Safety Climate

Assessing management and organizational influences on safety

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DURING THE PAST DECADE, interest has grown in understanding how management practices and other organizational factors impact workplace safety. Much of this activity has focused on the constructs of safety culture and safety climate. In fact, the attention given to organizational factors has expanded to the extent that Hale and Hovden refer to it as the "third age of safety." According to these authors, the first two "ages" of safety emphasized technical measures and human factors, respectively. This article summarizes safety climate-related findings from two field studies.

The first project examined compliance with universal precautions (UP) among healthcare workers (HCWs). UP are recommended work practices designed to protect HCWs from exposure to bloodborne pathogens. In essence, HCWs should assume that all patients are infectious for the human immunodeficiency virus (HIV), Hepatitis B virus (HBV) or another bloodborne pathogen.

The traditional approach to safe work practices in healthcare has revolved around employee training and enforcement of safety rules and regulations. Since this strategy has yielded suboptimal results, this study sought to explore the role of environmental and contextual factors in the compliance process.

The second set of findings are from a field study of work organization in the retail sector. Results presented focus on the determinants of safety climate and whether safety climate plays an important intervening role in safety performance. Previous research has emphasized the dimensional structure of safety climate and/or its impact on various safety outcomes (e.g., Flin, et al; Zohar). Relatively little is known about what produces a positive safety climate, and this knowledge is essential to helping organizations achieve high-level safety performance.

UP Compliance Among Nurses

Studies conducted both before and after promulgation of OSHA's Bloodborne Pathogens Standard indicate that compliance with UP is often quite poor (Hersey and Martin). The compliance problem itself is well-documented, but relatively little is known about why HCWs fail to follow UP recommendations. Lack of knowledge about modes of occupational transmission and UP procedures have been implicated, but recent studies show improvements in both information dissemination and knowledge levels (Gershon, et al). In addition, HCWs do not appear to dismiss or underestimate their personal risk of occupationally related infection. They also seem to possess a reasonable amount of confidence in the effectiveness of UP as a preventive measure. However, evidence suggests that many HCWs view UP as adversely affecting job performance and the patient/practitioner relationship. Various structural and organizational factors also have been implicated in noncompliance, but solid research data have been lacking (DeJoy, Gershon, et al).

These studies used the PRECEDE Model (Green and Kreuter) to examine individual, job/task and environmental/organizational factors related to compliance with UP. As Figure 1 shows, three sets of diagnostic factors help shape the development of

intervention strategies. Predisposing factors include the characteristics of the individual (e.g., beliefs, attitudes, values) that facilitate or hinder self-protective behavior. Predisposing factors are thought to provide the initial motivation for self-protective behavior. Enabling factors are aspects of the environment or system that block or promote self-protective action. Pertinent skills and knowledge would be included here, as would the availability and accessibility of PPE and other resources. Most barriers and costs associated with compliance would qualify as enabling factors.

Reinforcing factors include any rewards or punishments that follow or are anticipated as a consequence of behavior. Performance feedback, the social approval or disapproval received from coworkers, supervisors and managers, and other safety climate dimensions would typically be classified as reinforcing factors in workplace settings. In contrast to more traditional perspectives on workplace self-protective behavior, the PRECEDE model goes beyond individual-level variables and assigns considerable importance to social-environmental factors or the context within which the behavior occurs [DeJoy(a); (b)].

This research was conducted as part of a large survey of 1,716 hospital-based HCWs employed by three large (approximately 1,000 beds) acute-care hospitals in different parts of the U.S. Nurses represented the single largest occupational group (n = 902) and were selected as the sample for this study. Overall response rate for the survey was 57 percent. Response rates for nurses at the three sites were: 54 percent, 87 percent and 33 percent, respectively.

Given typical workloads and work schedules in large medical centers, a multistage followup protocol was used to maximize response rate. The variation in response rates across the three medical centers was largely a function of how well institutional staff followed the protocol for tracking nonresponders. Table 1 shows the measures used to assess each of the three diagnostic factors. With the exception of the single items used to assess prior training and occupational exposures, all measures were multi-item scales with good internal consistency (reliability). Most of the measures employed four- or five-point rating scales as response formats (e.g., "strongly agree" to "strongly disagree").

Safety climate was represented by four of the reinforcing factors: priority assigned to safety, formal feedback, informal feedback and management actions/commitment to safety. Self-rated compliance was captured via two measures: general compliance (sharps disposal, hand washing, glove use, waste disposal, handling scalpels, needle recapping, cleaning up spills, and eating and drinking in work area), and compliance with PPE (protective outer garments, eyeshields and face masks).

The PPE measure included three barrier-related practices that often show the poor levels of compliance (Nelsing, et al). (A more detailed description of the methods and analyses used can be found in DeJoy, Searcy, et al.)

Figure 1

PRECEDE Model Applied to Compliance with UP in Healthcare

The following fit indices were obtained in testing the model as presented:

$\chi 2$ (df=1,154) = 2,429.95;
GFI (goodness of fit index) = 0.91;
AGFI (adjusted goodness of fit index) = 0.89;
NNFI (non-normed fitness index) = 0.90;
RMSEA (root mean square error of approximation) = 0.035.
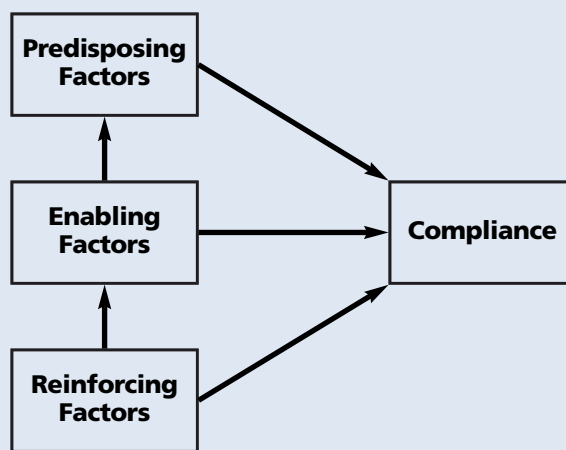
HCW Study Results

Structural modeling techniques were used to examine the effects of the three sets of diagnostic factors on compliance. First, a combination of exploratory and confirmatory methods were used to test the measurement models for the three diagnostic factors and compliance (Anderson and Gerbing). Following this, the full model in Figure 1 was tested. This model includes the direct effects of predisposing factors, as well as the direct and indirect effects of both enabling and reinforcing factors on compliance. In some cases, predisposing factors, or the individual's beliefs, attitudes, values, etc., may be sufficient to prompt self-protective action; however, the more likely situation is that enabling (e.g., resources, skills) and reinforcing (e.g., safety climate) factors contribute to and allow this initial motivation to be realized.

Following current practice, model fit was assessed using a set of fit indices (the caption for Figure 1 shows the values obtained for each fit index used in this study). The chi-square value for the full hypothesized model could be statistically rejected, but all other indices showed acceptable levels of fit. The total R^2 values were 0.18 for compliance with PPE and 0.41 for general compliance. The R^2 value (the squared multiple correlation coefficient) shows what proportion of the variance in the criterion variable (general compliance or compliance with PPE) was accounted for by all of the predictor variables combined. The variables included in the model explained only 18 percent of the variance for compliance with PPE, but a full 41 percent for general

Table 1

Diagnostic Factors: UP in Healthcare

Factor: Scale/Measure	# Items	Sample Item
Predisposing Effectiveness of preventive actions	3	"I can reduce my risk of HIV infection by complying with UP."
Risk-taking tendencies	6	"I prefer an exciting, unpredictable life."
Attitudes—HIV/AIDS patients	11	"HCWs should be made aware of the HIV status of all patients."
General knowledge—HIV	5	"AIDS is a disease caused by a virus."
Knowledge—HIV transmission in healthcare	8	"HIV may be transmitted to hospital workers by touching the skin of an HIV-infected person without wearing gloves."
Knowledge—Alternative modes of transmission	7	"A person can be infected with HIV by eating food that was prepared by someone infected with HIV."
Enabling Availability of PPE	5	"All of the necessary equipment and devices to help me avoid contact with HIV are readily available."
Job hindrances	4	"My job duties often interfere with my ability to comply with UP."
Workload	5	"How often does your job require you to work very fast?"
Training in UP	1	"I have been trained to use personal protective equipment (e.g., gloves, goggles, etc.)."
Training in PPE use	1	"In the past 12 months, how many hours of training did you receive specifically on UP?"
Reinforcing Priority assigned to safety	4	"In my organization, there are no significant compromises or shortcuts taken when worker protection from infectious diseases is at stake."
Formal safety feedback	4	"Where I work, unsafe practices are corrected by supervisors."
Informal safety feedback	4	"Employees in my workgroup remind each other of the need to comply with UP."
Management actions and commitment to safety	5	"Where I work, top-level management gets personally involved in safety activities."
Prior exposures to potentially contaminated materials (e.g., blood)	4	"Number of needlesticks in past six months."

compliance. Table 2 contains the regression coefficients for compliance regressed on each of the three diagnostic factors. These coefficients offer some insight into the relative importance of the individual variables comprising each of the three diagnostic factors. As Table 2 indicates, no predisposing factors significantly predicted compliance with PPE; however, three predisposing factors predicted general compliance. General compliance was better among those who had more positive attitudes toward patients with HIV; displayed lower risk-taking tendencies; and were better informed about modes of transmission in healthcare. Two enabling factors were significantly related to compliance with PPE: greater availability of PPE and having fewer job hindrances. Having fewer job hindrances was also a significant predictor for general compliance.

Among the reinforcing factors, three factors predicted compliance with PPE: priority assigned to safety, formal feedback and informal feedback. The coefficients for the first two factors were negative, indicating that compliance was actually poorer when a higher priority was assigned to safety and when more formal feedback on safety performance was provided. In contrast, receiving greater informal feedback was associated with better compliance with PPE. A similar effect for informal feedback was also evident for general compliance. In addition, greater prior exposure to potentially contaminated materials predicted poorer general compliance.

A series of nested models were analyzed to tease out the effects of safety climate on compliance. Nested models are frequently used to systematically examine the effects of adding different components of a theoretical or conceptual model. The change in chi-square per change in degree of freedom (χ^2/df) shows which additional paths produce the greatest improvement in model fit per degree of freedom (i.e., the greatest drop in chi-square per degree of freedom). The greatest improvement in model fit ($\chi^2/df = 26.09$) occurred when the indirect effects of reinforcing factors on enabling factors were added (i.e., the path between reinforcing and enabling factors in Figure 1). This suggests that safety climate impacted compliance indirectly.

It appears that a positive or supportive safety climate makes it more likely that the work environment will contain features or elements which make it easier for workers to follow safe work practices. In contrast, overall model fit did not improve much

Table 2

Table 2

Regression Coefficients (Gamma): Compliance Regressed on Diagnostic Factors

Variable	Regression Coefficients	
	Compliance with PPE	General Compliance
Predisposing Factors		
Effectiveness of preventive actions	0.04	-0.05
Attitudes toward HIV patients	0.00	0.11*
Risk-seeking tendencies	-0.04	-0.18**
General knowledge of HIV	-0.01	-0.10
Knowledge of alternative modes of transmission	-0.03	0.05
Knowledge of transmission in healthcare	0.02	0.16**
Enabling Factors		
Availability of PPE	0.15**	0.06
Job hindrances	-0.14**	-0.35**
Workload	0.00	0.02
Training in universal precautions	0.05	0.04
Training in PPE (in last 12 months)	0.00	-0.05
Reinforcing Factors		
Priority assigned to safety	-0.31**	0.18
Formal feedback	-0.27*	-0.28
Informal feedback	0.50**	0.48*
Management actions/commitment	0.16	0.17
Prior exposures	-0.01	-0.10*

$* = p<0.05;$ $** = p<0.01;$ $*** = p<0.001$

(χ^2/df = 7.08) when the direct effects of reinforcing factors on compliance were added. Model fit aside, this addition did produce a substantial improvement in R^2 (from 0.10 to 0.16) for compliance with PPE. Adding the direct effects of reinforcing factors actually decreased the R^2 for general compliance. As such, safety climate may operate somewhat differently for the two types of compliance. Still, the best overall R^2 values were obtained for the full hypothesized model (Figure 1).

Discussion

The PRECEDE model did a substantially better job predicting general compliance than compliance with PPE. This difference is noteworthy in that the PPE measure contained several barrier-related UP behaviors that have shown characteristically poor rates of compliance in previous research. As suggested by the regression coefficients in Table 2, the pattern of contribution of the three diagnostic factors differed across the two compliance measures. Among enabling factors, the ready availability of protective gear predicted better compliance with PPE but not better general compliance. The importance of access to protective equipment for compliance with PPE should not be

surprising; this measure included three PPE-related behaviors, namely wearing protective outer garments, eyeshields and face masks. This result points to the importance of making it easy for HCWs to access this gear when and where needed. The importance of job hindrances for both compliance measures is consistent with previous studies of UP-related behavior (DeJoy, Gershon, et al). Job- or task-related factors have been shown to be important for a variety of other workplace self-protective behaviors as well (e.g., hearing protectors, protective eyewear).

In addition to predicting compliance, job hindrances and availability of PPE as aspects of the environmental system, also influenced predisposing factors in a positive manner. Experiencing fewer job hindrances predicted stronger beliefs in the effectiveness of preventive actions; more positive attitudes about patients with HIV; diminished risk-seeking tendencies; and greater knowledge about HIV, alternative modes of HIV transmission and HIV transmission in healthcare. Greater perceived availability of PPE predicted stronger beliefs in the effectiveness of preventive actions, more positive attitudes toward HIV patients and greater levels of knowledge in each of the three areas measured.

Figure 2

Figure 2

Safety Climate as Mediator

Representation of the role of safety climate as a mediator of safety-related performance and outcomes.
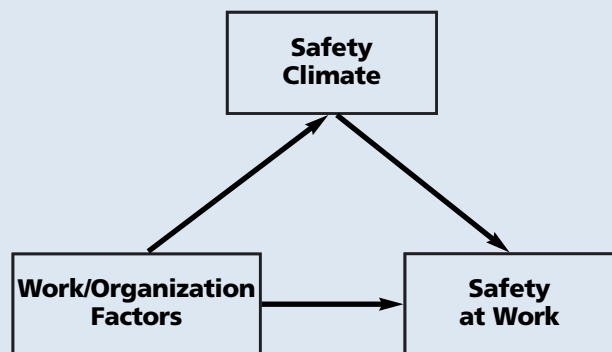
The nested models showed that a positive or supportive safety climate may increase the likelihood that the work environment will contain features or elements which enable workers to more readily comply with recommended work practices. Concerning PPE compliance, specifically, safety climate factors may act directly on compliance. Frequent and consistent feedback from coworkers and others may be especially important in prompting point-of-use compliance for these particular work practices. In contrast, the indirect effects of reinforcing factors appear to be more important for general compliance.

Viewed together, these findings suggest that the PRECEDE model provides a useful framework for examining the individual and environmental/organizational factors associated with compliance with UP among HCWs. The model directs attention to the skills and resources that permit attainment of behavioral goals, and views the environment as an important source of support and reinforcement for sustaining self-protective action. The present results also highlight the importance of readily available safety equipment and the need to identify and reduce job-related barriers to compliance. Perhaps the most important conclusion specific to safety climate is that a positive safety climate facilitates the creation of work environments which enable employees to follow safe work practices.

Safety at Work in Retail

There is fairly broad agreement that employee perceptions about management support for safety and the importance of safety within the organization are key ingredients of safety climate (Flin, et al). Safety climate, in turn, has been linked to various safety-related outcomes, including performance of safe work practices, safety-related activities/program effectiveness, interpretations of accidents, and accidents and other safety-related incidents or events (e.g., Griffin and Neal; Hofmann and Stetzer; Zohar).

In contrast, relatively little is known about the

determinants of safety climate, and such knowledge is critical to creating and maintaining positive and supportive safety climates within organizations. Safety climate is often thought to be a specific sub-type of organizational climate (Neal, et al), yet relatively little is known about whether a positive overall climate contributes to creating a positive climate for safety. Conventional efforts to improve safety performance generally involve hazard control and the establishment and enforcement of safety-related polices and programs. It is reasonable to think that good-faith efforts in these regards should also contribute to safety climate.

Besides assessing the ingredients of safety climate, the researchers were interested in exploring the extent to which safety climate plays a mediating role between various work situation factors and safety-related outcomes. Although seldom tested directly, many models of safety climate assume that safety climate mediates the linkages between general organizational system factors and safety-related behaviors and outcomes (Guildenmund; Hoffman, et al). Safety climate is increasingly being thought of as a leading indicator of safety performance. Figure 2 provides a schematic representation of these relationships.

Study Method

This study was part of a larger study of work organization in a large U.S. retailer. Data for the current study were collected from employees in 21 retail units located in the southeastern U.S. The stores varied in size from approximately 150 to 375 employees. Participation was entirely voluntary and anonymous, and questionnaires were administered onsite during regular business hours. Completed questionnaires were received from 2,208 employees, which represented an overall response rate of 50 percent. All departments and job categories were represented in the sample. Table 3 summarizes the measures used in this study.

Based on pertinent literature, the conceptualization of organizational climate included five multi-item scales: organizational support, coworker support, communication, participation with supervisor and participation with coworkers (Table 3). These measures tapped general employee perceptions about their workplace and were not specific to safety. The environmental conditions scale was developed on the basis of store "walkthroughs" and assessed exposure to hazards such as excessive heat, noise and poor lighting.

The measure of safety policies and programs assessed existing efforts in such areas as safety training, hazard communication and PPE. Safety climate was measured using the seven-item version of the NIOSH Safety Climate Scale (DeJoy, Murphy, et al). This scale emphasizes employee perceptions of management support for safety and the importance of safety issues within the organization (sidebar, pg. 55). The safety outcome of interest was a single item asking employees to rate their perceived level of personal safety and health on the job. Accident and

Table 3

Table 3

Scales & Measures: Study of Safety Climate in Retail

Scale or Measure	# Items	Sample Item
Organizational support	9	"The organization really cares about my well-being."
Coworker support		"My coworkers care about me as a person."
Communication	8	"Management gives enough notice to employees before making changes in policies and procedures."
Participation with supervisor	3	"Do you feel you can influence the decisions of your immediate supervisor regarding things about which you are concerned?"
Participation with coworkers	3	"I take part with others at my workplace in making decisions that affect me."
Environmental conditions	7	"I am exposed to hot or poorly ventilated work areas."
Safety policies and programs	5	"There are specific policies and programs in place that inform employees about job-related hazards and how they can be reduced."
Safety climate	7	See Safety Climate Scale.
Perceived safety at work	1	"All in all, how would you rate your current work situation in terms of your personal exposure to safety and health hazards?"

injury measures are notably unstable (Hopkins), and the diversity of jobs in retail made it difficult to construct an applicable set of safety-related activities or behaviors. (More detailed information on the full questionnaire can be found in Vandenberg, et al.)

Retail Study Results

Hierarchical, multiple regression techniques were used in these analyses. All analyses used age, gender, job tenure and hours worked per week as control variables. Control variables were entered into the models prior to entering other factors. The first set of analyses looked at the determinants of safety climate. Safety climate was regressed on the five organizational climate dimensions, plus the environmental conditions and polices and programs measures (Table 4). This combination of factors explained a full 55 percent of the variance in safety climate. Environmental conditions and safety policies and programs each contributed substantial explanatory power, and organizational climate made a significant addition beyond what was provided by the more traditional safety considerations. As Table 4 shows, three of the individual organizational climate dimensions contributed significantly to safety climate: organizational support, coworker support and communication.

Hierarchical regression analyses were also used to test for mediation. These analyses followed conventional procedures (Baron and Kenny). Basically, the preceding analyses were repeated but using perceived safety at work as the outcome measure. To test for mediation, safety climate was introduced into the model after the other control and independent measures had been included. Environmental conditions, safety polices and programs, organizational support and safety climate all made significant contributions to perceived safety at work. However, safety climate did not play a major medi-

Safety Climate Scale

1) Where I work, new employees quickly learn that they are expected to follow good workplace safety and health practices.

2) There are no significant shortcuts taken when workplace safety and health are at stake.

3) Employees are told when they do not follow good workplace safety and health practices.

4) I feel free to report workplace safety and health violations where I work.

5) Employees and management work together to ensure the safest and most healthful working conditions.

6) The safety and health of workers is a high priority with management.

7) My supervisor is concerned about my safety and health on the job.

ating role with respect to the other work factors. That is, the addition of safety climate into the model did not eliminate the effects of these other factors. Some partial mediation was noted for safety polices and programs in that the contribution of this factor was reduced but not eliminated by the addition of safety climate (from $p < 0.001$ to $p < 0.05$).

Discussion

These results show that overall organizational climate contributes in important ways to an organization's safety climate. As such, actions taken to create a positive and supportive overall climate should also impact the perceptions held by workers regarding the importance of safety in their organization. Organizational support and communication appear to be particularly important contributors to safety climate. These attributes may serve to heighten employee trust and foster a sense of mutual or shared

Table 4

Table 4

Hierarchical Regression Analyses: Predicting Safety Climate

Step & Predictor	Step 1	Step 2	Step 3	Step 4
Step 1				
Control Variables				
Age	0.031**	0.010	-0.010	0.004
Gender	0.023	0.029	0.018	-0.010
Tenure	-0.105***	-0.053*	-0.015	-0.003
Hours worked	0.002	0.004	0.004*	0.003
R^2	**0.013**			
Step 2				
Environmental conditions		-0.304***	-0.165***	-0.074***
R^2		**0.169**		
ΔR^2		**0.156**		
Step 3				
Safety policies and programs			0.516***	0.328***
R^2			**0.448**	
ΔR^2			**0.280**	
Step 4				
Organizational climate				
Organizational support				0.150***
Coworker support				0.069***
Participation—others				-0.008
Participation—supervisor				0.024
Communication				0.241***
R^2				**0.551**
ΔR^2				**0.103**

$* = p<0.05; ** = p<0.01; *** = p<0.001$

responsibility for safety. It is also important to note that good hazard control and well-designed jobs contribute to how employees feel about the climate for safety in their workplace. These results suggest several important leverage points for intervention.

The mediation results indicate that safety climate is an important factor in terms of safety-related outcomes, but, for the most part, it appears to add to, rather than mediate, the effects of the other more traditional programming considerations involving environmental controls and safety policies and programs. At this point, caution should be exercised in assuming that safety climate by itself broadly represents the organization's total efforts to maximize safety.

Conclusions

Both studies highlight the nature and role of safety climate. The first set of results demonstrate the importance of safety climate to safe work practices in healthcare and provide some insight into how a positive safety climate operates to impact workplace behaviors. The second project explored the determinants of safety climate in the retail setting and the mediating role that has been ascribed to it.

Safety climate appears to contribute in important ways to compliance with UP. Perhaps most importantly, a positive safety climate creates an environment that enables, supports and reinforces better compliance. Moreover, a multilevel or ecological model like the PRECEDE framework provides a useful means for understanding and ultimately improving self-protective behavior and workplace safety. This type of more comprehensive model pushes thinking beyond individual-level factors, and emphasizes the total person/environment interaction.

The second study highlights the close relationship between organizational climate and safety climate. Safety climate is a specific climate sub-type, and actions taken to foster a more positive overall climate within an organization are likely to spill over into the realm of safety as well. One possible interpretation of these results is that safety should be integrated into the total management system. That said, efforts to maximize safety should not simply focus on climate. As the present data show, hazard levels and safety polices and programs contribute to safety climate perceptions; these data also show substantial direct effects on safety-related outcomes that are not mediated by safety climate.

Practical Applications

The findings reported in this article have several implications for managing workplace safety. Both studies suggest that organizational and management factors are important ingredients in achieving good safety performance. The universal precautions study demonstrates once again that individual-level variables such as employee knowledge and attitudes (i.e., predisposing factors) are seldom sufficient to ensure safe employee behavior. Environmental and organizational constraints can easily overwhelm the employee's best intentions to work safely. For both types of UP compliance, individual-level factors explained only a limited amount of the variance in compliance.

This study also provides further evidence that PPE compliance can be improved by making the needed gear readily available and by minimizing the extent to which using it interferes with or degrades job performance. The HCW study also shows that safety climate can influence safe work practices either directly or indirectly. The indirect route is that a positive or supportive safety climate fosters the creation of work environments which make it easier for workers to comply with required safe work practices. Providing compliance-related feedback to employees through informal and formal channels can be especially helpful for improving compliance. Improving safety climate, along with conducting thorough job safety analyses, may be the best strategy for boosting compliance in particularly complex PPE applications.

The retail worker study shows that actions taken to create a positive and supportive overall organizational climate can also benefit safety. As expected, environmental conditions and safety policies and practices were each important determinants of safety climate. However, the organization's general climate also made an important contribution to safety climate beyond what was accounted for by the more traditional safety considerations. Taken together, environmental conditions, safety practices and policies, and general organizational climate accounted for more than 50 percent of the variance in safety climate.

This provides the beginnings of a roadmap for improving safety climate. Within the organizational climate domain, organizational support and communication were found to be important contributors to safety climate. One implication is that it is easier to have a positive safety climate when communications are open and bidirectional, and when specific actions are taken to make employees feel valued and supported as they work.

Good comunication fosters trust within an organization, and an organization that supports and values its employees is more likely to have committed employees. After all, the employment relationship is basically an exchange relationship. Actions taken by an employer to support and enhance employee well-being effectively rebalance the exchange relationship and promote heightened effort and commitment on the part of employees. If employees believe they are more than easily replaceable units of cost, they will more likely make special efforts in all areas of work, including safety. True excellence in the area of safety requires committed and motivated employees. ■

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