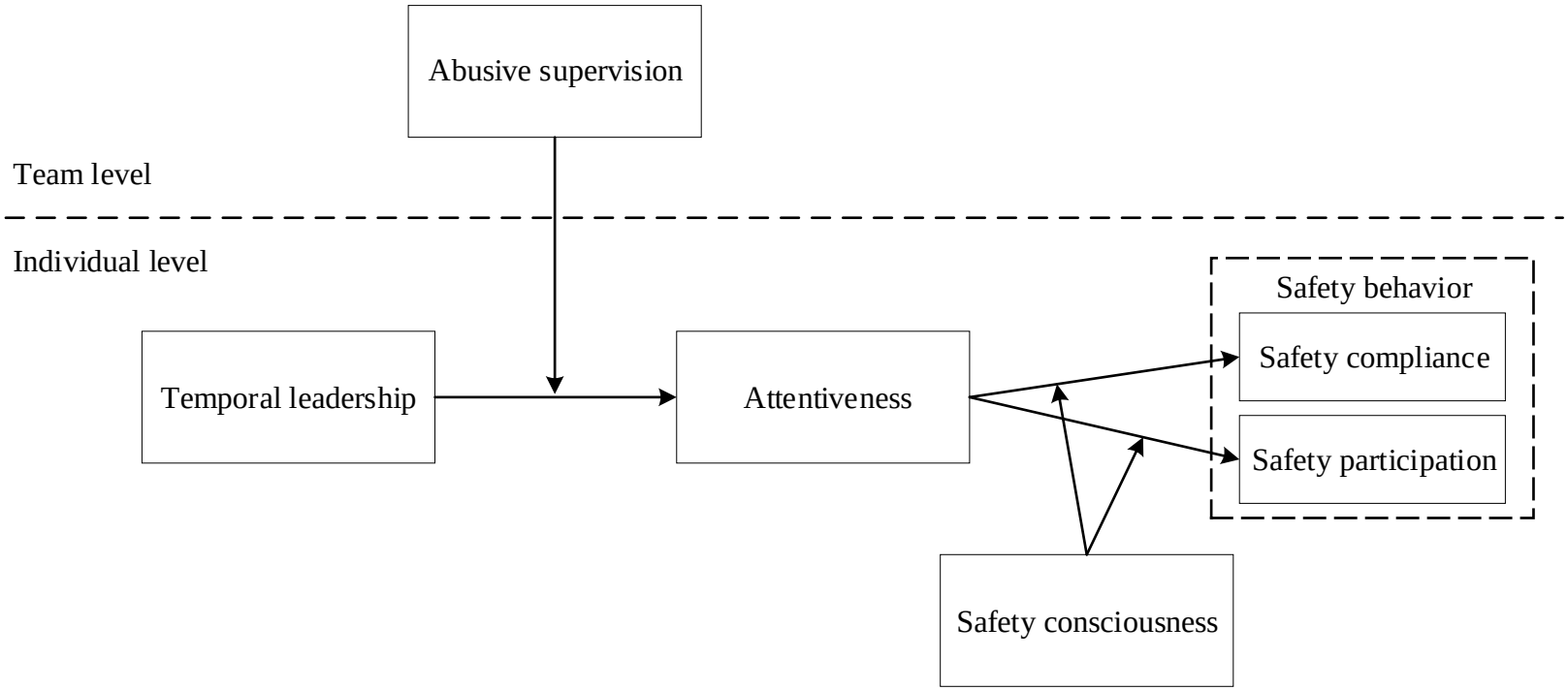

Figure 1. Conceptual model.

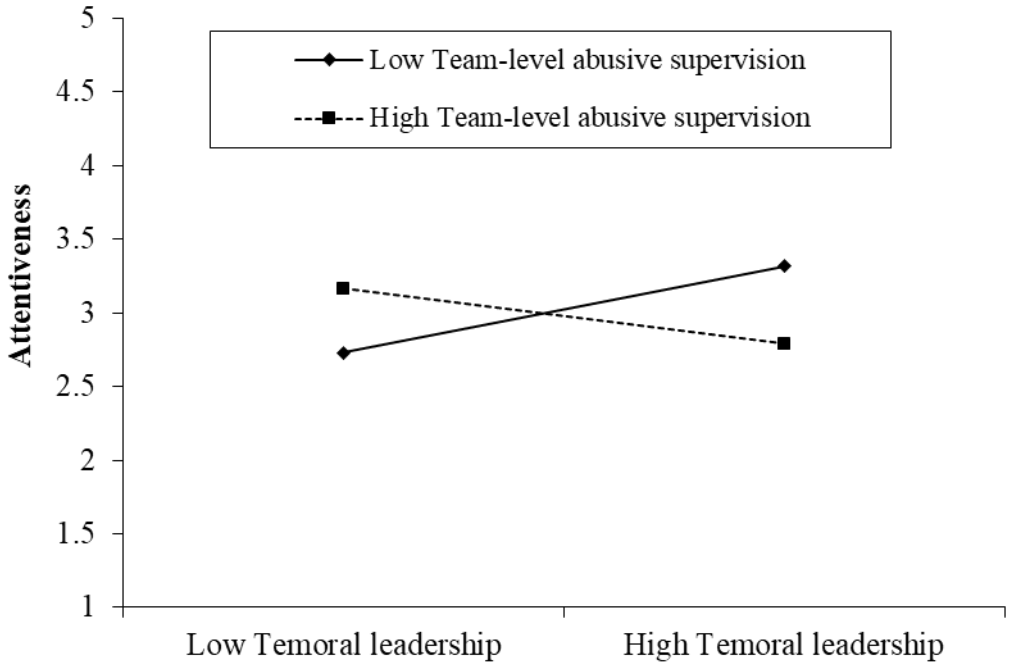

Figure 2. The moderation of team-level abusive supervision.

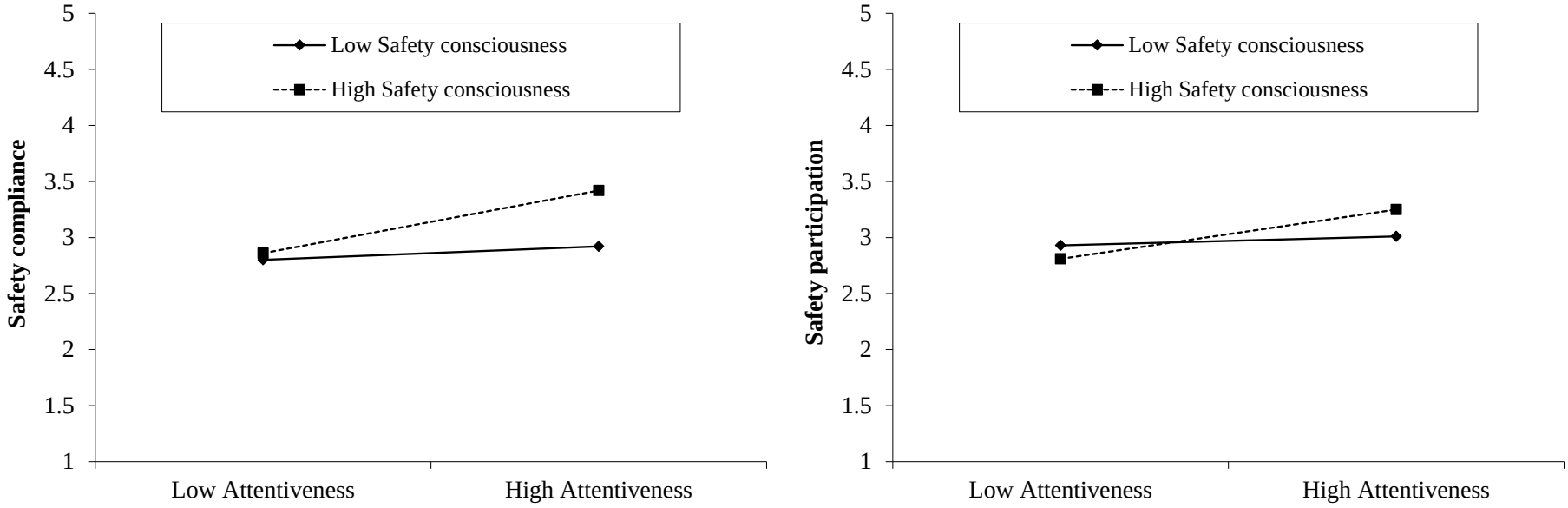

Figure 3. The moderation of safety consciousness.

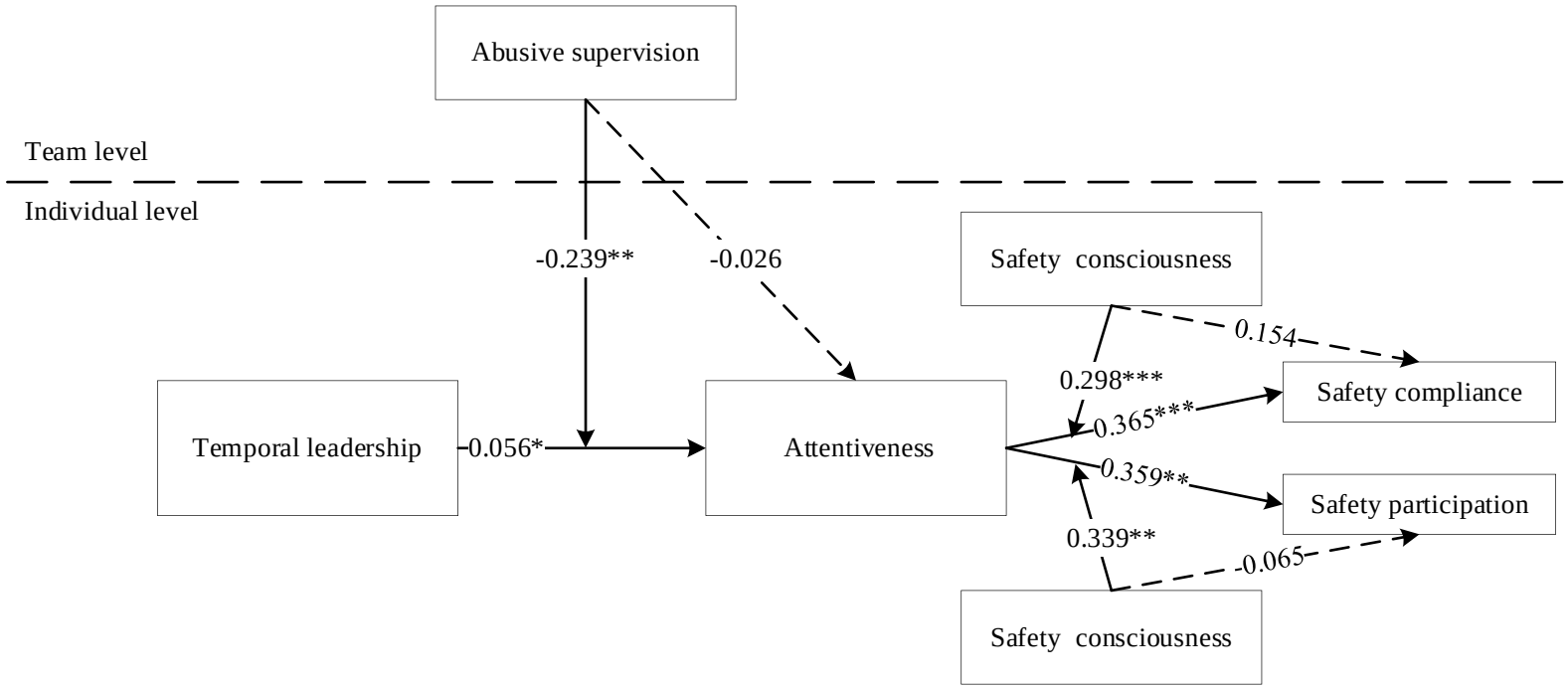

Figure 4. The results of hypothesized model using MSEM.

Tables

Table 1. Results of confirmed factor analysis

Model	Factor	χ^2	*df*	χ^2/df	RMSEA [95% CI]	SRMR	CFI	TLI
Six-Factor Model	TL, AS, ATT, SC, SP, SCO	1051.163	309	3.40	0.07 [0.06; 0.07]	0.05	0.91	0.90
Five-Factor Model	TL+AS, ATT, SC, SP, SCO	2166.760	314	6.90	0.11 [0.10; 0.11]	0.10	0.78	0.75
Four-Factor Model	TL+AS+ATT, SC, SP, SCO	3432.588	318	10.79	0.14 [0.13; 0.14]	0.17	0.62	0.58
Three-Factor Model	TL+AS+ATT+SCO, SC, SP	4305.334	321	13.41	0.15 [0.15; 0.16]	0.19	0.52	0.47
Single-Factor Model	TL+AS+ATT+SC+SP+SCO	6030.498	324	18.61	0.18 [0.18; 0.19]	0.21	0.31	0.25

Note: TL = Temporal leadership; AS = Abusive supervision; ATT = Attentiveness; SC = Safety compliance; SP = Safety participation; SCO = Safety consciousness. CI = Confidence interval.

Table 2. Means, standard deviations, and intercorrelations among variables.

Variables	Mean	*SD*	1	2	3	4	5	6	7	8	9	10
Level 1 (*N*=535)												
1. Gender	0.97	0.18	-									
2. Age	33.13	8.19	-0.08	-								
3. Education	1.92	0.66	-0.01	0.02	-							
4. Type	2.13	0.92	-0.11**	-0.03	0.31***	-						
5. Temporal leadership	2.99	1.18	-0.01	-0.07	-0.12**	0.03	(0.86)					
6. Abusive supervision	2.07	0.77	-0.04	0.01	0.01	0.03	-0.29***	(0.93)				
7. Attentiveness	2.00	0.60	0.07	-0.03	-0.02	-0.01	0.13**	-0.02	(0.83)			
8. Safety compliance	2.25	0.99	0.07	-0.05	-0.07	0.02	0.07	-0.16***	0.31***	(0.79)		
9. Safety participation	2.26	1.28	0.05	-0.03	-0.04	0.03	0.03	-0.13**	0.17***	0.31***	(0.90)	
10. Safety consciousness	1.92	0.51	0.06	-0.04	-0.01	-0.02	0.14**	-0.06	0.77***	0.31***	0.15***	(0.81)
Level 2 (*N* = 120)												
1. Team size	4.46	0.62	-									
2. Team-level abusive supervision	-	-	0.01	-								

Note: SD = standard deviation. Values in the parenthesis are Cronbach's alpha coefficient. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3. Direct and moderation effects testing using R.

Variable	Attentiveness		Safety compliance		Safety participation	
	Model 1	Model 2	Model 3	Model 4	Model 5	Mode 6
Level-1 and level 2 control						
Gender	0.26(0.15)	0.06(0.04)	0.02(0.04)	0.06(0.04)	0.31(0.32)	0.04(0.04)
Age	-0.00(0.00)	-0.02(0.04)	-0.01(0.01)	-0.04(0.04)	-0.00(0.01)	-0.02(0.04)
Education	0.00(0.04)	0.01(0.05)	-0.10(0.07)	-0.08(0.04)	-0.10(0.09)	-0.06(0.05)
Type	-0.01(0.03)	-0.01(0.05)	0.05(0.05)	0.05(0.04)	0.07(0.06)	0.06(0.05)
Team size	-0.01(0.04)	-0.00(0.05)	-0.08(0.07)	-0.05(0.04)	-0.03(0.09)	-0.02(0.04)
Level-1 independent and interaction effects						
Temporal leadership	0.06**(0.02)	0.12**(0.04)	0.02(0.04)	0.01(0.04)	-0.00(0.05)	-0.01(0.04)
Attentiveness			0.50***(0.07)	0.17**(0.06)	0.36***(0.09)	0.13(0.07)
Safety consciousness				0.14*(0.06)		0.03(0.07)
Attentiveness × Safety consciousness				0.11***(0.03)		0.09**(0.03)
Level-2 independent and cross-level effects						
Abusive supervision		-0.02(0.05)				
Temporal leadership × Abusive supervision		-0.13**(0.04)				
Marginal R^2	0.02	0.04	0.11	0.15	0.04	0.05
Conditional R^2	0.06	0.10	0.18	0.17	0.04	0.05

Note: N = 535 at the individual level, N = 120 at the team level. Pseudo R^2 is calculated based on the formulas from Snijders and Bosker (1999). $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table 4. The test of mediation, and moderated mediation through MSEM and Bootstrap with Monte Carlo method.

Variables/Path	Estimate	*SE*	95% LLCI	95% ULCI
Mediation of attentiveness				
Temporal leadership→Attentiveness→Safety compliance	0.03**	0.01	0.010	0.057
Temporal leadership→Attentiveness→Safety participation	0.02**	0.01	0.006	0.046
Moderation of team-level abusive supervision				
Path: Temporal leadership→Attentiveness				
Low (1-SD)	0.24***	0.06	0.123	0.358
High (1+SD)	-0.13*	0.06	-0.246	-0.009
Difference	-0.37***	0.11	-0.578	-0.156
Moderated mediation of team-level abusive supervision				
Path: Temporal leadership→Attentiveness→Safety compliance				
Low (1-SD)	0.09***	0.03	0.032	0.161
High (1+SD)	-0.05*	0.03	-0.105	-0.003
Difference	-0.14***	0.06	-0.256	-0.041
Path: Temporal leadership→Attentiveness→Safety participation				
Low (1-SD)	0.09**	0.03	0.029	0.161
High (1+SD)	-0.05*	0.03	-0.104	-0.003
Difference	-0.14**	0.06	-0.260	-0.038
Moderation of individual-level safety consciousness				
Path: Attentiveness→Safety compliance				
Low (1-SD)	0.21*	0.11	0.001	0.427
High (1+SD)	0.52***	0.11	0.306	0.727
Difference	0.31***	0.08	0.139	0.468
Path: Attentiveness→Safety participation				
Low (1-SD)	0.19	0.12	-0.041	0.414
High (1+SD)	0.53***	0.12	0.306	0.759
Difference	0.34**	0.10	0.147	0.545
Moderated mediation of individual-level safety consciousness				

Path: Temporal leadership→Attentiveness→ Safety compliance				
Low (1-SD)	0.01	0.01	-0.001	0.032
High (1+SD)	0.03*	0.01	0.003	0.060
Difference	0.02*	0.01	0.002	0.037
Path: Temporal leadership→Attentiveness→Safety participation				
Low (1-SD)	0.01	0.01	-0.003	0.031
High (1+SD)	0.03*	0.02	0.003	0.063
Difference	0.02**	0.01	0.002	0.043

Note: Bootstrap =20,000. *SE* = Standard error, LLCI = Lower-level confidence interval, ULCI = Upper-level confidence interval. $^{+}p < 0.01$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.