**Employee Perspectives on Safety Citizenship Behaviours and Safety Violations**

**Abstract**

Two studies investigate whether employees viewing discretionary safety activities as part of their job role (termed safety citizenship role definitions, SCRDs) plays an important part in predicting two types of safety violation: routine violations conceptualized as related to an individual’s available cognitive energy or ‘effort’; and situational violations, which are those provoked by the organization (Reason, 1990). Study 1 showed SCRDs predicted situational violations only, and partially mediated the relationships between Perceived Management Commitment to Safety (PMCS) and work engagement with situational violations. These findings add to those by Hansez & Chmiel (2010), showing that routine and situational violations have predictors that differ. Study 1 findings also extend research reported by Turner, Chmiel and Walls (2005), by showing that the effect of Job Control on SCRDs was mediated by both PMCS and work engagement. In study 2, participation in discretionary safety activities (safety participation) fully mediated the relationship between SCRDs and situational violations. The link between SCRDs and routine violations was non-significant and, strikingly, so was the link between safety participation and routine violations. These results support the view that processes involving SCRDs and safety participation are not cognitive-energetical in nature. In addition, study 2 findings extend previous work by Neal & Griffin (2006) by showing that SCRDs and safety knowledge partially mediated relationships between safety motivation and safety participation, whereas the direct effect of safety motivation on safety participation was non-significant. The results from both studies support the view that SCRDs are important in predicting situational violations.

SCRDs were shown to partially mediate the relationship between safety motivation and self-reported participation in discretionary safety activities (Safety Participation) which, in turn, related to situational violations. Similar to study 1, the link between SCRDs and routine violations was non-significant, as was the link between safety participation and routine violations. These findings support the view that the effect of SCRDs on situational violations is fully mediated by participation in discretionary safety activities.

**Keywords:** Job control, work engagement, situational and routine violations, safety citizenship role definitions, perceived management commitment to safety, safety motivation

**Introduction**

Neal & Griffin (2006) found that employees reporting they took part in discretionary safety activities (safety participation), such as promoting safety initiatives and volunteering for safety committees, predicted later compliance with mandatory safety rules and regulations. Taking part in discretionary safety activities has been linked to the perspective employees take on such participatory activities. If they consider them as more part of their job, they are more likely to carry them out (Hofmann, Morgeson, & Gerras, 2003). Therefore, how employees regard discretionary safety activities in relation to their job (Safety Citizenship Role Definitions, SCRDs) is potentially important to predict their compliance with, or violation of, mandatory safety rules and regulations.

In this paper, we have two main aims: one is to investigate the role of SCRDs in mediating the relationships between important workplace and employee variables, and violations; and the other is to test the proposition that safety participation is involved in the relationship between SCRDs and violations.

The general model of safety performance advanced by Christian, Bradley, Wallace, & Burke (2009) identifies that both distal and proximal factors are antecedents of safety participation and safety violations. Situational distal factors refer to aspects of employees’ working situations, such as those involved in their jobs, whereas proximal factors are safety-related motivation, knowledge and skills possessed by employees.

In light of past research by Turner, Chmiel, & Walls (2005) showing that job control predicts SCRDs, we develop our hypotheses using job control as a primary distal variable of interest in study 1. Christian et al. (2009) showed safety motivation to be the key proximal variable involved in the prediction of safety participation and safety compliance. Therefore we develop our hypotheses using safety motivation as a primary variable of interest in study 2.

Study 1

Previous research by Turner et al. (2005) showed job control predicted SCRDs: greater control predicted employees reporting discretionary safety activities were more part of their job. Hansez & Chmiel (2010) showed work engagement and perceived management commitment to safety (PMCS) mediated the relationship between job resources and routine and situational violations. Job control is an important job resource related to safety outcomes (Nahrgang, Morgeson & Hofmann, 2011). Therefore, in study 1 we investigate whether work engagement and PMCS mediate the relationship between job control and SCRDs in predicting violations.

*Safety Citizenship Role Definitions and Safety Violations*

Based on Neal & Griffin (2006) and Hofmann et al., (2003) we expect SCRDs to relate to violations since, as noted above, SCRDs are associated with involvement in safety citizenship behaviours (safety participation) which predict compliance with mandatory rules and regulations.

In contrast to previous research that treats compliance with, or violation of, mandatory rules and regulations as one category of safety behaviours, we distinguish between routine and situational violations in this paper. Routine violations are conceptualized as related to an individual’s available cognitive energy or ‘effort’, and situational violations are those provoked by the organization (Reason, 1990). Using the Job Demands Resources (JDR) model (Bakker & Demerouti, 2007), Hansez & Chmiel (2010) showed that routine and situational violations were separable types of violation, and had predictors that differ. As expected, they found that job strain, a variable indicating depletion of cognitive energy, mediated the relationship between job demands and routine, but not situational, violations. Thus, we include both types of violation in this paper to enable us to investigate more fully the potential processes associated with SCRDs in predicting violations.

An important question then, is whether SCRDs should predict both routine and situational violations? Routine violations are conceptualized as effort related, and so are associated with depletion of cognitive energy. On the other hand, perspective taking appears mostly associated with social-psychological processes. It is difficult, therefore, to see why the perspective employees take on discretionary safety activities, or their consequent participation in such activities, should predict routine violations (the relationship between safety participation and routine violations is tested specifically in study 2). Indeed, Turner, Stride, Carter, McCaughey & Carroll (2012) showed that job demands, conceptualised as energy depleting in the JDR model, *did not* predict safety participation. Nonetheless previous research is somewhat ambiguous, since Turner et al. (2005) showed that job demands *did* predict SCRDs. It is plausible to suggest, however, that the association between job demands and SCRDs found by Turner et al. (2005) reflected that employees with higher job demands were less receptive to considering non-mandatory safety activities as part of their job, without implying that the perspective they took predicts effort-based routine violations. So, we propose that SCRDs will predict situational violations only, and test that proposition in study 1.

H1: SCRDs will relate to situational violations only

As a consequence of H1, when we produce our hypotheses below about the role of SCRDs in the relationships between job control, work engagement, PMCS and violations, we expect SCRDs to be involved in predicting situational violations only.

*Job Control, Work Engagement and violations*

From the perspective of the Job Demands Resources model (JDR), job resources play both an intrinsic and extrinsic motivational role reflected in work engagement. Work engagement is conceptualized as a motivational state characterised by vigour, absorption, and dedication. Job resources foster employees’ growth, learning, and development on the one hand, and the willingness to invest one’s efforts and abilities to the work task on the other, thereby achieving work goals (Bakker & Demerouti, 2007).

Hansez & Chmiel (2010) argued, with respect to safety, that work engagement is associated with the development of new ways to cope with cumbersome organizational safety practices, and with investing extra effort in meeting safety goals. For example, on the one hand, employees could arrange for personal protective equipment to be more easily accessible, so reducing situational violations. On the other hand, engaged employees could be more willing to compensate for depletion of cognitive energy, so reducing routine violations. Their results supported this view.

In relation to job control in particular, Parker, Axtell & Turner (2001) and Turner et al. (2012) found that job control was positively related to safety compliance (i.e. not violating rules and regulations). We argue, therefore, that having greater autonomy over when and how to carry out one’s job will allow engaged employees the opportunity to manage and change more readily organizational practices that provoke violations, so reducing situational violations. Consistent with this view, Snyder, Krauss, Chen, Finlinson, & Huang (2008) showed that perceptions of safety-related situational constraints, such as ‘incorrect instructions’ and ‘improper work layout’, predicted workplace injury severity, but this effect was buffered by higher control over safety, such as being able to modify work conditions to make them safer.

In addition, higher job control implies that engaged employees are also likely to be more efficient with when and how they use their cognitive resources, and so, willing and able to invest more effort in meeting safety goals, such as reducing routine violations.

Therefore, we expect higher job control to be associated with both lower situational and routine violations, and for work engagement to mediate those relationships.

H2: Work Engagement will mediate the relationship between Job Control and both Routine and Situational Safety Violations

*Job Control, Perceived Management Commitment to Safety, and violations*

Neal, Griffin & Hart (2000) proposed that general organizational climate provides a context in which specific evaluations of the value given to safety are made. For example, they argued if employees perceive that there is open communication in the organization, then they may also perceive that communication about safety is valued in the organization. Similarly, if employees perceive that the organization is supportive of their general welfare and well-being, they will be more likely to perceive that the organization values the safety of employees. Based on Zohar’s (1980) original work, such safety perceptions inform employee expectations regarding organizational approval or disapproval for safety behaviors, thereby encouraging or discouraging those behaviors (Chmiel & Hansez, 2016). Consistent with this view, Neal et al showed that employees’ perceptions of their management’s values related to safety predicted compliance with mandatory safety rules and regulations.

Using similar reasoning, Hansez & Chmiel (2010) proposed that job resources would provide a context for perceptions of management’s values and attitudes to safety (i.e. PMCS). For example, training may improve the way employees do their job and, at the same time, reduce the risk involved in it, leading to the perception that management values safety. Consistent with this reasoning, Hansez & Chmiel showed that PMCS mediated the relationship between job resources and both routine and situational violations.

Hansez & Chmiel included decision latitude, a measure closely related to job control, as one of their indicators of job resources. We propose that giving employees more control over how and when they carry out their tasks implies they have more opportunity to manage potentially hazardous situations (cf. Turner et al, 2012). So, similar to other job resources, job control provides a context for evaluating their manager’s values and attitudes to safety: having greater opportunity to manage hazards is likely to lead to a more positive evaluation of the management’s approach to safety. Thus, we expect the relationship between job control and routine and situational violations to be mediated by PMCS.

H3: PMCS will mediate the relationship between Job Control and both Routine and Situational Safety Violations

*Perceived Management Commitment to Safety, Safety Citizenship Role Definitions and Situational Violations*

As noted above, PMCS involves perceptions that inform employees’ expectations regarding organizational approval or disapproval for safety behaviors, and thereby relate to safety violations (Chmiel & Hansez, 2016). Interestingly, however, there appears to be an additional possible process relating PMCS to violations. Didla, Mearns, & Flin (2009) interviewed oil and gas employees, a majority of whom gave as one of their main reasons for engaging in safety citizenship behaviors their perception that that was what was expected of them based on their perception of their organization’s approach to safety. In short, they considered discretionary behaviors as part of their role based on their perception of management expectations regarding safety. Thus, we expect PMCS to relate to SCRDs in addition to having a direct effect on safety violations. Hence, consistent with hypothesis 1, we expect SCRDs to partially mediate the relationship between PMCS and situational violations.

H4: SCRDs will partially mediate the relationship between PMCS and situational violations

*Work Engagement, Safety Citizenship Role Definitions and Safety Violations*

 Bakker & Leiter (2010) characterise engaged employees as actively trying to change the design of their jobs, including negotiating job content and assigning meaning to tasks. Work engagement, thus, implies seeking to expand or re-define ones job role. Thus, we expect work engagement to predict the perspective employees take on their job roles, including safety-related aspects, and so, we expect work engagement to predict SCRDs. Hence, consistent with hypothesis 1, we expect SCRDs to mediate the relationship between work engagement and situational violations.

However, it is also the case that work engagement entails a willingness to invest effort more generally, without necessarily involving a change in employee views of their job role (Bakker & Demerouti, 2007). Thus, we expect SCRDs to only partially mediate the relationship with situational violations:

H5: SCRDs will partially mediate the relationship between work engagement and situational violations

*Basic Structural research Model*

 Hypotheses 1-5 can be represented in a basic structural research model for study 1. We model also two correlations. First, Nahrgang et al (2011) showed that (1) autonomy was associated with safety climate perceptions, and also that (2) safety climate, incorporating overall perceptions of the safety climate, perceptions of management’s involvement in safety and the proactive management of safety, was associated with work engagement,. Thus, we model PMCS and work engagement to be correlated. Second, Hansez & Chmiel (2010) showed that routine and situational violations were correlated in their study, and so, we model this relationship too. Our expected relationships are shown in figure 1.

[Figure 1 about here]

**Method**

*Sample and procedure*

In order to test our hypotheses and to validate the proposed pattern of relationships, a self-report questionnaire was administrated to employees in a UK chemical manufacturing plant employing approximately 202 employees. Questionnaires were given out over a period of 4 days, completed in an in-site training facility. The sample included 169 workers, response rate 84%. This sample was predominantly male (88.2%, N = 149), with a few female (11.8%, N = 20) participants. The mean age was 43.58 years old (SD = 8.3). The mean job tenure in the company was 17 years (SD = 10.07). The sample includes 36% of operators (N = 62), 33.73% of engineering staff (N = 57), 15% of support functions (e.g. co-ordinator, operations or support manager, finance) (N = 26) and 11.83% of ‘Others’ (N = 20) (5 unspecified).

Two socio-demographic variables (age, organizational tenure) were significantly related with the constructs of our theoretical model. Consequently, using the full partial covariate effects (Little, Rhemtulla, Gibson & Schoemann, 2013), we included these two variables as covariates to control for their effects in our analyses of the hypothesized structural links.

*Measures*

*Job control.* In the present study, job control was measured by timing control (4 items, e.g. ‘Do you decide on the order in which you do things?’) and method control (6 items, e.g. ‘Can you decide how to go about getting your job done?’) from Jackson, Wall, Martin & Davids (1993) and Wall, Jackson & Mullarkey (1995). All items were responded on a 5-point scale: not at all (1), just a little (2), moderate amount (3), quite a lot (4), a great deal (5). Since these control components have been shown to correlate highly in previous studies, and did so here, they were combined to form one job control scale (cf. Parker, Chmiel & Wall, 1997). Principle components analysis produced 1 factor (α = .92). Responses were coded such that higher scores referred to higher job control.

*Perceived management commitment to safety.* Thirteen items reported by Chmiel (2005) as predicting accident involvement were used to assess PMCS, similar to items used by Hansez & Chmiel (2010). Principle components produced 1 factor (α = .94), containing items such as ‘My management has a positive attitude towards safety’ and ‘I am happy with the level of safety training for my job’. These items were responded on a 5-point Likert scale: strongly disagree (1); disagree (2); neither agree/disagree (3); agree (4); strongly agree (5). Such individual perceptions are often shown to agree between employees within the same work unit. Therefore, we calculated intra class coefficient, which was very low (p = .09). Therefore, we considered that grouping effects were marginal in our data, allowing the use of perceived management commitment to safety as an individual level variable.

*Work engagement* was measured with the nine-item version of the Utrecht Work Engagement Scale, or UWES (Schaufeli, Bakker, & Salanova, 2006). The three dimensions of vigor, dedication and absorption are measured with three items each. Sample items are “at my work, I feel bursting with energy” (vigor), “my job inspires me” (dedication) and “I get carried away when I’m working” (absorption). Even if engagement is usually used as a multidimensional construct, a one-factor solution has been shown to be valid for the nine-item version of the UWES (Schaufeli et al., 2006). Answers were made on a Likert scale ranging from 0 (never) to 6 (always). A high mean score indicates high engagement.

*Safety Citizenship Role Definition* was measured with 4 items from Hofmann et al.’s (2003) safety citizenship role definition scale. We used the items relating to initiating safety-related change plus the item concerning volunteering for safety committees. These items were questions asking the respondents about how much of the described behaviors they believe are part of their job or above and beyond their job responsibilities (maybe because it is someone else’s job). Items (α = .84) are “Trying to change the way the job is done to make it safer”, “Volunteering for safety committees”, “Trying to improve safety procedures” and “Trying to change policies and procedures to make them safer”. These items were responded on a 4-point Likert scale: part of my job (1), somewhat above and beyond my job (2), largely above and beyond my job (3), definitely above and beyond my job (4). Items were reverse coded so a higher score indicates employees considered that discretionary activity to be more part of their job.

*Safety violations.* Safety violation items were those used by Hansez & Chmiel (2010) corresponding to Reason, Parker & Lawton (1998)’s characterization of ‘situational’ and ‘routine’ violations. ‘Situational’ violations were reverse scored such that a high score indicated higher violation (6 items, α = .76). An example item is ‘I always use safety equipment, even when it’s not easily available’. ‘Routine’ violations, connected to effort, were scored such that a high score indicated higher violation (4 items, α = .85). An example item is ‘I sometimes cut corners if it makes the task easier’. These items were responded on a 5-point scale: strongly disagree (1), disagree (2), neither agree/disagree (3), agree (4) and strongly agree (5). Confirmatory factor analyses on the present sample showed a two factor solution fit the data well, compared to a one factor solution.

**Results**

*Data analysis*

Structural equation modeling analyses (SEM) were performed using MPlus 6. Data were analyzed following a two-stage process suggested by Anderson & Gerbing (1988). First, we assessed the measurement model through a series of confirmatory factor analyses to evaluate the independence of constructs examined in our study. Second, we proceeded with the assessment of the hypothesized structural relationships among latent variables. To limit the number of parameters to be estimated, we reduced the number of items per factor by combining them to create a limited number of indicators per construct (Landis, Beal, & Tesluk, 2000). Using the balancing technique, we generated aggregate indicators by averaging items with high and low loadings. We thus reduced number of items to three for each of our constructs. It is one of the parcelling strategies that preserves common construct variance whilst minimizing unrelated specific variance (e.g., Little et al., 2013; Little, Cunningham, Shahar & Widaman, 2002).

*Measurement Model*

The distinctiveness between the variables included in our study was tested through the comparison of several nested models (Bentler & Bonett, 1980). First, we examined the fit of our hypothesized six-factor model comprising job control, perceived management commitment to safety, work engagement, SCRDs, situational and routine violations. The results indicate that this hypothesized measurement model fit the data reasonably well (χ2 (120) =194.87, *p*<.001, RMSEA = .06, NNFI = .95, CFI = .96). The loadings of all items were above .50, the recommended cut-off for factor loadings (Kline, 2011). We also tested a 5-factor model obtained by combining the two dimensions of violations (i.e. job control, perceived management commitment to safety, work engagement, safety citizenship role definition and violations), a 3-factor model obtained by combining safety dimensions (i.e. job control, work engagement and safety-related variables) and a 1-factor model. A chi-square difference test was used to compare the nested models (Bentler & Bonett, 1980; James, Mulaik, & Brett, 1982). Results indicate that the six-factor model was significantly superior to all more constrained models. Consequently, we used this six-factor model to test our hypotheses. Table 1 shows the fit indices for the alternative models.

[Table 1 about here]

*Relationships among variables*

Means, standard deviations, Cronbach’s alphas and correlations among variables are presented in Table 2.

[Table 2 about here]

The correlations between work engagement and safety outcomes are interpreted as follows: the higher work engagement, the higher the SCRDs and the lower routine and situational violations. A higher SCRD is also associated with lower situational and routine violations. Higher PMCS is associated with higher work engagement, higher SCRDs, and lower routine and situational violations. Job control is also significantly correlated with all variables.

We tested our hypotheses using SEM. Table 3 presents fit indices for the hypothesized structural model (Model 1) and a series of alternative models (Models 2 to 4). In all models, error terms of routine and situational violations and of PMCS and work engagement were allowed to correlate.

[Table 3 about here]

Model 1 fit the data reasonably well, as indicated by the following indices: χ2 (156) = 248.32, *p*<.001, RMSEA = .06, NNFI = .95, CFI = .95. To evaluate whether this hypothesized model was the best depiction of our data, we compared this model with several alternative nested models containing additional paths that were theoretically plausible. We successively added paths from (a) job control to SCRDs (Model 2), (b) from job control to routine violations (Model 3) and (c) from job control to situational violations. Each time, the χ2 difference between model 1 and the alternative nested model was not significant. Therefore model 1 was retained. Only standardized parameter estimates for model 1 are shown in Figure 2.

For ease of presentation, we show the structural model in figure 2 rather than the full measurement model.

[Figure 2 about here]

To be able to confirm mediation hypotheses, we used bootstrap to estimate indirect effects. This method generates a sampling distribution for the indirect effect empirically by repeatedly estimating the indirect effect after sampling from the existing data set with replacement and estimating the model in each resample (Preacher & Hayes, 2008). Table 4 shows only significant indirect effects.

[Table 4 about here]

 SCRDs were significantly related to situational violations (path coefficient=-.22, p<.05) but not to routine violations (path coefficient=-.16, p=ns), thus supporting hypothesis one: SCRDs were related to situational, but not routine violations. The more employees consider discretionary safety activities as part of their job the lower were situational violations.

In regard to hypothesis two: job control was significantly related to work engagement (path coefficient=.39, p<.001) and work engagement was significantly related to both routine violations (path coefficient=-.22, p<.05), and situational violations (path coefficient=-.25, p<.01), Table 4 shows the indirect effects of job control on routine and situational violations involving work engagement were also significant. These findings support hypothesis two: work engagement mediated the relationship between job control and both routine and situational safety violations. More job control predicted higher work engagement, which in turn predicted lower routine and situational violations.

In regard to hypothesis three: job control was significantly related to PMCS (path coefficient=.32, p<.001), PMCS was significantly related to both routine violations (path coefficient=-.20, p<.05), and situational violations (path coefficient=-.28, p<.01). Table 4 shows the indirect effects of job control on routine and situational violations, involving PMCS, were also significant. These findings support hypothesis three: PMCS mediated the relationship between job control and both routine and situational safety violations. More job control predicted higher PMCS, which in turn predicted lower routine and situational violations.

In addition to the significant path between PMCS and situational violations, the path between PMCS and SCRDs was significant (path coefficient=.25, p<.01). As already noted, the path between SCRDs and situational violations was significant. Table 4 shows that the indirect effect of PMCS on situational violations, involving SCRDs, is also significant. These findings support hypothesis four: SCRDs partially mediated the relationship between PMCS and situational violations. Higher PMCS predicted higher SCRDs which, in turn, predicted lower situational violations.

In addition to the significant path between work engagement and situational violations, the path between work engagement and SCRDs was significant (path coefficient=.21, p<.05). As already noted, the path between SCRDs and situational violations was significant. Table 4 shows that the indirect effect of work engagement on situational violations, involving SCRDs, is also significant. These findings support hypothesis five: SCRDs partially mediated the relationship between PMCS and situational violations. Higher work engagement predicted higher SCRDs which, in turn, predicted lower situational violations.

In Table 4, we also noted significant double mediations. Indirect effects of job control on situational violations through PMCS and SCRDs were statistically different from zero. The same result was found for job control on situational violations, through work engagement and SCRDs.

**Discussion**

The results from study 1 support our hypotheses, and point to the importance of the perspective employees take on their roles, with regard to safety, in predicting situational violations. Both PMCS and work engagement were identified as predictors of SCRDs and, interestingly, the effect of job control on SCRDs was mediated by both of these, elaborating on the findings reported by Turner et al (2005) that showed job control was associated with SCRDs. Here, we have a possible explanation for that effect. More control promotes increased work engagement, as the JDR model suggests, which encourages a broader perspective on the role employees are willing to adopt. In addition, more control is associated with perceptions that management are more committed to safety, entailing a reinforcement of the importance of safety, more generally as part of an employee’s role. Further research is needed to test these propositions more fully. In addition, our results add to the view proposed by Hansez & Chmiel (2010) that safety-specific and non-safety specific processes are involved in safety violations, by showing that the perspective employees take on the safety aspects of their jobs is important and predicted by both safety specific and non-safety specific constructs.

The results from study 1 show that taking a view that discretionary safety activities are part of one’s job is related to safety violations. Important, though, is that it is situational violations that are predicted, not effort-based routine violations. This finding implies that the relationship between SCRDs and violations is not governed by simply putting more effort into behaving safely in general: another explanation is needed. Considering safety as more in role could lead, as we outlined in our introduction, to greater participation in discretionary safety activities, such as volunteering for safety committees, and/or promoting safety to co-workers. This could lead to changing the organizational constraints that provoke situational violations, e.g. by re-positioning personal protective equipment so making it easier to access. In study 2 we test whether the relationship between SCRDs and situational violations is mediated by safety participation as we suggested in study 1.

Study 2

In study 2, we consider safety motivation, a proximal factor in the model of Christian et al (2009), and investigate its relationships to SCRDs, safety knowledge, safety participation and violations.

*Safety Citizenship Role Definitions, safety participation, and violations*

In line with our proposals in study 1, where we argued SCRDs would be associated with situational violations only, we argue similarly that safety participation will only be associated with situational rather than routine violations. This is because participation is about being able to influence changes in organization constraints and procedures provoking a violation (i.e. situational violations), rather than being related to the energy or effort an employee has to put into their job-related safety (i.e. routine violations). Thus, we expect:

H1: Safety participation will be related to situational violations only.

We therefore include a measure of routine violations to allow a test of hypothesis 1. Including routine violations also allows for a replication of study 1 findings regarding the (lack of) association between SCRDs and routine violations.

We also argued, in study 1, that the effect of SCRDs on situational violations was because SCRDs predicted involvement in corresponding discretionary safety activities (c.f. Hofmann et al, 2003), and it is through participation that the organizational constraints that provoke situational violations could be changed, so reducing situational violations. Therefore, we test this hypothesis here and expect:

H2: Safety participation will mediate the relationship between SCRDs and situational violations.

*Safety motivation, SCRDs, and safety participation*

Neal & Griffin (2006) found that safety motivation predicted future participation in discretionary safety activities. The measure of motivation used by Neal and Griffin reflected how important employees regarded safety. We use the same measure here. We reason that the more important an employee thinks safety is, the more likely it is that some will regard many safety-related practices, not just those that are mandatory, as worthwhile and part of their role. Thus, they are more likely to view discretionary safety activities as part of their job. In turn, as argued in study 1, SCRDs should predict safety participation. Therefore, we reason that SCRDs should mediate the relationship between safety motivation and safety participation. There are no studies that have explored this relationship to our knowledge, so our hypothesis is exploratory.

In addition, though, we reason that if an employee believes safety to be important, they may volunteer for a safety committee, or initiate safety proposals, without necessarily regarding such activities as part of their job. For example, they may feel they have important information on safety to share with others, or they may want to direct attention to safety concerns they have. So, we expect SCRDs to only partially mediate the relationship between safety motivation and participation. Thus:

H3: SCRDs will partially mediate the relationship between safety motivation and safety participation

*Safety motivation, safety knowledge, and safety participation*

Previous research has demonstrated that safety motivation and safety knowledge predicts both safety compliance and safety participation (Christian et al., 2009; Neal et al., 2000). Christian et al (2009) suggested that motivation should lead to knowledge acquisition in many domains, including safety. They supported this point by demonstrating that safety knowledge partially mediated the relationship between safety motivation and safety performance (participation and compliance).

In the case of safety participation, a possible explanation for this observation is that, if you believe safety to be important and that leads you to gain knowledge that may help improve it, you are likely to want to share it with others. For example, by volunteering for a safety committee, and/or through proposing safety initiatives. We test the proposition, therefore, that safety knowledge will mediate the relationship between safety motivation and safety participation. We also argue that there are other reasons to participate in discretionary safety activities. For example, to direct attention to safety concerns an employee may have. Thus, believing safety to be important can lead you to participate in discretionary safety activities regardless of the knowledge you have. Consistent with Christian et al’s findings therefore, we expect that:

H4: Safety knowledge will partially mediate the relationship between safety motivation and safety participation.

*Safety knowledge, SCRDs, and situational violations*

We discuss two further issues before we present our research model. These concern the relationship between safety knowledge and SCRDs, and the relationship between safety knowledge and situational violations.

First, the relationship between safety knowledge and SCRDs is unexplored. One possibility is that knowing more about safety will encourage an employee to appreciate a wider range of safety issues as relevant to their work, and so, encourage discretionary safety activities to be regarded as more part of his/her job. Alternatively, it may be that regarding discretionary safety activities as more part of one’s job encourages employees to learn more about safety. We cannot decide on these positions in the current study, but they imply that safety knowledge and SCRDs will be associated, and so we model the relationship as a correlation.

Second, although we predict that situational violations are reduced through safety participation, previous research shows that safety knowledge predicts compliance with safety rules and regulations (Griffin & Neal, 2000; Neal et al, 2000). Therefore, we cannot rule out a direct relationship between safety knowledge and situational and routine violations. We test therefore whether either of the paths, between safety knowledge and situational violations, and between safety knowledge and routine violations, is significant.

Hypotheses 1-4, plus the correlation between safety knowledge and SCRDs, and the paths between safety knowledge and routine and situational violations can be represented in a basic structural research model for study 2. As in study 1, we allowed routine and situational violations to correlate also. The research model is shown in figure 3.

[Figure 3 about here]

**Method**

*Sample and procedure*

In order to test our hypotheses and to validate the proposed pattern of relationships, a self-report questionnaire was administrated to 800 employees in a Belgian chemical manufacturing plant; 329 people responded, a response rate of 41%. After eliminating cases with missing values, the final sample included 305 workers. With respect to age, 3.28% (n=10) were less than 25 years old, 24.26% (n=74) between 25 and 35, 34.10% (n=104) between 36 and 45, 25.57% (n=78) between 46 and 55, and 10.49% (n=32) were more than 55 years old (7 unspecified). The job tenure in the company was distributed as follows: less than one year (2.95%, N = 9), between 1 and 5 years (61%, N=61), between 6 and 10 years (12.46%, N=38), between 11 and 20 years (30.82%, N=94) and more than 20 years (31.15% N=95) (8 unspecified). The sample included 30.16% of manual workers (N=92), 33.77% of employees (N=103) and 27.87% of managers (N=85) (25 unspecified). Two socio-demographic variables (age and hierarchical responsibilities) were significantly related with the constructs of our model. These variables were included as covariates to control their effect in the analyses, as in study 1.

*Measures*

*Safety Citizenship Role Definition* was measured with 4 items from Hofmann et al. (2003), as in study 1.

*Safety knowledge, safety motivation and safety participation* were measured with items used by Griffin & Neal (2000). Safety knowledgecomprised 4 items (α=.85). An example item is ‘I know how to perform my job in a safe manner’. Safety motivation comprised 4 items (α=.82). An example item is ‘I feel that it is worthwhile to put in effort to maintain or improve my personal safety’. Safety participation comprised 4 items (α=.78). An example item is ‘I put in extra effort to improve the safety of the workplace’.

*Safety violations*. As in study 1, safety violation items were those used by Hansez & Chmiel (2010), corresponding to Reason et al.’s (1998)’s characterization of ‘situational’ (6 items, α=.65) and ‘routine’ violations (4 items, α=.77).

**Results**

*Data analysis*

As in study 1, structural equation modelling analyses (SEM) were performed using MPlus 6. In the same way as for study 1, data were analyzed following a two-stage process suggested by Anderson & Gerbing (1988). First, the measurement model was assessed through a series of confirmatory factor analyses to evaluate the independence of constructs. Second, we proceeded with the assessment of the hypothesized structural relationships among latent variables. To limit the number of parameters to be estimated, we reduced the number of items per factor by using the balancing technique. Thus, the number of items was reduced to three for each of our constructs.

*Measurement Model*

To test the distinctiveness between the variables examined in this study, a series of nested models were compared (Bentler & Bonett, 1980). First, we examined the fit of our hypothesized 6-factors model, including SCRDs, safety participation, safety motivation, safety knowledge, routine violations and situational violations. The results indicate that this hypothesized measurement model fit the data reasonably well (χ²(120) = 273.96, p<.001, RMSEA = .07, NNFI = .92, CFI = .94). The loadings of all items were above .50, the recommended cut-off for factor loadings (Kline, 2011). We also tested a series of 5-factor and 4-factor models and a 1-factor model. A chi-square difference test was used to compare the nested models (Bentler & Bonett, 1980; James, Mulaik, & Brett, 1982) (table 5). Results indicate that the six-factor model was significantly better than all more constrained models.

[Table 5 about here]

*Relationships among variables*

Means, standard deviations, Cronbach’s alphas and correlations among variables are presented in Table 6.

[Table 6 about here]

The correlations show that all constructs are significantly related to each other, with the exception of the link between SCRDs and routine violations (r=-.08) which was not significant.

 We tested the hypothesized structural model with SEM. Table 7 presents fit indices for this model (Model 1) and alternative models (Models 2 and 3). In all models, error terms of routine and situational violations, and of SCRDs and safety knowledge were allowed to correlate.

[Table 7 about here]

Model 1 fit reasonably well the data, as indicated by the following indices: χ²(155) = 331.56, p<.001, RMSEA = .06, NNFI = .92, CFI = .93. To evaluate whether this model was the best depiction of our data, we compared this model with two alternative nested models containing additional paths that were theoretically plausible. We successively added paths from (a) safety motivation to situational violations, and (b) safety motivation to routine violations. Each time, the χ² difference between model 1 and alternative models was not significant. Therefore model 1 was retained. Only standardized parameter estimates for model 1 are shown in Figure 4.

[Figure 4 about here]

As in study 1, we used bootstrap to estimate indirect effects.

[Table 8 about here]

 Safety participation was significantly related to situational violations (path coefficient = -.68, p<.001), whereas the path coefficient between safety participation and routine violations was non-significant (path coefficient=-.20, p=ns). Thus, our first hypothesis is supported: safety participation predicted situational violations only, with greater participation predicting fewer situational violations.

In addition to the significant path between safety participation and situational violations, the path coefficient between SCRDs and safety participation was also significant (=.21, p<.001) showing that considering discretionary safety activities as more part of one’s job predicted more participation in those activities, confirming earlier findings by Hofmann et al. (2003). Figure 4 shows the direct path between SCRDs and situational violations is non-significant (path coefficient=.06, p=ns). Further table 8 shows the indirect effect of SCRDs on situational violations involving safety participation is significant, thereby supporting hypothesis two: safety participation mediates the effect of SCRDs on situational violations. Higher SCRDs predicts greater participation in discretionary safety activities, which in turn predicts lower situational violations.

Noteworthy also is that the direct path between SCRDs and routine violations was non-significant (path coefficient = .02, p=ns), thereby replicating the result found in study 1.

Regarding hypotheses three, figure 4 shows, in addition to the significant path between SCRDs and safety participation, the path between safety motivation and SCRDs is significant (path coefficient = .20, p<.001). Table 8 shows further that the indirect effect of safety motivation on safety participation involving SCRDs is also significant, as is the indirect effect of safety motivation on safety participation involving safety knowledge. These results support hypothesis three: SCRDs partially mediate the relationship between safety motivation and safety participation. The more safety is considered to be important, the more discretionary safety activities are predicted to be viewed as part of one’s job, which in turn predicts greater participation in those activities.

Regarding hypothesis four, figure 4 shows the path between safety motivation and safety knowledge is significant (path coefficient = .47, p<.001), as is the path between safety knowledge and safety participation (path coefficient = .47, p<.001). Further, Table 8 shows the indirect effect of safety motivation on safety participation involving safety knowledge is significant. Since the indirect effect of safety motivation on safety participation via SCRDs is also significant these results support hypothesis four: safety knowledge partially mediates the relationship between safety motivation and safety participation. The more safety is considered to be important predicts the more safety knowledge an employee has, which in turn predicts greater participation in discretionary safety activities.

Interestingly, the direct path between safety motivation and safety participation was non-significant (path coefficient=.12, p=ns), suggesting the important mediators between safety motivation and safety participation are SCRDs and safety knowledge. It’s interesting to note though that the indirect effect involving safety knowledge is potentially stronger than that for SCRDs, since the lower 95% confidence interval value is considerably further away from zero than the value for the effect involving SCRDs.

In table 8, we also noted significant double mediations. The relationships between safety motivation and situational violations was significantly mediated by SCRDs and safety participation on the one hand, and safety knowledge and safety participation on the other hand. However the effect involving SCRDs was only significant if a 90% confidence interval was considered, whereas the latter remained significant with a 95% confidence interval, suggesting again that the indirect effect involving safety knowledge is potentially stronger.

**Discussion**

 Our results have several interesting aspects. First, they provide support for the view, outlined in study 1, that the effect of SCRDs on situational violations is mediated by safety participation: the significant indirect effect of SCRDs on situational violations involving safety participation, coupled with the non-significant direct path between SCRDs and situational violations, shows safety participation fully mediated the effect of SCRDs on situational violations.

Second, SCRDs were not significantly associated with routine violations, replicating the pattern of associations between SCRDs and violations found in study 1. It is striking, also, that safety participation was not significantly associated with routine violations. Taken together with the results from Turner et al. (2012) showing job demands did not predict safety participation, and those from Hansez & Chmiel (2010) showing demands did predict routine violations, our findings strongly suggest that effort-based mechanisms are not associated with SCRDs and safety participation.

Our findings suggest therefore a possible account of the relationship identified as puzzling by Neal & Griffin (2006), where safety participation predicted future safety compliance: it is through participation that an employee can effect a change in organizational procedures and arrangements that lessen organizational constraints likely to provoke situational violations. For example, through joining a safety committee, employees can persuade the organization to make protective equipment more accessible to them, so they are more likely to use it as intended.

Third, our results extend Neal & Griffin’s (2006) finding that safety motivation is a predictor of future safety participation, by showing relationships between these variables involved SCRDs and safety knowledge, whereas the direct path between safety motivation and safety participation was non-significant. The mediating effect of SCRDs in the relationship between safety motivation and safety participation is consistent with the idea that employees who believe safety to be important are more likely to broaden their definition of their jobs to include discretionary, as well as mandatory, safety activities. The mediating effect of safety knowledge in the relationship between safety motivation and safety participation is consistent with the idea that employees who know how to improve safety would want to participate in voluntary safety activities to benefit others and their organizations. Further research is needed to explore this idea.

**General Discussion**

The two studies presented in this paper provide support for the importance of the way employees view their jobs as including discretionary safety activities (SCRDs). Study 1 looked at the relationship of SCRDs to job control, PMCS and work engagement connected to safety violations. Study 2 looked at the relationship of SCRDs to safety motivation, safety knowledge, and safety participation connected to safety violations. In both cases, SCRDs played a part in predicting situational rather than routine violations, implying psycho-social rather than cognitive-energetical mechanisms are involved (c.f. Chmiel & Hansez, 2016). The results provide support for the view that the relationship between SCRDs and situational violations is wholly mediated by participation in corresponding discretionary safety activities.

Interestingly, Turner et al. (2012) found that an interaction between social support and job control predicted safety participation, leading the authors to conclude that:

 ‘having the opportunity (job control) in combination with a supportive work environment (social support) is likely to result in a heightened propensity to undertake activities that promote workplace safety (safety participation)’.

The significant paths we find in study 1 and study 2 provide evidence to add to this contention: job control acted through work engagement (i.e. willingness) and PMCS (i.e. a perceived encouraging safety environment) to predict employee perspectives on including discretionary safety activities as part of their job. And such perspectives relate to situational violations, through participation in discretionary safety activities.

That is, job control may provide both the opportunity for an employee to consider discretionary safety activities as more part of his or her job and promote the propensity to do so, leading to a safer working environment.

There are limitations in our studies since the data are cross-sectional and based on self-report and thus, common method variance could influence the relationships we found. The influence of common method variance may not be that great: it is striking that paths involving SCRDs predicted only situational, not routine violations, across two samples from different countries, and we found other relationships were non-significant where common method variance would act to inflate correlations between those variables (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Nonetheless, future research should involve longitudinal data and objective measures if possible.

*Practical Implications*

Several practical suggestions can be made based on our findings. SCRDs play a part in predicting situational violations through taking part in discretionary safety activities. Thus, encouraging employees to take a broader perspective on their jobs is likely to improve safety in their workplaces. Job control and the perception of management safety values and activities are implicated in such broader perspectives and may be changed by management practices. Thus, empowering employees by giving them greater autonomy can have a positive impact on work engagement and safety. In giving greater autonomy, as well as enabling a resource employees can draw upon, managers also signal they regard safety as important, and that they trust employees in using that autonomy. At a practical level, therefore, we would recommend training sessions for managers aimed at raising awareness of such processes and how they may be fostered, and how employee perspectives on discretionary safety activities could be broadened through communicating and promoting the belief that safety is important. An intervention that could enable these activities is described by Pedersen & Nielsen (2013). The intervention, based on DeJoy’s (2005) Theory of Integrative Safety Management, involved workshops attended by both managers and employees and were aimed at getting a high degree of worker involvement, by having them formulate and discuss safety issues that they found important, based on an initial mapping of organizational safety factors. By attending these workshops, managers demonstrated their support for and commitment to the process and could take part in discussions of safety problems and solutions. The discussions led to the formulation of a list of activities to be carried out. The purposes of the workshops were to increase safety communication and exchange between managers and employees and increase the commitment to and prioritization of safety, and showed beneficial results.

**General Conclusion**

Two studies have shown that safety citizenship role definitions, that is, the perspective employees take in considering discretionary safety activities as part of their job, are important in the relationships of job control and safety motivation to safety performance. In particular, our findings show that such perspectives are important to reduce violations provoked by the organization, and that employees may alter the organizational constraints helping to produce them, by taking part in discretionary activities, such as volunteering for safety committees and initiating changes in organizational practices.

**References**

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modelling in practice: A review and recommended two-step approach. *Psychological Bulletin, 103*, 411-423.

Bakker, A. B., & Demerouti, E. (2007). The job demands-resources model: State of the art. *Journal of Managerial Psychology, 22,* 309-328.

Bakker, A.B., & Leiter, M.P. (2010). Where to go from here: Integration and future research on work engagement. In A.P. Bakker & M.P. Leiter (Eds.), *Work engagement, A Handbook of Essential Theory and Research (pp.181-196)*. Hove, east Sussex: Psychology Press.

Bentler, P. M., & Bonnett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structure. *Psychological Bulletin, 88*, 588–606.

Chmiel, N. (2005). Promoting healthy work: self-reported minor injuries, work characteristics, and safety behavior. In C. Korunka & P. Hofmann (Eds.), *Change and Quality in Human Service Work* (pp. 277-288). München & Mering: Rainer Hampp Verlag.

Chmiel, N., & Hansez, I. (2016). Jobs and Safety Behaviour. In S.Clarke, T.M. Probst, F. Guldenmund, & J. Passmore (Eds.) The Wiley Blackwell Handbook of The Psychology of Occupational Safety and Workplace Health. Chichester: John Wiley & Sons.

Christian, M.S., Bradley, J.C., Wallace, J. C. & Burke, M.J. (2009). Workplace safety: A meta-analysis of the roles of person and situation factors. *Journal of Applied Psychology, 94*, 1103-1127.

DeJoy, D.M. (2005). Behavior change versus culture change: Divergent approaches to managing workplace safety. *Safety Science, 43*, 105–129.

Didla, S., Mearns, K., & Flin, R. (2009). Safety citizenship behavior: A proactive approach to risk management. *Journal of Risk Research, 12*, 475-483.

Griffin, M. A., & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge and motivation. *Journal of Occupational Health Psychology, 5,* 347-358.

Hansez, I., & Chmiel, N. (2010). Safety behavior: Job demands, job resources and perceived management commitment to safety. *Journal of Occupational Health Psychology, 15,* 267-278.

Hofmann, D.A., Morgeson, F.P., & Gerras, S.J. (2003). Climate as a moderator of the relationship between leader-member exchange and content specific citizenship: Safety climate as an exemplar. *Journal of Applied Psychology, 88,* 170-178*.*

Jackson, P. R., Wall, T. D., Martin, R., & Davids, K. (1993). New measures of job control, cognitive demand, and production responsibility. *Journal of Applied Psychology, 78,* 753–762.

James, L. R., Mulaik, S. S., & Brett, J. M. (1982). *Causal analysis: Assumptions, models, and data.* Beverly Hills, CA: Sage.

Jöreskog, K., & Sörbom, D. (2006). *LISREL for Windows [Computer software].* Lincolnwood, IL: Scientific Software International, Inc.

Kline, R. (2011). *Principles and practice of structural equation modelling (3th ed).* New York: Guilford Press.

Landis, R. S., Beal, D. J., & Tesluk, P. E. (2000). A comparison of approaches to forming composite measures in structural equation models. *Organizational Research Methods, 3*, 186-207.

Little,T.D., Cunningham, W.A., Shahar, G. & Widaman, K.F. (2002). To Parcel or Not to Parcel: Exploring the Question, Weighing the Merits. *Structural Equation Modelling*, *9*, 151-173.

Little, T. D., Rhemtulla, M., Gibson, K., & Schoemann, A. M. (2013). Why the items versus parcels controversy needn’t be one. *Psychological Methods.* 18, 285-300.

Nahrgang, J.D., Morgeson, F.P., & Hofmann, D.A. (2011). Safety at work: A meta-analytic investigation of the link between job demands, job resources, burnout, engagement, and safety outcomes. *Journal of Applied Psychology, 96,* 71-94*.*

Neal, A., & Griffin, M.A. (2006). A Study of the Lagged Relationships Among Safety Climate, Safety Motivation, Safety Behavior, and Accidents at the Individual and Group Levels. *Journal of Applied Psychology, 91*, 946-953.

Neal, A., Griffin, M. A., & Hart, P. M. (2000). The impact of organizational climate on safety climate and individual behaviour. *Safety Science, 34*, 99-109.

 Parker, S.K., Axtell, C. M., & Turner, N. (2001). Designing a Safer Workplace: Importance of Job Autonomy, Communication Quality, and Supportive Supervisors. *Journal of Occupational Health Psychology, 6,* 211-228.

Parker, S.K., Chmiel, N., & Wall, T.D. (1997). Work Characteristics and Employee Well-being Within a Context of Strategic Downsizing. *Journal of Occupational Health Psychology, 2,* 289-303.

Pedersen, L.M. & Nielsen, K.J. (2013). Integrated Safety Management as a Starting Point for Changing the Working Environment. In G.F.Bauer & G.J. Jenny (Eds). *Salutogenic organizations and change. The concepts behind organizational health intervention research.* Dordrecht: Springer.

Podsakoff, P. M., MacKenzie, S. B., Lee, J-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88,* 879-903*.*

Preacher, K., & Hayes, A. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40,* 879–891.

Reason, J.T. (1990). Human Error. Cambridge: Cambridge University Press.

Reason, J. T., Parker, D., & Lawton, R. (1998). Organizational controls and safety: The varieties of rule-related behaviour. *Journal of Occupational and Organizational Psychology, 71,* 289-304.

Schaufeli, W.B., Bakker, A.B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study*. Educational and Psychological Measurement, 66*, 701-716.

Snyder, L. A., Krauss, A. D., Chen, P. Y., Finlinson, S., & Huang, Y-H. (2008). Occupational safety: Application of the job-demand-control-support model. *Accident Analysis and Prevention, 40*, 1713-1723.

Turner, N., Chmiel, N., & Walls, M. (2005). Railing for safety: Job demands, job control, and safety citizenship role definitions. *Journal of Occupational Health Psychology, 10,* 504-512.

Turner, N., Stride, C.B., Carter, A.J., McCaughey, D., & Carroll, A.E. (2012). Job Demands-Control-Support model and employee safety performance. *Accident Analysis & Prevention, 45*, 811-817.

Wall, T. D., Jackson, P. R., *&* Mullarkey, S. (1995). Further evidence on some new measures of job control, cognitive demand, and production responsibility. *Journal of Organizational Behavior, 16,* 431-455.

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology, 65,* 96-102.

**R2 Analyses (with reverse scoring)**

*Table 1*. Fit indices for measurement models in study 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Model | χ2 | *df* | *χ2/**df* | NNFI | CFI | RMSEA | ∆*χ² (∆df)* |
| 6-factor model | 194.87\*\*\* | 120 | 1.62 | .95 | .96 | .061 | --- |
| 5-factor model (combining violations dimensions) | 239.35\*\*\* | 125 | 1.91 | .93 | .94 | .07 | 44.48 (5)\*\*\* |
| 3-factor model (combining violations dimensions, PMCS and SCRD) | 683.22\*\*\* | 132 | 5.17 | .68 | .72 | .16 | 488.35 (12)\*\*\* |
| 1-factor model  | 1253.38\*\*\* | 135 | 9.28 | .37 | .44 | .22 | 1058.51 (15)\*\*\* |

*Note. N* =169. PMCS = Perceived Management Commitment to Safety; SCRD = Safety Citizenship Role Definition; χ² = Minimum Fit Function Chi-Square; df = degrees of freedom; NNFI = Non-Normed Fit Index; CFI = Comparative Fit Index; RMSEA = root-mean-square error of approximation; Δχ² = chi-square difference tests between the six-factor model and alternative models. \*\*\**p* < .001.

*Table 2.* Descriptive statistics and inter-correlations among variables in study 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Variables | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | Job control | 3.65 | .89 | (.92) |  |  |  |  |  |
| 2 | Perceived management commitment to safety | 3.73 | .62 | .26\*\*\* | (.94) |  |  |  |  |
| 3 | Work engagement | 3.47 | .86 | .40\*\*\* | .49\*\*\* | (.88) |  |  |  |
| 4 | Safety citizenship role definition | 3.60 | .66 | .14 | -.30\*\*\* | -.24\*\* | (.84) |  |  |
| 5 | Routine violations | 2.40 | .80 | -.29\*\*\* | -.34\*\*\* | -.32\*\*\* | -.22\*\*\* | (.85) |  |
| 6 | Situational violations | 2.48 | .59 | -.32\*\*\* | -.42\*\*\* | -.38\*\*\* | .29\*\*\* | .63\*\*\* | (.76) |

*Note. N* =169. Correlations among variables are provided below the diagonal and Cronbach’s alphas are provided on the diagonal.\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

*Table 3.* Fit Indices for Nested Structural Models in study 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | *χ²* | *df* | *χ²/df* | RMSEA | NNFI | CFI | SRMR | ∆*χ² (∆df)* | Model comparison |
| Model 1(Hypothetical model) | 248.32 | 156 | 1.59 | .06 | .95 | .95 | .06 | - | - |
| Model 2 (Model 1 + path between JC and SCRD) | 246.15 | 155 | 1.59 | .06 | .95 | .95 | .06 | 2.17 (1) | Model 2 vs Model 1 |
| Model 3 (Model 1 + path between JC and RV) | 246.79 | 155 | 1.59 | .06 | .95 | .95 | .06 | 1.53 (1) | Model 3 vs Model 1 |
| Model 4 (Model 1 + path between JC and SV) | 247.01 | 155 | 1.59 | .06 | .94 | .95 | .06 | 1.31 (1) | Model 4 vs Model 1 |

*Note. N* = 169. In all models, error terms of routine and situational violations were allowed to correlate. JC = job control; SCRDs = safety citizenship role definition; RV = routine violations; SV = situational violations; χ² = Minimum Fit Function Chi-Square; df = degrees of freedom; NNFI = Non-Normed Fit Index; CFI = Comparative Fit Index; RMSEA = root-mean-square error of approximation; Δχ² = chi-square difference tests between the hypothetical model and alternative models.

\*\*\**p* < .001.

*Table 4.* Indirect Pathways using Bootstrapping in study 1

|  |  |  |
| --- | --- | --- |
|  | Bootstrapping | Percentile 95% CI |
|  | Effect | SE | Lower | Upper |
| Indirect effect : x 🡪m 🡪 y (simple mediation) |  |  |  |  |
| Job control 🡪 PMCS 🡪 SV | -.076 | .028 | -.141 | -.032 |
| Job control 🡪PMCS🡪RV | -.075 | .029 | -.147 | -.029 |
| Job control 🡪PMCS 🡪 SCRDs | .066 | .028 | .022 | .137 |
| Job control 🡪 WE 🡪 SV | -.084 | .026 | -.146 | -.040 |
| Job control 🡪 WE 🡪 RV | -.091 | .035 | -.164 | -.028 |
| Job control 🡪 WE 🡪 SCRDs | .067 | .032 | .016 | .144 |
| PMCS 🡪SCRDs 🡪 SV | -.052 | .023 | -.108 | -.017 |
| WE 🡪 SCRDs 🡪 SV | -.035 | .016 | -.075 | -.009 |
| Indirect effect : x 🡪m1 🡪 m2 🡪 y (double mediation) |  |  |  |  |
| Job control 🡪PMCS🡪SCRDs🡪SV | -.010 | .005 | -.026 | -.003 |
| Job control 🡪 WE 🡪 SCRDs 🡪SV | -.012 | .007 | -.033 | -.003 |

*Note*. *N* =169. PMCS = perceived management commitment to safety; SCRDs = safety citizenship role definition; WE = work engagement; RV = routine violations; SV = situational violations; SE = standard error; CI = confidence interval; 10,000 bootstrap samples.

Figure 1

 *Figure 1*. The Research Model for study 1.

Figure 2

.32\*\*\*

.39\*\*\*

-.25\*\*

.47\*\*\*

-.22\*

.71\*\*\*

.25\*\*

-.20\*

-.16 (ns)

.21\*

-.28\*\*

-.22\*

*Figure 2.* Study 1:Full Mediation Model with Completely Standardized Path Coefficients.

*Note*. For the sake of clarity, only structural relationships are shown. \**p* < .05; \*\**p* < .01; \*\*\**p* < .001

*Table 5*. Fit indices for measurement models in study 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Model | χ² | *df* | χ²/ *df* | NNFI | CFI | RMSEA | Δχ² (Δdf) |
| 6-factor model | 273.96\*\*\* | 120 | 2.28 | .92 | .94 | .07 | --- |
| 5-factor model(combining SV and RV) | 384.34\*\*\* | 125 | 3.07 | .87 | .90 | .08 | 110.38 (5) |
| 5-factor model(combining SP and SK) | 435.93\*\*\* | 125 | 3.49 | .85 | .87 | .09 | 161.97 (5) |
| 5-factor model(combining SP and SM) | 546.73\*\*\* | 125 | 4.37 | .79 | .83 | .11 | 272.77 (5) |
| 5-factor model(combining SK and SM) | 535.67\*\*\* | 125 | 4.29 | .80 | .83 | .10 | 261.71 (5) |
| 5-factor model(combining SCRD and SP) | 572.35\*\*\* | 125 | 4.58 | .78 | .82 | .11 | 298.39 (5) |
| 4-factor model(combining SP, SV and RV) | 495.79\*\*\* | 129 | 3.84 | .82 | .85 | .10 | 221.83 (9) |
| 4-factor model(combining SP, SK and SM) | 683.94\*\*\* | 129 | 5.30 | .73 | .78 | .12 | 409.98 (9) |
| 1-factor model | 1433.25\*\*\* | 135 | 10.62 | .40 | .47 | .18 | 1159.29 (15) |

Note. N = 305. SCRD = Safety Citizenship Role Definition; SP = Safety Participation; SM = Safety Motivation; SK = Safety Knowledge; RV = Routine Violations; SV = Situational Violations. χ² = Minimum Fit Function Chi-Square; df = degrees of freedom; NNFI = Non-Normed Fit Index; CFI = Comparative Fit Index; RMSEA = root-mean-square error of approximation; Δχ² = chi-square difference tests between the seven-factor model and alternative models. \*\*\*p < .001.

*Table 6*. Descriptive statistics and inter-correlation between variables for study 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Variables | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | Safety citizenship role definition  | 2.82 | 1.02 | (.92) |  |  |  |  |  |
| 2 | Safety participation  | 3.77 | .61 | .38\*\*\* | (.78) |  |  |  |  |
| 3 | Safety knowledge | 3.86 | .53 | .33\*\*\* | .52\*\*\* | (.85) |  |  |  |
| 4 | Safety motivation | 4.24 | .60 | .18\*\*\* | .31\*\*\* | .41\*\*\* | (.82) |  |  |
| 5 | Routine violations  | 2.69 | .75 | -.08 | -.19\*\*\* | -.16\*\* | -.16\*\* | (.77) |  |
| 6 | Situational violations | 2.36 | .47 | -.20\*\*\* | -.50\*\*\* | -.36\*\*\* | -.26\*\*\* | .38\*\*\* | (.65) |

*Note. N = 305*. Correlations among variables are provided below the diagonal and Cronbach’s alphas are provided on the diagonal. \*p < .05, \*\*p<.01, \*\*\*p<.001

*Table 7.* Fit indices for structural model in study 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | χ² | *df* | χ²/ *df* | NNFI | CFI | RMSEA | Δχ² (Δdf) |
| Hypothetical Model (Model 1) | 331.56 | 155 | 2.14 | .92 | .93 | .06 | -- |
| Model 1 + path from SM to SV | 331.17 | 154 | 2.15 | .91 | .93 | .06 | .39 (1) |
| Model 1 + path from SM to RV | 331.17 | 154 | 2.15 | .91 | .93 | .06 | .00 (1) |

*Note. N* = 305. SM = safety motivation, SV = situational violations; RV = routine violations; χ² = Minimum Fit Function Chi-Square; df = degrees of freedom; NNFI = Non-Normed Fit Index; CFI = Comparative Fit Index; RMSEA = root-mean-square error of approximation; Δχ² = chi-square difference tests between the hypothetical model and alternative models.

\*\*\**p* < .001.

*Table 8.* Indirect pathways using bootstrapping for study 2

|  |  |  |
| --- | --- | --- |
|  | Bootstrapping | Percentile 95% CI |
|  | Effect | SE | Lower | Upper |
| Indirect effect : x 🡪m 🡪 y (simple mediation) |  |  |  |  |
| SM 🡪 SCRD 🡪 SP | .043 | .021 | .002 | .083 |
| SM 🡪SK🡪SP | .230 | .049 | .134 | .325 |
| SK 🡪 SP 🡪 SV | -.331 | .088 | -.503 | -.158 |
| SCRD 🡪SP🡪 SV | -.146 | .060 | -.262 | -.029 |
|  |  |  |  |  |
| Indirect effect : x 🡪m1 🡪 m2🡪 y (double mediation) |  |  |  |  |
| SM🡪SCRD🡪 SP🡪SV | -.029 | .016 | -.059 | .002\* |
| SM🡪KS🡪 SP🡪SV | -.157 | .046 | -.248 | -.066 |

*Note. N=305*. SCRD = Safety Citizenship Role Definition; SP = Safety Participation; SM = Safety Motivation; SK = Safety Knowledge; RV = Routine Violations; SV = Situational Violations.

\*Significant mediation with CI 90% : lower = .003 ; upper = .055

Figure 3

*Figure 3*. Research Model for study 2

Figure 4

.12 (ns)

.20\*\*\*

.47\*\*\*

.06 (ns)

.09 (ns)

.21\*\*\*

.31\*\*\*

-.68\*\*\*

.53\*\*\*

.02 (ns)

-.20 (ns)

-.06 (ns)

.49\*\*\*

*Figure 4.* Final model from structural equation modelling (SEM) analysis for study 2

*Note*. For the sake of clarity, only structural relationships are shown. \**p* < .05; \*\**p* < .01; \*\*\**p* <.001