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A Conceptual Framework for Studying Safety Climate and Culture of Commercial Airlines

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A comprehensive safety climate and safety culture framework, which can be utilized to assess various predictors and consequences of safety climate and to assess airline's safety culture in relation to one another, is presented. The framework depicts a process whereby individual, group, and organizational predictor variables, through perceived safety climate, affect first level outcomes. First level outcomes can lead to direct costs for the organization, as well as lowered productivity. In the framework, individual and environment variables are purported to moderate the relationship between work-related events and safety climate. Motivation is also expected to mediate the relationships between predictors and safety climate, as well as predictors and individual level consequences. Overall, organizational culture and environment are likely to affect safety climate and safety culture.

Introduction

To date, there is a lack of comprehensive and coherent safety culture or safety climate frameworks (Mearns & Flin, 2001). Studying safety climate and culture of airlines is a difficult undertaking; therefore it is often the case that problems are solved reactively and the focus is on mechanics of mishap(s). Examining safety climate and culture from an organizational psychological perspective, however, could provide a more holistic understanding of why and how mishaps occur, and provide a predictive model for preventing them. The basis of an organizational psychological perspective is people's perceptions of organizational processes (e.g., structure, selection, reward policies), which are often the root of mishaps (Reason, 1997). Therefore, in this paper we present a comprehensive safety climate and safety culture framework (see Figure 1), which can be utilized to assess various predictors and consequences of safety climate and to assess airline's safety culture in relation to one another.

Conceptual Framework

Our framework is based on Lazarus and Folkman's (1984) transactional model for studying occupational stress. The transactional model demonstrates that process variables mediate the relationship between predictors and outcomes. Safety climate is depicted in our model as a process variable; it's through safety climate that predictors will affect outcomes. It provides context for why certain consequences occur due to work-related events.

Predictors of Safety Climate/Culture

Individual Predictors. Individual predictors are variables that reflect characteristics of the people who are employed in an organization and the characteristics of the jobs in which they work. Two individual predictors identified in our framework are job characteristics and personal characteristics. *Job characteristics* describe attributes of a job, such as task involvement, job autonomy and responsibility, skill discretion, physical demands, work hours, shift patterns, and fatigue. Previous research has found that organizational members contribute more in ensuring safe operations when provided autonomy and responsibility within their work tasks (Parkes & Bochner, 2001), as responsibility can lead to a sense of pride in maintaining a good safety record (von Thaden et al., 2003). Additional characteristics of one's work environment include *work schedules, work hours, shift patterns, and fatigue.* Research has shown that, demanding pilot schedules leads to fatigue and subsequent performance problems and errors (Bourges-Bougrine et al., 1999). Finally, *physical demands* reported by flight crew members, such as inadequate cockpit design and experience of fluctuations between hot and cold temperatures, noise, altitude pressure, and acceleration (e.g. Orlady & Orlady, 1999) can have detrimental effects on employees' health, and subsequently, safe flight operations (Gadd, 2002).*Personal characteristics*, such as s*afety consciousness*, are associated with taking safety precautions, and low levels of safety consciousness can lead to adverse outcomes, such as accidents (Behn et al., 1999). *Safety competence* (Gadd, 2002) has been shown to increase likelihood of safe flight operations (Hofmann et al., 1995).

Group Predictors. Group level predictors are classified into two subcategories: *leadership* and *psychosocial stressors*. Previous research has found that *leadership* affects the way subordinates perceive safety (e.g. Zohar, 2002) and lack of strong leadership was directly related to incidents and accidents amongst aircrews during simulator training exercises (Kanki, 1996). Safety climate was found to be affected by *management commitment* (e.g. Wiegmann et al., 2002). Mearns et al. (2001) found that employees' perceptions of managements' commitment to safety was positively correlated to satisfaction with safety actions. Other leadership aspects that can affect safety climate are *task orientation and goal setting (*Tuttle et al., 1975), as well as *innovation or risk behaviors*. Leaders are also pivotal in *monitoring safe practices (*Huettig et al., 1999) which is central to pilot decision making, and consequent flight safety. *Psychosocial stressors* consist of variables related to role behaviors and perceptions, which entail role conflict, role overload, role ambiguity, interpersonal relationships, and communication. Stressors can have human and financial costs (e.g., turnover, poor work performance, accidents, and fatalities; Tuttle et al., 1975). Role overload (i.e., performance pressure) has been found to be a strong predictor of injury (e.g. Zohar, 2000) and can lead to avoidance coping methods (Dillenger et al., 2003). Avoidance coping can adversely affect accident prevention, e.g., behavioral disengagement was chosen as the first choice of coping strategy amongst student pilots (Dillenger et al.). Also, C*ommunication* of safety-related information must occur upward, as well as downward, and must be accessible to anyone needing it to perform well. In an aviation context, when pilots do not engage in positive briefings with the other crewmembers, they can be responsible for mishaps (Dillenger et al., 2003). Without establishing a tone for reporting safety hazards, crew members might be reluctant to do so on their own, and may not always communicate their observations for fear of retribution (e.g.Behn et al., 1999), despite being cognizant of potential safety hazards.

Organizational Predictors. One of the more immediate work environment predictors is the organization's structure and resulting *organizational politics* (Thompson et al., 1997), which can affect perceived safety climate. It is possible that organizational politics would promote *job risk-taking.* Generally, research has found that probability of taking risks is a function of the perception of risk, appreciation of risk, likelihood of accidents/incidents, and previous outcomes (Adams, 2003; von Thaden et al. 2003). Some of the important human resource predictors affecting safety climate are *preparation and planning*, *training*, *reporting system and rewards*. *Preparation and planning* is required for safe flight operations and it has been estimated that over 100 hours of preparation are spent on each hour of flight (Sternstein & Gold, 1991). Thus, the extent to which Dispatch promotes safety as a priority consideration over financial gain might have an effect on people's perceptions of safety climate. Also, *training* efforts by an airline's management will affect perceived safety climate. An example is Crew Resource Management (CRM) training, developed in 1979, after human error was identified as the primary cause of many air transport accidents. One of the major emphases in CRM is communication of concerns, or reporting possible problems and incidents. One way airline employees are able to voice concerns is through *reporting systems*, such as NASA's Aviation Safety Reporting System (ASRS). ASRS can also be utilized for research purposes (Reynard et al., 1986) to determine safety issues and to generate safety recommendations that could eventually be implemented into FAA policies targeted towards improving safety (e.g., Burian & Barshi, 2003). Again, fear of retribution prevents people from using it (Behn et al., 1999). R*eward systems* that promote safety behavior and help to correct unsafe behaviors in an organization are needed in order to ensure a positive perception of safety climate (von Thaden et al., 2003)

Mediator and Moderators

Motivation is presented as an intermediary process variable that <u>mediates</u> the effects of predictors on individual (first-level) outcomes. The extent to which the stated goals are aligned with actual goals an organization is trying to reach will act as a motivator for employees to achieve the goals (Adams, 2003). Enacting stated goals for safety, thus, would likely enhance organizational safety outcomes (e.g. Griffin & Neal, 2000). According to Tuttle et al. (1975), one way to motivate employees is through performance relevant and immediate feedback, which positively affects employees' safety performance (Griffin & Neal, 2000). Thus, our framework demonstrates that the effects of various predictors, such as training, will likely affect individual outcomes, such as transfer of training, through people's motivation to achieve valued organizational outcomes, such as reduced incidents and increased well-being.

Person Moderators. Our framework postulates that certain personality and demographic variables, such as locus of control (Rochlin, 1999), propensity for risk-taking (e.g. Nicholson, 2001) and education, can moderate the relationship between safety climate predictors and safety climate outcomes.

Environment Moderators. Environment moderators identified in our framework include feedback, peer cohesion, group size, and support for safety by organizational members (i.e., management, co-worker, supervisor, and self). Previous research (e.g., Zacharatoset al., in press) has shown that feedback, peer cohesion, and support for safety are important variables that might affect safety climate in the aviation industry. Karasek and Thorell (1990) have found that job-decision latitude is associated with better work performance, positive employee attitudes, and physical and psychological well-being, whereas the opposite occurs with little decision latitude. Sadly, with increased automation, pilots sometimes see the automated flight information as a better decision-maker than themselves. Skitka et al. (1999) found that aircrews in automated conditions tended to engage in less discussion before arriving at decisions due to over-reliance on the automated systems. Peer cohesion is another potential moderator of the relationship between predictors and perceived safety climate (Simard & Marchad, 1994) and safety performance (Zacharatos et al., in press). However, excessive group cohesion may also lead to *groupthink*, which is a possible bottleneck to safety (Nicholson, 2001). Large, bureaucratic groups with dominating leaders are often reasons cited for groupthink. Thus, *group size* is a variable that might affect perceived safety climate. Another potential moderator present in the work environment is support for safety and it is important for organizations, including supervisors (Thompson et al., 1997), management, and colleagues (Fogarty, 2003; Goldman et al., 1991) to support safety initiatives.

Outcomes of Safety Climate.

Behavioral Outcomes. Behavioral outcomes often lead to organizational outcomes, such as accidents. One way to prevent accidents is to ensure *safety compliance* and minimize *risky behaviors* (Neal et al., 2000; Reason, 1997). A positive climate for safety will increase safety compliance among employees (Neal et al., 2000). Although the FAA imposes penalties for non-compliance with safety issues; if pay or other rewards are based on performance, such as on-time departures or expediting check-in, then workers might feel pressured to focus more on speed of task execution than *safety task performance* (Kaminski, 1997; Thompson et al., 1997). Because relatively few consequences are associated with inconsistent adherence to safety standards, even in the aviation industry (Thaden et al., 2003), risks are taken at the expense of passengers, crewmembers, and people in line of the flight path. Thus, poor safety climate would result in increased violations and errors (Fogarty & Neal, 2002). Violations can be prevented through *safety participation* (e.g. Goldman et al., 1991; Neal et al., 2000) and by developing *safety promoting events*, such as safety meetings that increase safety participation. Safety meetings are supposed to take place among crew members before flights, in terms of coordinating roles. Lack of crew coordination is often attributed to crew errors (Aviation Today, 2000). Unfortunately, quality of crew coordination has declined post 9/11/2001, due to new “safety” procedures (Chute, 2002).

Attitudinal Outcomes. Safety climate is expected to affect people’s attitudes, and subsequently organizational outcomes. For example, it has been noted that apathy or a bold attitude can lead to violations of safe operations and increase risk-taking (Hofmann et al., 1995). Moreover, apathy might be a result of employees becoming desensitized to safe operations over time and transferring responsibility of safety to others (Hofmann et al., 1995). That is, a poor safety climate might lead to apathetic attitudes. Also, organizational commitment (e.g. Parkes & Bochner, 2001), turnover intention, anxiety/frustration, tension, complacency, organizational/job satisfaction, safety satisfaction, and morale will be affected by perceived safety climate. In turn, these attitudes are expected to affect organizational safety outcomes. Furthermore, organizational workplace characteristics, such as communication, recognition, safety, coworkers, and feedback lead to high *morale*, which in turn, lead to job satisfaction and commitment (Fogarty, 2003). Dunbar (2001) found the extent to which employees felt management was committed to workers’ welfare and helped employees feel safe was predictive of employees’ reported satisfaction with safety in the workplace. However, with low commitment, low satisfaction, and poor safety, airline employees might report experiencing *tension*. When safety climate is perceived to be poor tension might result (Eiff & Mattson, 1998).

Cognitive Outcomes. Previous research found that exposure to informal or formal safety training and experience of incidents or accidents influences an individual’s appraisal of potential threatening situations (Goldberg et al., 1991). Furthermore, repetition of tasks leads to the ability to perform tasks with little conscious thinking regarding the steps involved (Hofmann et al., 1995), however, task performance is still subject to slips and errors (Reason, 1997). Slips or lapses are a type of cognitive error that occur due to an individuals’ dependence on memory to carry out a known task, however, the individual may depend on a wrong preexisting schema to guide execution (Hofmann et al., 1995; Reason, 1997). Therefore, in order to reduce errors, it is crucial to investigate cognitive factors (i.e., risk or situational awareness,) that result from predictors of safety climate and perceived safety climate. Safety research should also focus on sources of risk and deviations from standards (Rochlin, 1999), which are influenced by emphasis placed on representation, perception, or interpretation of risk (Krimsky & Golding, 1992) within an organization. In the aviation industry, pilots are referred to as *risk managers* to illustrate that managing risk is part of achieving goals in flight (Lofaro & Smith, 1999). Prevention of accidents can be accomplished by making sure that risk managers comprehend the gravity of risk and have the competencies for managing risks, as precursors to risk reduction (e.g. Adams, 2003). One way to ensure competencies is through reinforcement of one's *knowledge of regulations* and ensuring that off-the-job *training is transferred on-the-job*

Organization Outcomes. Organizational outcomes of safety culture and climate include attrition, accident and incident rates, reputation of safety, and employee well-being and health. The main emphasis of the aviation industry is accident prevention and a "no accident" record. Safety climate predictors, such as policies, procedures, training, and leadership (e.g., Barling et al., 2002; Burian & Barshi, 2003; Zohar, 2000), and mediators such as safety compliance and motivation (e.g., Holling, 1999) help prevent adverse outcomes (i.e., accidents, incidents, and injuries). The occurrence rate of adverse outcomes (e.g., accident rate, number of delays) can provide a measure for demonstrating the effectiveness of various safety climate predictors. In addition to physical outcomes, other social outcomes, such as a positive reputation is indicative of a positive safety culture (Schneider et al., 1994). Attrition is another organizational outcome that is influenced by climate predictors, such as the selection system of an organization. Previous research has found that mismatch of organizational and employee values, and the quality of information provided to applicants affect attrition rates (e.g. Schneider & Schneider, 1994).

Conclusion

Safety is one of the greatest demands placed on commercial airlines. However, it is not enough to have locked cockpits or to have checklists to ensure all safety procedures are followed. Airline employees must adopt a mindset for safety that ensures both procedural and common sense safety. Eiff was noted as stating, "aviation industry has been woefully negligent in addressing work-related hazards. This fact is underscored by recent exploding lost-time injury and disability claims in most aviation organizations. Increased operational tempos coupled with challenges in providing adequate staffing and equipment have generated environments rich in injury potentials" (Aviation Today, 2001, p. 3). Maintaining a safety climate is one strategy for thwarting injuries. The proposed framework exemplifies variables that might relate to perceived safety climate. Our purpose was to introduce aviation researchers to possible antecedents and consequences of safety climate. We do not recommend trying to study all these variables in one study but to study some of these variables in more simplistic models that address salient concerns.

This framework is an inclusive guide researchers and aviation practitioners can use for determining variables relevant to assessing safety climate and culture. Eventually, results of empirical research based on the framework can be molded into a tool for benchmarking safety standards across airlines. Identification of key variables related to safety culture and safety climate can enable aviation executives and safety officials to take preventative, instead of reactive, measures to enhance organizational processes that ultimately affect safety behaviors and ensure the safety and security of the flying public.

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