Safety Climate Dimensions, Leader-Member Exchange, and Organizational Support as Predictors of Upward Safety Communication in a Sample of Rail Industry Workers

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Abstract

The freedom employees feel to communicate safety concerns with their supervisors, termed upward safety communication, has been shown to be related to adverse safety events (Hofmann and Morgeson, 1999). Research to date has demonstrated that good supervisor-employee relationships (leader-member exchange), a sense that the organization values an employee (perceived organizational support) and safety climate (including perceived management attitudes toward safety, job demands interfering with safety, and pressure from coworkers to behave safely) all contribute to employees' comfort in bringing up safety issues with their supervisors. However, little is known about which specific dimensions of safety climate are most predictive of upward safety communication. Using a sample of 548 railway workers, we found that when all factors were considered simultaneously using dominance analysis, the dominant factor predicting upward safety communication was perceived management attitudes toward safety, followed by job demands interfering with safety and then leader-member exchange. Implications for research and practice are discussed.

keywords/phrases: safety climate, upward safety communication, leader-member exchange, perceived organizational support, dominance analysis

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1. Introduction

Workplace safety is an organizational issue that continues to exact costs from companies in financial and human capital. The United States Department of Labor (2007) reported 4.4 million occupational injuries and related injuries in 2005. The National Safety Council (2002) reported that these occupational injuries are costing an estimated of $512.4 billion annually for organizations. What can organizations do to keep their employees safe and minimize the costs associated with employee injuries?

Most organizations focus on safety policies and procedures when considering how to enhance a safe working environment, such as safety training workshops, safety manuals, and the like. However, many organizations fail to recognize the human component of a safe workplace. The best-designed policies and procedures embedded in an organizational environment that is not supportive of safety measures are often doomed to failure.

The freedom employees feel to discuss safety issues with their supervisors, which Hofmann and colleagues have termed *upward safety communication,* has been identified as a critical component of a safe work environment (Hofmann and Morgeson, 1999; Hofmann and Stetzer, 1998). Hofmann and colleagues have shown that when employees feel free to raise safety concerns with their supervisors, injury rates decrease. This is likely due to benefits of improved communication between employees and supervisors, such as a better understanding of proper safety policies and procedures, improved monitoring of employee compliance with those procedures, and early identification of problems that allows for preventative measures to be developed.

Given that increased freedom to raise safety concerns is related to fewer injuries, it is important for organizations to understand how to increase this type of communication between employees and supervisors. Previous research has indicated that there are at least three broad predictors of upward safety communication, namely leader-member exchange, perceived organizational support, and safety climate (Hofmann and Morgeson, 1999; Hofmann and Stetzer, 1998). Construct definition and measurement for the first two (leader-member exchange and perceived organizational support) are fairly well-established (Eisenberger, Huntington, Hutchison, and Sowa, 1986; Graen and Uhl-Bien, 1995; Wayne, Shore, and Liden, 1997). The third factor (safety climate) has not been thoroughly analyzed (Flin, 2007; Flin, Mearns, O'Connor, and Bryden, 2000; Guldenmund, 2000; Mueller, DaSilva, Townsend, and Tetrick, 1999). Hofmann and Stetzer's link between safety climate and upward safety communication relied on a general measure of safety climate (1998), but safety climate has often been discussed as having many different dimensions (e.g., Mueller et al., 1999). Our aim in the current study is to use dominance analysis to provide an initial examination of which dimensions of safety climate were most predictive of upward safety communication in a sample of employees where safety is a major concern.

2. Upward Safety Communication

Research on workplace safety has shown that there are various ways organizations can attempt to decrease the number of injuries that occur on the job, such as mandatory safety training and regular appraisals on employee safety compliance. In addition to safety policies and procedures, communication can also be an extremely important part of reducing workplace injuries. As noted above, the freedom employees feel in discussing safety issues with their direct supervisors, or upward safety communication, has been linked to improved safety commitment

as well as decreased in juries (Hofmann and Morgeson, 1999; Hofmann and Stetzer, 1998). We seek to replicate and add some specificity to Hofmann and colleagues' findings regarding what predicts employees' comfort with raising safety concerns with their supervisors (Hofmann and Morgeson, 1999; Hofmann and Stetzer, 1998).

Consider an example where Dan works for John in a railroad company. Dan notices one day before his shift starts that the ice on the railroad track was not removed completely by the early morning shift, which could cause workers to slip and fall or prevent them from getting out of the way of moving equipment. He thinks the workplace would be safer if work was postponed until the track was completely cleared of all ice and snow. What would make Dan more likely to approach John with his idea?

2.1 Social Exchange Perspective

Hofmann and Morgeson (1999) studied how social exchanges between employees and their supervisors affect the safety of the working environment. They invoked Blau's Social Exchange Theory (1964) when stating that perceived management attitudes about safety, a key component in safety climate (Zohar, 1980), could be considered an implied obligation for employees to engage in safe behaviors at work. Using this perspective, safety behavior, such as upward safety communication, is cast as an employee citizenship behavior. Picking up on the earlier example, if Dan perceives that his organization and his supervisor are supportive of him, he is likely to feel obliged to reciprocate by informing them of the potentially dangerous ice buildup on the tracks.

One aspect of social exchange is expected to occur at the organizational level. Eisenberger, Huntington, Hutchison and Sowa (1986) defined perceived organizational support (POS) as "global beliefs concerning the extent to which the organization values their

contributions and cares about their well-being" (p. 501). Perceived organizational support develops because employees have a tendency to assign humanlike characteristics to their employing organization (Eisenberger et al., 1986). Furthermore, POS is one-sided in that it focuses solely on the employer's side of the exchange as perceived by the employees (Coyle-Shapiro and Conway, 2005).

An employee's perceptions of the organization's concerns for its employees is an important precursor to safety communication. Employees who perceive their organization has concern for them and cares for their well being will feel freer to raise safety concerns with their supervisors. Hofmann and Morgeson (1999) demonstrated that POS is positively related to upward safety communication. When there is organizational support and concern, employees are more likely to feel that safety issues are important and that action will be taken. This will likely help employees feel free to raise safety concerns with their supervisors. Therefore, we expect to replicate Hofmann and Morgeson's finding that employees who perceive the organization is concerned about its employees will report greater comfort in communicating with their supervisors about safety issues than those who do not perceive much organizational concern.

Hypothesis 1: Perceived organizational support will be positively correlated with upward safety communication.

Another aspect of social exchange is expected to occur with one's supervisor. The strength of a working relationship in which an exchange occurs between an employee and his/her supervisor has been termed leader-member exchange (LMX; Graen and Scandura, 1987). When supervisor-employee relationships are good (i.e., when LMX is high), the relationship is based more on mutual trust than hierarch, and goals are internalized by the employee. LMX involves an exchange of resources between employees and leaders (Graen and Scandura, 1987).

Employees offer high levels of performance for the exchange, whereas leaders can offer employees influence in the decision-making process, valued task assignments, autonomy to perform tasks without direction, support for the activities of the employees, and attention for professional development.

High quality supervisor-employee relationships have many positive organizational outcomes, such as job performance, organizational citizenship behaviors, and doing favors for others (Wayne et al., 1997). Fairhurst (1993) studied the communication patterns for high, medium and low LMX dyads. The study found that high quality supervisor-employee relationships involve open discourse surrounding non-routine problems. Applying this finding specifically to safety communication, it is expected that employees who have strong relationships with their supervisors will feel more comfortable discussing safety concerns with those supervisors. As a result, they will feel free to discuss even the smallest concern with their supervisor to correct or avoid potential safety incidents. When supervisor-employee relationships are poor in quality, employees may feel uncomfortable or even afraid to bring any safety concerns to the supervisor's attention. In this situation, safety issues may surface only after an incident has progressed to a point when it becomes acute.

Previous research has demonstrated that high LMX is positively related to upward safety communication (Hofmann and Morgeson, 1999). We expect to replicate this finding and have included the quality of the supervisor-employee relationship as an important antecedent of upward safety communication in the proposed model.

Hypothesis 2: Leader-member exchange will be positively correlated with upward safety communication from employees to their supervisors.

2.2 Safety Climate Perspective

Safety climate is defined as employees' perceptions pertaining to safety policies, procedures, and practices (Zohar, 1980, 2002). Policies and procedures are the guidelines established to ensure safe behavior, and practices are the implementation of the policies and procedures as well as employees' perceptions of the relative importance of safe conduct at work (Zohar and Luria, 2005). A strong, positive safety climate is created when management, coworkers, and job tasks consistently encourage employees to carry out their jobs safely.

A positive safety climate is an important part of a safe work environment. A great deal of past research has examined the many benefits of having a positive safety climate in an organization (e.g., Griffin and Neal, 2000; Hofmann and Stetzer, 1996, 1998; Huang, Ho, Smith, and Chen, 2006; Zacharatos, Barling, and Iverson, 2005). Hofmann and Stetzer (1996, 1998) studied the effects of safety climate using employees from a large chemical processing plant and a large utility company. Both studies used Zohar's (1980) original measure of safety climate; results indicated that a positive safety climate is related to decreased unsafe behaviors among employees. Griffin and Neal (2000) and Zacharatos et al. (2005) studied the effects of safety climate in large manufacturing companies. Both studies found that a positive safety climate is related to safety compliance, motivation to remain safe and motivation to learn about safety practices.

In our earlier example, Dan was trying to decide whether to discuss a possible safety issue with his supervisor, John. In addition to engaging in a social exchange relationship with his organization and/or supervisor, Dan must also feel there is a strong safety climate to raise any safety concerns. If the management is perceived as paying only lip service to safety issues, then Dan is likely to feel as though John is more concerned about productivity than safety, which may

make him less likely to raise any type of safety concern to John that might get in the way of getting work performed quickly. Therefore, we expect that whether an organization has a supportive safety climate will be an important predictor of the level of upward safety communication.

Indeed, we are not the first to note that safety climate is expected to exert an influence on communication, especially communication related to safety issues. In a study of medical errors in hospitals, Edmondson found that when management projected a climate of fear around medical errors, employees were less likely to engage in open communication about any errors they may have made or witnessed (1996). Similarly, Probst and Estrada (2008) found that injury under-reporting was higher in organizations with poor safety climates.

In sum, positive climates for safety demonstrate that the organization values keeping their employees safe from harm or injury. Employees feeling valued in this way will be encouraged to report safety concerns because they will be more likely to feel as though safety issues will be taken seriously and preventative or corrective actions will be taken. However, if the organization does not value the safety of its employees and the work environment, then the employees will be reluctant to report safety concerns because the organization will not be likely to take actions regarding safety issues. Therefore, we expect that when organizations have a positive climate for safety, employees will feel more comfortable communicating safety-related issues with their supervisors, which will, by definition, increase the level of upward safety communication.

The link between safety climate and upward safety communication has been empirically examined by Hofmann and Stetzer (1998). They examined this link at both individual and group levels. The correlations between the two constructs at the individual level was .49 in the first sample and .57 in the second. The correlations between the two constructs when aggregated to

the group level was .61 in the first sample and .55 in the second. All correlations were statistically significant and in the expected direction. What is missing from this examination of the relationship between safety climate and upward safety communication is a consideration of the *specific dimensions* of safety climate.

3. Safety Climate Dimensions

The dimensionality of safety climate has been the subject of some debate, a debate that has not yet been fully resolved. Flin, Mearns, O'Connor, and Bryden (2000) looked for common themes across 18 published safety climate studies conducted in various countries. They noted several key themes across these studies. Most prominent was perceptions of management safety attitudes and behaviors, with all 18 studies containing at least some items measuring this aspect of safety climate. Another broad theme common to many studies was satisfaction with or presence/absence of safety systems. Risk-taking at work was the third most common theme, measured as self-report risk-taking, attitudes toward risk-taking, or perceptions of risks/hazards at work. The fourth theme concerned the balance between work pace and safety, and the fifth theme was the perception of workers' safety qualifications, skills, and knowledge.

Mueller, DaSilva, Townsend, and Tetrick (1999) conducted an empirical examination of the most common models, measuring organizational safety climate using data from 500 U.S. undergraduate and graduate students, all of whom were working at least part-time when they took the survey. Mueller and colleagues determined that a four-factor model adapted from Zohar's (1980) original model provided the best model fit. This model reflects many of the important themes found in Flin and colleagues' work (2000). The four-factor model included perceived management attitudes toward safety, job demands interfering with safety, safety peer pressure, and incentives for safe behaviors.

4. The Current Study

Only three of the four safety climate dimensions reported by Mueller et al. (1999) were included in the current study. The measurement of incentives for safety behaviors was omitted because there was no incentive program for safety behaviors implemented at the organization in which the study took place. Although safety climate is often conceptualized and analyzed at the workgroup level, safety climate was examined at the level of individual perceptions in the current study because workgroup information was unavailable.

Because Hofmann and Stetzer (1998) did not analyze differential effects of safety climate on upward safety communication, it is somewhat difficult for practitioners to know with any precision what they might do to improve the safety communication between employees and their supervisors. Certainly, improving social exchange aspects is an important part of the equation, but we were interested in simultaneously examining specific safety climate dimensions to determine which might emerge as better independent predictors of upward safety communication. We describe each of the dimensions of safety climate in turn, along with our hypotheses about how each is expected to relate to employees' freedom in communication about safety concerns with their supervisors.

4.1 Management attitudes about safety

An attitude is an outlook that one takes, either positively or negatively, toward a person, object or event (Ajzen, 1988). Behaviors of an individual can be taken as an indicator of the person's attitudes toward something. Management safety attitudes are defined as workers' perceptions of management's awareness of safety issues and willingness to invest valuable resources to address them (Zohar, 1980). In the current study, employees are asked to report their perceptions of their management's attitudes about safety. For sake of brevity, employee

perceptions of management safety attitudes will henceforth be referred to as “management safety attitudes”.

Research has shown that pressure from supervisors influences employee safety habits (Vandenput, 1970; Westaby and Lowe, 2005). If management supports safety procedures and is willing to invest in employees’ safety, the employees are likely to feel more comfortable discussing safety-related issues with their supervisors. On the other hand, when management has negative attitudes about safety procedures and does not support the practice of safe behaviors, then employees will feel less comfortable confiding in their supervisors about safety-related issues in the organization. Therefore, management safety attitudes are expected to be positively related to upward safety communication.

Hypothesis 3: Management attitudes about safety will positively predict upward safety communication.

4.2 The tension between safety and work

The degree to which job requirements affect whether or not employees practice safety behaviors is referred to as job demands interfering with safety (Zohar, 1980). When work interferes with safe behavior, this creates conflict and tension for employees. Work-safety tension can be related to the level of risk in the job, the psychological and physical demands of job tasks, or the number of tasks the job requires. All of these sources of job demands have been shown to predict important organizational outcomes. Job demands may affect the perceptions of a healthy work environment (Lowe, Schellenberg, and Shannon, 2003), employee well-being (Marshall, Barnett, and Sayer, 1997; Turner, Chmiel, and Walls, 2005) and turnover intentions (Morrow and Crum, 1998).

As one might expect, tension between work and safety demands also has an effect on organizational safety issues. Turner et al. (2005) found that employees with higher levels of job demands are less likely to consider safety as a part of their organizational role. If employees consider safety as a part of their role in the organization, they will be more likely to communicate safety-related issues to their supervisors. Likewise, if employees feel they must complete job tasks using unsafe behaviors or they feel pressure from their supervisor or upper management to complete their job tasks too quickly to comply with the safety procedures, then the flow of safety communication between supervisors and employees will decrease. Therefore, the more job demands employees have, the less likely they will be to raise safety concerns with supervisors, decreasing the level of upward safety communication.

Hypothesis 4: Perceived job demands will be negatively correlated with upward safety communication.

4.3 Pressure from coworkers to behave safely

The pressure or support employees receive from other coworkers regarding safety-related issues has been termed safety peer pressure (Zohar, 1980). Social pressures can have either a positive or negative effect on employees. These pressures can consist of an employee pressuring a coworker to follow safety policy by wearing safety goggles when required or an employee pressuring a coworker to rush through their work, avoiding safety procedures so that they can get home sooner. When other team members are exposed to specific work hazards, an employee can become more aware of them and put forth steps to prevent them (Roy, 2003). Also, when coworkers are following safety procedures, this can pressure other employees to behave in the same manner, which fosters preventative behavior. Having positive social support for a safety environment leads employees to feel they work in a healthier work place (Lowe et al., 2003).

Safety peer pressure can have negative effects as well, such as tolerance for risky behaviors (Roy, 2003). Coworkers can influence risk-taking orientation, thereby influencing safety habits (Vandenput, 1970; Westaby and Lowe, 2005). Pressure from coworkers could influence workers' level of job-related risk taking.

Although management safety attitudes are expected to influence safety peer pressure, it is not hypothesized that safety peer pressure would in turn be related to upward safety communication. The relationships among coworkers should not have a large effect on the communication between employees and supervisors. When employees have a safety concern that they would consider raising with their supervisors, we do not expect them to look to their coworkers' safety behavior to inform their comfort level in doing so. Instead, employees who wish to address their supervisors about a safety risk are more likely to consider their relationships with their supervisors and safety-related information such as management safety attitudes and safety job demands. Thus, we do not expect that safety peer pressure will be a dimension of safety climate that will influence upward safety communication.

Hypothesis 5: Safety peer pressure will not be predictive of upward safety communication.

5. Method

Each of the hypotheses is tested in two ways, and the overall results summarized with a third analysis. Hypothesis testing includes bivariate correlations between predictor and outcome, as well as examination of standardized coefficients of a regression equation with all five predictors (two social exchange predictors and three safety climate predictors) included. The summarization of which factors dominate is conducted using dominance analysis, which is a method used to examine the predictive power of each variable as compared to all possible nested

models of predictors (Azen and Budescu, 2003; Budescu, 1993). For example, the effect of the predictive power of X_1 in a three-predictor model would examine incremental predictive power (measured by ΔR^2) of X_1 when it is added to equations with no variables (a null model), with each of the other variables (X_2 or X_3), and with both of the other variables (X_2 and X_3). The average ΔR^2 for X_1 is then compared to the average ΔR^2 of X_2 and X_3, with the largest value indicating general dominance.

5.1 Participants

Participants were mechanical employees of the Canadian Pacific Railway[1] who worked in maintenance repair shops. These non-management employees represent a spectrum of job titles, including machinists, outside hostler/diesel service attendants, yard engineers, train attendants, carmen/carwomen (freight), locomotive mechanics, rail car mechanics, engine attendants, boilermakers, storepersons, laborers, and mechanic and machinist apprentices. There were 795 employees selected to participate in the study. Of those employees, there were a total of 636 participants who completed the surveys, for a response rate of 80%. Given that the field of railroad work is a predominately male workforce, the participants were not asked to report their gender to ensure the anonymity of the participants who were female. However, the participants were asked to report on other demographic characteristics. Participants were asked to report which of the six locations they worked at most of the time and which of the four shift schedules (days, afternoons, nights, swing shifts) they most often worked. The participants varied greatly across locations and shifts. The mean tenure range for participants in this sample was 21-30 years, and the mean age range was 46-50 years.

Participants were asked to complete a paper-and-pencil survey, which was administered on site during working hours. The surveys were completed on company time to increase the

response rate of participants. To further ensure anonymity, no personal or identifiable information was asked. Participants were required to place their surveys in an unmarked envelope and seal it prior to returning it to the survey administrator. Survey administrators were mostly individuals belonging to the same labor union as the respondents, which helped decrease concerns about reprisals or loss of confidentiality.

5.2 Measures[2]

The survey consisted of statements that measured six separate constructs, which were part of a larger survey to establish a baseline of safety climate at each location. The participants used a five-point Likert scale to report whether or not they agreed with the statements (1 = *strongly disagree*, 5 = *strongly agree*). The full list of items is available from the corresponding author upon request.

5.2.1 Upward safety communication

Upward safety communication was measured using a seven item scale of "raising safety concerns with supervisors," which was drawn from Hofmann and Morgeson's (1999) study (e.g. "I feel comfortable discussing safety issues with my supervisor(s)"). Three of the items were worded negatively and as such were reverse scored. The results showed that the seven-item scale demonstrated good internal consistency ($\alpha = .86$).

5.2.2 Leader-member exchange

Leader-member exchange (LMX) was measured using a seven-item measure of "supervisor-employee relationships," which was drawn from Wayne et al.'s (1997) study (e.g. "I usually know where I stand with my supervisor(s)"). Reliability analysis indicated good internal consistency ($\alpha = .89$).

5.2.3 Perceived organizational support

Perceived organizational support (POS) was measured using a three-item measure of "organizational concern for employees," which was adapted from the Survey of Perceived Organizational Support (SPOS; Eisenberger et al., 1986). An example item is "The organization cares about my well-being." The three highest-loading items were selected (Items 8, 9, and 10; loadings from .74 to .83) based on Eisenberger, Stinglhamber, Vandenberghe, Sucharski, and Rhoades' (2002) factor analysis. The items were slightly altered to make the statements situation specific for the railway employees: the words "my organization" were replaced with the organization's name. The reliability analysis resulted in a reliability coefficient of .90.

5.2.4 Safety climate

Safety climate was measured using a total of 25 items. The specific dimensions of safety climate measured were management safety attitudes, safety peer pressure, and job demands. The items were derived from a number of scales (Dedobbeleer and Beland, 1991; Hofmann, 2004; Hofmann and Stetzer, 1996; Mueller et al., 1999; Zohar, 1980), but aligned with the factors found in the research by Mueller et al. (1999).

Job demands were measured using a six-item measurement of "work-safety tension" (e.g. "The reward system at my job promotes high performance even if it means acting unsafely" (reversed)). Items one and two were taken from Zohar (1980) as reported by Muller et al. (1999), items three through five were taken from Hofmann and Stetzer (1998), and item six was taken from Hofmann (2004). All but one of the items were worded negatively and as such were reverse scored. The six-item scale demonstrated good internal consistency ($\alpha = .70$).

Management safety attitudes was measured using a 13-item scale of "management safety" (e.g. "Where I work, senior management gets personally involved in safety activities").

These items include references to all levels of management, from senior management to front line supervisors. Items 1 – 11 were taken from the 21 Zohar (1980) items reported in Mueller et al. (1999), item 12 was developed by Dedobbeleer and Beland (1991), and item 13 was developed by Hofmann (2004). The 13-item scale demonstrated good internal consistency (α = .93).

Safety peer pressure was measured using a six-item scale of "coworker safety," which was adapted from Zohar (1980) by Muller et al. (1999). An example item is "Workers in my group expect other workers to behave safely." The reliability analysis indicated good internal consistency (α = .81).

These safety climate items were subjected to confirmatory factor analysis. This analysis showed that the three factor model as described above fit the data well. Although the chi-square fit index was significant (x2(249) = 992.32), the CFI was .91 and the RMSEA was .069, both of which are indicative of good fit. In addition, the factor loadings of all items except one was over .60. Because the overall fit was good, and this low-loading item was reverse-coded (which often produces lower factor loadings), all items were retained.

6. Results

The means, standard deviations, and scale score intercorrelations for all study variables are reported in Table 1[2]. Based on the bivariate correlations, Hypotheses 1 – 4 were supported, as all of the constructs significantly correlated with Raising Safety Concerns with Supervisors (upward safety communication). We noted that the bivariate correlation between Work-Safety Tension (i.e., safety job demands) was in the opposite direction from predicted in Hypothesis 4. Additionally, contrary to Hypothesis 5, there was a significant bivariate correlation with Coworker Safety (safety peer pressure: r = .377, p < .001).

The predictors were also entered in a hierarchical multiple regression analysis, with the social exchange predictors entered in the first step and the safety climate predictors added in at the second step (Table 2). Results indicated that both social exchange predictors had significant regression coefficients in the first step, and the R^2 value for that step was also significant (R^2 = .37, $p < .001$). In the second step, the addition of the safety climate predictors did significantly increase the R^2 value ($\Delta R^2 = .13$, $p < .001$). In support of Hypothesis 1, the regression coefficient for Supervisor-Employee Relationships (LMX) was significant in the final step (β = .30, $p < .001$). Hypothesis 2 was not supported, in that the regression coefficient for Organizational Concern for Employees (POS) was not significant in the final step ($\beta = -.02$, $p > .05$). In support of Hypotheses 3, the regression coefficient for management's attitudes toward safety was significant in the final step ($\beta = .25$, $p < .001$). Hypothesis 4 was not supported, in that the regression coefficient for Work-Safety Tension (i.e., safety job demands) was significant ($\beta = .33$, $p < .001$) but in the opposite direction as the prediction. Finally, in support of Hypothesis 5, the regression coefficient for Coworker Safety (i.e., safety peer pressure) was not significant in the final step ($\beta = .02$, $p > .05$).

A dominance analysis (Azen and Budescu, 2003; Budescu, 1993) was also conducted to examine relative predictive power for each of the five predictors (Table 3). In essence, each predictor is assessed in terms of the R^2 change when including it in equations with varying number of predictors. Table 3 indicates the average R^2 contribution for each construct when included in equations with *k* predictors, which is called conditional dominance. Complete dominance is indicated by a construct having the highest R^2 contribution at each level of *k* (Budescu and Azen, 2004). No factor achieved complete dominance, although management safety attitudes came close.

General dominance is indicated by a construct having the higher R^2 contribution averaged across levels of *k*. The results for general dominance largely supported the results from the hierarchical multiple regression. The dominant predictor was management safety attitudes, which had an average R^2 contribution of .119 over the other variables, followed closely by supervisor-employee relationships (i.e., LMX; average R^2 contribution = .106) and work-safety tension (i.e., safety job demands; average R^2 contribution = .080). Organizational concern for employees (i.e., POS) and coworker safety (i.e., safety peer pressure) contributed little predictive power over other predictors (respectively, average R^2 contribution = .030; average R^2 contribution = .013).

7. Discussion

The current study addresses the often ignored human component of a safe workplace. We focused on the freedom employees feel in discussing safety issues with their direct supervisors, known as upward safety communication (Hofmann and Morgeson, 1999). A model was created to simultaneously test predictors of this type of communication between employees and their supervisors. Both dyadic interactions and safety climate were measured to understand their relationships with upward safety communication. Identifying the predictors could help organizations build and maintain this communication system between employees and their supervisors.

First, we examined the intercorrelations among the study variables. The intercorrelations among the scale scores and latent variables for Supervisor-Employee Relationships (LMX), Organizational Concern for Employees (POS) and Management Safety indicated that they were highly related to one another. This may be due to strong causal links among these constructs, although we note that our cross-sectional design is not sufficient to test this adequately.

Next, we tested the hypotheses. We found support for Hypothesis 1, which stated that LMX would be positively related to upward safety communication. These results replicate previous findings (Hofmann and Morgeson, 1999). Therefore, when employees and supervisors have higher quality relationships, employees will feel more comfortable communicating safety concerns to their direct supervisors. These results suggest that one way to increase upward safety communication would be to focus on good quality supervisor-employee relationships.

Hypothesis 2 stated that perceived organizational support, which was to be a replication of Hofmann and Morgeson's findings (1999), would predict upward safety communication. Interestingly, the results did not support this hypothesis. Although this predictor had a significant regression coefficient in the first step of the hierarchical regression (see Table 2), the coefficient became nonsignificant after safety climate predictors were introduced into the regression equation. Notably, the highest correlation with this construct was management's attitudes toward safety (Table 1: $r = .654$, $p < .001$), indicating that it is probably not helpful to have both constructs as predictors. The dominance analysis indicated that management attitudes toward safety was the better predictor of upward safety communication, probably because that construct is safety-related whereas POS is a general attitude toward one's organization.

Hypothesis 3 was supported by all analyses, indicating that management safety attitudes is a strong predictor of upward safety communication. In fact, the dominance analysis indicated it had the highest average R^2 contribution of all predictors. This supports Vandenput's (1970) and Westaby and Lowe's (2005) research which found that managers can influence employee safety habits.

Hypothesis 4 stated that job demands that interfere with safety would be negatively related to upward safety communication. The results indicate that a relationship does exist

between the two variables, yet it was in the opposite direction, which does not support Hypothesis 4. Therefore, the more tension between work and safety that the employees encountered, the more comfortable they felt communicating safety concerns with their supervisors. One reason for this unexpected relationship could be that employees may not feel the job demands are a consequence of their supervisors' actions. If they do not feel their supervisors are the source of these demands, then they may feel more comfortable communicating safety concerns to them. Second, this positive relationship could exist because when employees experience more tension between work and safety, they have more reason to discuss safety issues with their supervisors, forcing them to develop good communication channels. A true understanding of this contrary result awaits further research.

Finally, Hypothesis 5 stated that safety peer pressure was not predicted to be related to upward safety communication. Although these constructs did have a significant bivariate correlation, the regression coefficient in the final step was not significant and the dominance analysis did not indicate it contributed to any notable increase in R^2 over the other predictors. Thus Hypothesis 5 was supported.

7.1 Implications

In sum, the results indicate that both dyadic interactions between employees and supervisors and safety climate are important predictors of upward safety communication. The results of the current study are important both for practitioners working in the field and organizational researchers. Organizations are encouraged to dedicate some of their resources to enhancing the dyadic relationships between employees and supervisors, instead of solely applying them to enhance safety policies and procedures. Perhaps it would be beneficial for organizations to have employees and supervisors participate in relationship-building exercises or

team-building games to enhance the relationship between the two (Fairhurst, 1993; Wayne et al., 1997). Doing so may help the organization become a safer place to work by increasing the safety communication between employees and supervisors.

Also, organizations need to ensure that the safety climate of the working environment is supportive of employees practicing safety behaviors and complying with safety policies and procedures, instead of pressuring them to disregard those policies in place to improve productivity. Specifically, organizations need to make sure that management cares about the safety of the employees, so that employees will feel encouraged to communicate safety concerns with their supervisors. Strong management safety attitudes will also encourage employees to persuade their coworkers to comply with safety policies. To do this, organizations need to ensure that during management training, safety is shown as a high priority of the organization.

Finally, although the results demonstrating a positive relationship between job demands and upward safety communication may lead one to conclude that increasing job demands on safety would be an effective way of increasing upward safety communication, we prefer to encourage organizations to keep the job demands affecting employee safety at a minimum. While employees feel comfortable communicating these safety issues with their supervisors there will most likely be more injuries in the workplace if there are more job demands affecting the safety of the work environment (Marshall et al., 1997; Turner et al., 2005).

7.2 Strengths of the current study

One of the strengths of the current study is that the survey had an excellent response rate, which yielded a relatively large sample size. The data were collected in a way to increase response rates and response quality of participants. First, the survey administrators, who were fellow members of the respondents' union, ensured participant anonymity, which should serve to

increase the quality of the participants' responses by making them less likely to answer in a socially desirable way (Duncan, 1979). Second, participants were given the opportunity to complete the surveys during working hours, which meant they were getting paid for the time they spent completing the survey. Having a large sample size for the study decreases the probability of committing a Type II error, which is the error of accepting the null hypothesis when it is false (Wilkerson and Olson, 1997). Finally, the data were collected across different locations in Canada as well as across a variety of working shifts. Therefore, we expect the results to represent mechanical employees at all locations and on every shift at the organization.

Another strength is the use of dominance analysis to determine the relative importance of predictors. As noted above, this analysis technique is the one of two preferred methods for answering questions of relative importance of predictors (cf. relative weights analysis, Johnson, 2000). Especially when predictors are correlated, taking regression results on their own can lead to incorrect analyses of the relative importance of predictors (Budescu, 1993). Semi-partial correlations provide information about the unique variance a predictor accounts for over and above the variance accounted for by all other predictors. As such, it is sensitive to accuracy in model specification. In contrast with semi-partial correlations, dominance analysis considers both the total variance a predictor accounts for *and* the unique variance a predictor accounts for across all possible subsets of other predictors. This analysis provides a unique insight into the relative importance of predictors of upward safety communication.

7.3 Limitations

One potential limitation to the study is the use of self-reports. Although a great deal of organizational research relies on self-report, using self-reported data can cause problems with potential common method bias. This type of bias in the data can either inflate or deflate observed

relationships between constructs (Podsakoff, MacKenzie, Lee, and Podsakoff, 2003). In general, participants within an organization will tend to respond to the items in socially desirable ways; therefore they will under-report behaviors deemed inappropriate and over-report appropriate behaviors (Donaldson and Grant-Vallone, 2002). The use of multiple raters or information from multiple sources would be a more reliable way of collecting information. Specifically, managements' reports on their own safety attitudes or the level of comfort they feel about communication safety issues with their subordinates may be a more reliable way to collect information about management safety attitudes.

Another potential limitation is that the survey was only administered at one point in time; therefore, we were unable to investigate causal relationships. This means that we cannot claim that these particular constructs actually cause higher levels of upward safety communication, but only state that they are related to each other. Collecting data at multiple points in time could allow for stronger causal inferences to be made about the relationships.

Finally, the information was collected solely from one industry in one country, which may limit the generalizability of the results found. The railway industry tends be a more hazardous workplace compared to most working environments in other industries. Many times the safety hazards that railroad employees encounter can be life or death situations. This is rarely the case in an office environment. Therefore, this data may be less generalizable to working environments where employees are not confronted with such serious safety hazards on a daily basis. Additionally, we acknowledge that differing labor laws may limit generalizability across national borders.

7.4 Conclusions

These results indicate there are safety-related and non safety-related predictors of upward safety communication. If these results are replicated, perhaps using longitudinal data that could improve causal inferences, practitioners may be well advised to invest in both dyadic relationships and general safety climate to improve upward safety communication in organizations. Researchers interested in this construct are encouraged to study antecedents and consequences of upward safety communication, across time and in different industries, so that a fuller picture of the nomological network of this construct can be gained.

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Footnotes

[1] The organization has given the authors consent for identification.

[2] In accordance with our agreement with the Federal Railroad Administration and the Volpe National Transportation Systems Center, we use the survey scale names to refer to the measurement of the constructs and the original construct name to refer to the conceptual construct itself.

Table 1

Means, Standard Deviations, Intercorrelations Between Scale Scores

			1	2	3	4	5	6
	M	*SD*	Correlations					
1. Raising Safety Concerns with Supervisors (Upward Safety Communication)[a]	3.43	0.77	—					
2. Supervisor-Employee Relationships (Leader-member Exchange)	2.98	0.83	.62	—				
3. Organizational Concern for Employees (Perceived Organizational Support)	2.41	1.02	.47	.57	—			
4. Management Safety (Management Attitudes toward Safety)	3.01	0.84	.68	.65	.65	—		
5. Work-Safety Tension (Safety Job Demands)	3.61	0.73	.39	.30	.23	.38	—	
6. Coworker Safety (Safety Peer Pressure)	3.46	0.70	.38	.30	.30	.456	.18	—

Note. Sample sizes range from N = 506 to 516. All correlations are significant, $p < .001$

[a] Survey scale names are listed with construct names in parentheses

Table 2

Regression Results for Predictors of Upward Safety Communication

Variable	*B*	*SE B*	β	R^2	ΔR^2
Step 1					
Supervisor-Employee Relationships (Leader-member Exchange) [a]	0.44	0.04	.51*		
Organizational Concern for Employees (Perceived Organizational Support)	0.10	0.03	.15*	.37*	.37*
Step 2					
Supervisor-Employee Relationships (Leader-member Exchange)	0.26	0.04	.30*		
Organizational Concern for Employees (Perceived Organizational Support)	-0.01	0.03	-.02		
Management Safety (Management Attitudes toward Safety)	0.26	0.04	.25*		
Work-Safety Tension (Safety Job Demands)	0.30	0.05	.33*		
Coworker Safety (Safety Peer Pressure)	0.02	0.04	.02	.50*	.13*

[a] Survey scale names are listed with construct names in parentheses

Note. * $p < .001$, N = 488

Table 3

Dominance Analysis Results for Predictors of Upward Safety Communication

	k	LMX	POS	MSA	SJD	SPP
Conditional dominance	0	.347	.195	.391	.227	.115
	1	.175	.063	.201	.115	.032
	2	.099	.016	.112	.076	.010
	3	.064	.025	.067	.059	.003
	4	.047	-.002	.044	.048	.000
General dominance		.106	.030	.119	.080	.013

Notes. Sample sizes ranged from N = 488 to 506. *k* = the number of variables entered into comparison regression equations. LMX = Supervisor-Employee Relationships (Leader-Member Exchange), POS = Organizational Concern for Employees (Perceived Organizational Support), MSA = Management Attitudes toward Safety (Management Safety), SJD = Work-Safety Tension (Safety Job Demands), SPP = Coworker Safety (Safety Peer Pressure).