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Does safety climate moderate the influence of staffing adequacy and work conditions on nurse injuries?

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1. Introduction

Hospitals are dangerous places for their workers. According to the U.S. Department of Labor, hospitals have a higher incidence rate for nonfatal occupational injuries (7.5) than does the construction industry (6.2), manufacturing (5.6) and trade, transportation and utilities (5.6) (DOL, 2005). And hospital nurses have one of the highest rates of work-related injuries in the United States. In particular, back injuries and needlesticks have been identified as top safety concerns (American Nurses Association, 2003;diCastro, 2006). The incidence of back injuries in 2000 resulting in lost time from work was 90.1 per 10,000 full-time hospital workers, compared to 70.0 for truck drivers and 47.1 for agricultural workers (DOL, 2002). Among nurses, the annual prevalence of back injuries is estimated to range from 30% to 76% with a lifetime prevalence of 35% to 80% (Ando et al., 2000;Trinkoff, Brady, & Nielsen, 2003). Comparable estimates have been documented for needlesticks. Based on data from the 1998–2000 National Electronic Injury Surveillance System, the rate of exposure to bloodborne pathogens from a needlestick injury has been estimated at 15.3 per 1,000 full-time equivalents for nurses, compared to 13.9 for other hospital workers such as clinical technologists and laboratory technicians and 7.1 for physicians (Chen & Jenkins, 2005). A recent small study (Inviro Medical, 2006) found that 64% of respondents reported being accidentally stuck by a needle while working, while 47% of nurses report being stuck by a contaminated needle, some multiple times by both contaminated and clean needles.

The consequences of work-related injuries are substantial with expenditures as high as $90 million annually for registered nurses (RNs) alone (Waehrer, Leigh, & Miller, 2005). Along with higher employer costs due to medical expenses, disability compensation, and litigation, nurse injuries also are costly in terms of chronic pain and functional disability (Trinkoff, Lipscomb, Geiger-Brown, & Brady, 2002), exposure to serious and potentially lethal infectious agents (DeJoy, Searcy, Murphy, & Gershon, 2000), absenteeism (Tate, Yassi, & Cooper, 1999), and turnover, since as many as 20% of nurses who leave direct patient care positions do so because of risks associated with the work (Lynch & Freund, 2000).

While isolated studies have been conducted in individual hospitals to evaluate the efficacy of back injury prevention interventions (Lynch & Freund, 2000;Nelson et al., 2006;Yassi et al., 2001), approaches to employee safety in most healthcare organizations have been limited to modification of individual behavior through enforced compliance with safety rules and procedures and mandatory participation in safety training. Because these approaches have been of only modest benefit in reducing injuries (DeJoy, Gershon, & Schaffer, 2004), there is an emerging consensus that successful safety initiatives will depend on a theoretically sound understanding of the interrelationships among individual, environmental, and organizational factors that affect safe job performance (Katz-Navon, Naveh, & Stern, 2005;Lundstrom, Pugliese, Bartley, Cox, & Guither, 2002;Shannon, Mayr, & Haines, 1997).

Despite this emerging consensus, the investigation of nurse safety outcomes has been limited almost exclusively to descriptive studies that document injury rates or identify isolated job factors associated with increased risk of injury. These studies provide little insight into the mechanisms through which organizational factors are linked to the safety behaviors of individual nurses or nursing workgroups as a whole. In this study, we contribute to knowledge development by testing a theoretical model that examines relationships between organizational context (characteristics of the external, hospital, and nursing unit environments), structure (unit capacity, work engagement, work conditions), safety climate, and effectiveness (needlesticks and back injuries among nursing workgroups in acute care hospitals). The results of such a study may have important implications in designing effective intervention strategies that improve workplace safety for nurses.

1.1 Theoretical framework

Structural contingency theory (SCT) was used as the basis for model specification. The basic assumption of SCT is that effective organizational performance depends on the extent to which internal structures of the organization match the type of work and environmental conditions under which the organization operates (Scott, 2003). Based on this assumption, contingency theorists argue that decisions about structure must take into account the environment of the organization and the tasks it performs, which, taken together, comprise its “context.”

1.2 Organizational context

1.2.1 External environment—Characteristics of the external environment can be thought of as elements that, while existing outside the boundaries of the organization, have the potential to affect all or part of the organization. We used three variables to represent external environment: *rural or urban status*, *managed care penetration*, and *geographic region.* These variables were included because they influence work-related factors that have been shown to have a direct effect on nurse safety outcomes. For example, higher rates of exposure to bloodborne pathogens have been documented among nurses in rural compared with those in urban hospitals (Glenn & Ramsey, 1995), suggesting that nurses in rural hospitals may less consistently adhere to safe needle precautions than nurses in urban hospitals. Nurses who work in rural hospitals also differ from their urban counterparts in work patterns and commuting behavior (Skillman, Palazzo, Keepnews, & Hart, 2006), both of which have been linked to nurse safety outcomes (Sveinsdóttir, 2006;Trinkoff, Le, Geiger-Brown, Lipscomb, & Lang, in press). Managed care (i.e., HMO) penetration was included because it has provided the impetus for numerous nursing unit re-design efforts like the introduction of professional practice models and changes in nursing skill mix that affect utilization of nursing personnel, staffing adequacy (Hoover, 1998;Mark, Harless, McCue, & Xu, 2004;Mark, Salyer, & Wan, 2003) and, ultimately, safety. Finally, because there is substantial regional variation among hospitals in illness treatment, volume and complexity of procedures performed, and resource consumption (Wennberg & Gittlesohn, 1973;Wennberg, Freeman, & Culp, 1987), we included geographic region as a variable. Regional differences may have implications for nurse safety because they influence such factors as patient acuity, work complexity, and staffing needs (Geiger-Brown et al., 2004).

1.2.2 Hospital environment—Characteristics of the hospital environment were specified using size, organizational life cycle, teaching status, technological complexity, and magnet certification. Size was included because studies suggest that large organizations report fewer occupational injuries and less frequent lost time due to injuries (McVittie, Banikin, & Brocklebank, 1997;Moses & Savage, 1994). Larger organizations typically have more managerial levels and a higher proportion of support staff, which may increase the resources that can be devoted to safety issues (Daft, 1992;Kimberly, 1976).

Studies have found increased musculoskeletal injuries among employees in organizations that, in response to life cycle decline, have adopted lean production systems that intensified job demands and work pace (Babson, 1995;Landsbergis, Cahill, & Schnall, 1999). In this study, organizational life cycle was defined as change in the number of hospital admissions over two consecutive years. In prior work, instability in hospital admissions negatively affected enactment of a professional practice environment in which nurses have greater autonomy and more actively participate in decision-making (Mark et al., 2003). In turn, autonomy and decision-making participation have been linked to better safety outcomes among employees in general and nurses in particular (Aiken, Sloan, & Klocinski, 1997;Parker, Axtell, & Turner, 2001;Simard & Marchand, 1995).

While we found no studies comparing nurse safety outcomes in teaching and non-teaching hospitals, patients in teaching hospitals generally are sicker and receive more aggressive and complex care than do patients in non-teaching hospitals (Iezzioni et al., 1990). Nurses in these settings, therefore, may experience heavier work demands due to higher patient acuity and greater work complexity, thus increasing the risk of injury (Ando et al., 2000;Menzel, Brooks, Bernard, & Nelson, 2004;Trinkoff, Lipscomb, Geiger-Brown, Storr, & Brady, 2003). While it is reasonable to assume that, like teaching hospitals, the risk of injury is higher for nurses in hospitals that offer more high technology services, no studies have described the effect of technological complexity on work-related injuries among nurses. However, Mark and colleagues (2003) found that greater technological complexity had a positive effect on the enactment of a professional nursing practice environment. Therefore, it is possible that technological complexity may have an indirect effect on reducing work-related injuries through its contribution to the development of work conditions that enable adherence to safe work practices.

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Finally, we included a variable that identified whether or not the hospital was accredited as a “magnet” hospital. This term was first used during the nursing shortage of the early 1980s (McClure, 1983) to describe hospitals that provided work conditions that supported professional nursing practice and, for this reason, were successful in recruiting and retaining nurses. At present, approximately 200 hospitals have achieved magnet status by undergoing a rigorous certification process sponsored by the American Nurses’ Credentialing Center for Excellence in Nursing. Aiken and colleagues (1997) found that nurses in magnet-certified hospitals reported less frequent exposure to bloodborne pathogens compared to nurses in non-magnet hospitals.

1.2.3 Nursing unit environment—Environmental characteristics of the nursing unit were specified using size, availability of support services, patient acuity, and work complexity. These variables have been linked in previous research to workload demand and nurse staffing requirements and, thus, have implications for work-related injuries (Menzel et al., 2004;Trinkoff, Lipscomb et al., 2003). Using a multi-level analytic approach, for example, Mark et al. (2003) found that unit size was negatively associated with enactment of a professional nursing practice environment. In this same study, however, availability of support services like patient transporters, couriers for specimen collection, and computerized physician order entry was strongly associated with a positive practice environment. These findings

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suggest that unit size and availability of support services may differentially contribute to the explanation of work-related injuries through their effect on nurses' work conditions.

Higher patient acuity and greater work complexity have been linked to increased work-related injuries among nurses (Ando et al., 2000;Geiger-Brown et al., 2004;Lundstrom et al., 2002). Nurses are more likely to encounter time-sensitive situations that require immediate action when patient acuity is high. In such situations, the need for an immediate response to patient needs may outweigh the perceived benefits of adhering to safety precautions. In fact, one of the most common reasons nurses give for failure to comply with safety precautions is that a delay in treatment will be harmful to the patient (Williams, Campbell, Henry, & Collier, 1994). Work complexity not only has implications for staffing adequacy (Geddes, Salyer, & Mark, 1999;Mark, Salyer, & Harless, 2002), it also contributes to work conditions that are conducive to injury. Nurses have consistently identified increased work complexity in terms of time constraints and work hindrances as factors associated with the decision to take shortcuts that reduce adherence to safe needle precautions (Ferguson, Waitzkin, Beekmann, & Doebbeling, 2004).

1.3 Organizational structure

Organizational structure refers to the administrative mechanisms used to balance coordination with work role specialization, thus enabling the organization to accomplish its tasks. Administrative mechanisms that support adequate nurse staffing and promote positive work conditions, in particular, are seen as critical components of the organizational structure in acute care hospitals because they affect both quality of care and nurse safety outcomes. For this reason, we specified organizational structure at the nursing unit level using two measures of staffing adequacy, unit capacity and work engagement, and a single composite measure of nurses' work conditions, derived from unit-level indicators of nurses' autonomy, participation in decision-making, and relational coordination.

1.3.1 Unit capacity and work engagement—While most researchers have operationally defined nurse staffing in terms of nurse-patient ratios or hours of care provided by RNs, the American Nurses' Association (1999) suggests a broader approach to its measurement. Thus, we developed a measure of staffing adequacy that included: proportion of RNs among the unit-level nursing staff; proportion of RNs on the unit with, at minimum, a baccalaureate degree; average RN tenure on the unit; RN commitment to care; and, nursing expertise. Factor analysis of these variables yielded two distinct factors, which we named unit capacity (incorporating RN proportion and proportion of RNs with a baccalaureate degree) and work engagement (incorporating RN tenure, commitment, and expertise).

When measured using nurse-patient ratios or hours of RN care, adequate nurse staffing has been consistently linked to fewer work injuries (Clarke, Sloane, & Aiken, 2002;Geiger-Brown et al., 2004;Trinkoff et al., in press). However, the relationship between unit capacity as an indicator of staffing adequacy and nurse safety outcomes has not been previously described. Similarly, while studies have not examined the relationship between work engagement and nurse safety outcomes, Harter, Schmidt, and Hayes (2002) found that higher work engagement among employees in industrial organizations was associated with fewer work days lost due to injury. This finding lends support to the argument that employee safety depends not only on compliance with safety rules but also voluntary participation in safe work practices, participation that is strongly influenced by involvement in and commitment to the work.

1.3.2 Work conditions—There is emerging evidence suggesting that safety initiatives are more likely to succeed in organizations where employees perceive that they are valued and supported. Positive work conditions characterized by greater autonomy and participation in decision-making have been linked to better employee safety outcomes (DeJoy, Gershon et al., 2004;Shannon et al., 1997). These findings indicate that positive work conditions may enhance the ability of employees to appropriately respond to work exceptions and unanticipated situations that often are the harbinger of injuries (Parker et al., 2001). Further, effective organizational performance depends, in part, on well coordinated work processes that develop from strong communication and relationship ties among frontline workers (Gittell, 2002). Gittell (2000) argues that workgroups characterized by strong relational coordination are more likely to achieve high quality outcomes because they accurately communicate information and share knowledge and, for these reasons, can engage in effective problem solving as a team. Strong collegial relationship ties have been linked to such employee outcomes as greater willingness to make safety suggestions and adhere, without supervision, to safety precautions (Simard & Marchand, 1995). Among nurses, work conditions that support strong interdisciplinary relationships have been linked to fewer needlestick injuries (Aiken et al., 1997;Clarke et al., 2002).

1.4 Safety climate

Safety climate is defined as the shared perceptions of employees about the value and importance of safety to the organization (DeJoy, Schaffer, Wilson, Vandenberg, & Butts, 2004). While numerous dimensions of safety climate have been described in the organizational literature, four have received consistent support as critical to the development of a strong safety climate. First, employee perceptions about the importance of safety depend on managerial behaviors that convey a commitment to safety and actively promote employee involvement in safety issues (Hofmann & Stetzer, 1996;Shannon et al., 1997). Second, the balance that is maintained between work production and worker safety is critical to employee perceptions about the value of safety to the organization (DeJoy, Gershon, & Schaffer, 2004). Third, information flow is critical in shaping employee perceptions about the importance of safety. A strong safety climate is more likely to develop when open lines of communication are maintained such that safety information flows not only from management to employees but also from employees to management (Katz-Navon et al., 2005). Finally, the response to unsafe behaviors is critical to the formation of a positive safety climate (DeJoy, Gershon et al., 2004). Constructive feedback from supervisors and immediate co-workers creates a nonpunitive atmosphere that enhances employee willingness to report safety violations and participate in the identification and resolution of work-related factors that contribute to unsafe behaviors.

Safety climate has been linked to employee outcomes like compliance with safety policies, perceived workplace safety, safety knowledge, and perceived ability to maintain safety in the workplace (DeJoy, Schaffer et al., 2004;Gershon et al., 2000;Huang, Ho, Smith, & Chen, 2006;Parker et al., 2001;Probst, 2004). In addition, safety climate has been identified as a strong predictor of fewer near misses, unsafe behaviors, and work-site injuries (Hofmann & Morgeson, 1999;Hofmann & Stetzer, 1996).

Much of the safety literature has focused on identifying the factor structure of safety climate or examining relationships between safety climate and outcomes (Neal & Griffin, 2002). As a result, efforts to integrate this variable into a theoretical model that reflects the contribution of organizational context and structure to safety outcomes have been limited. Responding to this concern, DeJoy (1996) suggested that safety climate might contribute to the explanation of safety outcomes through its interaction with structural characteristics of the work setting. In particular, he argued that safety climate functions to reinforce adherence to safe work practices, thus augmenting the positive effect of workplace factors that are conducive to safe work practices or, in contrast, mitigating the negative effect of workplace factors that hinder adherence to such practices. Consistent with DeJoy's argument, we modified our research model to permit investigation of safety climate as a possible moderator of the relationship between organizational structure and effectiveness.

2. Methods

2.1 Study context

The research model in this study was tested using data from the Outcomes Research in Nursing Administration Project-II (ORNA-II). ORNA-II is a large multi-site organizational causal modeling study designed to investigate relationships between the context and structure of acute care hospitals and organizational, nurse, and patient outcomes (Mark, 2002). ORNA-II data collection began in 2003 and ended in 2004.

2.2 Sample

The ORNA-II sample was comprised of hospitals randomly selected from Joint Commission on Accreditation of Health Organizations (JCAHO)—accredited acute care facilities with at least 99 licensed beds. Two medical-surgical nursing units at each hospital participated. Among hospitals with only two eligible units, both participated; among hospitals with more than two eligible units, an on-site study coordinator selected the units that participated. Federal, for-profit, and psychiatric hospitals were excluded, as were critical care, pediatric, obstetric, and psychiatric units. Two-hundred and eighty one nursing units in 143 hospitals participated in the study. On each participating unit, RNs with more than three months of experience on the unit were asked to respond to three different study questionnaires, distributed during six consecutive months. The first questionnaire was returned by 4,911 nurses, the second by 3,689 nurses (75.1% response rate), and the third by 3,272 nurses (66.6% response rate).

2.3 Data collection

On-site study coordinators participated in a 1½-day training program conducted by the ORNA-II research team. In this program, the study purpose and goals were presented, conceptual and operational definitions for the key data elements were reviewed and clarified, and procedures for data collection were described. To ensure consistency in data collection procedures and data integrity, information presented in the training program was incorporated into a hard-copy procedure manual given to each study coordinator. To further enhance data integrity, members of the research team reviewed all data and contacted study coordinators by phone, fax, or e-mail to resolve data discrepancies. Finally, all calculations, required for the measurement of selected variables, were completed in the research office to insure that the same formulae were used and any mathematical errors were corrected.

Data from each hospital were obtained during three rounds of data collections conducted over six consecutive months. The research model determined the temporal ordering of the data collected during each round, with information about context (characteristics of the external, hospital, and nursing unit environments) obtained during the first month of data collection, information about structure (unit capacity, work engagement, and work conditions) and safety climate obtained two months later, and finally, information about organizational effectiveness (needlesticks and back injuries) obtained three months later. To enhance response rates, we used Dillman's (1978) Total Design Method to emphasize the importance of participation to the success of the study. During each data collection round, staff nurses received a study questionnaire followed in two weeks by a duplicate questionnaire and a letter reminding them about the importance of participation. The duplicate questionnaire was followed in two weeks by a second reminder letter, which was followed in two weeks by a third reminder letter.

2.4 Measures

Organizational context and effectiveness were measured at the hospital or nursing unit level as appropriate. Organizational structure and safety climate were measured using data from self-administered questionnaires in which staff nurses responded to items referenced to the workgroup. These data were aggregated to represent measurement at the nursing unit level. Justification for data aggregation was based on values equal to or greater than .70 for the r_{wg} statistic, which estimates within-group agreement (James, Demaree, & Wolf; 1984;Lindell, Brandt, & Whitney, 1999). We also estimated the proportion of variance explained by group membership using the intraclass correlation coefficient or ICC(1) and mean rater reliability of the aggregated data using ICC(2). ICC(2) values of .70 or higher indicate adequate reliability (Bliese, 2000).

2.4.1 External environment—*Urban or rural status* was measured based on location in a Metropolitan Statistical Area (MSA) (i.e., > 50,000 population), with hospitals in an MSA classified as urban. *Managed care penetration* was measured as the percentage of total hospital discharges paid under an HMO managed care plan. *Geographic region* was measured using the American Hospital Association's nine census divisions.

2.4.2 Hospital environment—*Hospital size* was measured as the number of open and staffed beds. *Organizational life cycle* was measured using a five-category classification in which hospitals were labeled as "growers" if admissions increased 5% or more in two consecutive years; "decliners" if admissions decreased 5% or more in two consecutive years; "stable" if admissions did not increase or decrease more than 5% in two consecutive years; "unstable" if admissions increased or decreased more than 5% in only one of the two years; and, "highly unstable" if admissions increased or decreased more than 5% in the first year and decreased or increased more than 5% in the second year. *Teaching status* was measured as the ratio of medical and dental residents to the number of hospital beds. *Technological complexity* was measured using Medicare case mix index and the Saidin index, which is the weighted sum of the number of high technology services offered by a hospital. Because the Saidin index is weighted by the percentage of hospitals in the United States that do not offer the service, it increases more with the addition of technologies that are relatively rare (Spetz & Maiuro, 2004). *Magnet certification* was measured using a single item that asked if the hospital was currently certified by the American Nurses Credentialing Center for Excellence in Nursing.

2.4.3 Nursing unit environment—*Unit size* was measured as the number of beds available for occupancy. *Availability of support services* was measured using a checklist in which nurses rated 27 support services as not available, inconsistently available, or consistently available, with higher scores indicative of greater availability (Mark, 1992;Mark et al., 2003). *Patient acuity* was measured using a 14-item Likert-type questionnaire developed by Overton, Schneck and Hazlett (1977) and twice revised by Mark (Mark, 1992,Mark et al., 2004). Nurses were asked to estimate the proportion of patients on their unit who had complex problems (e.g., how many patients require the use of technical equipment, medications through central venous lines, or frequent monitoring). Items on this scale are anchored by five response options ranging from "a few (< 20%)" to "most (> 80%)" with higher scores indicative of higher patient acuity. *Work complexity* was measured using seven Likert-type items that asked nurses about the extent to which their unit was characterized by frequent interruptions or unanticipated events with higher scores indicative of greater work complexity (Salyer, 1996).

2.4.4 Organizational structure—*Unit capacity* was measured as a composite factor-summated variable based on proportion of RNs among the total nursing staff on the unit and proportion of RNs on the unit with, at minimum, educational preparation at the baccalaureate level.

Work engagement was measured as a composite factor-summated variable based on average RN tenure on the unit and aggregated scores on 16 items from the Nursing Expertise and Commitment to Care Scale (Minick, Dilorio, Mitchell, & Dudley, 2000). Nursing expertise was measured with eight items in which RNs rated the expertise of their nursing workgroup in terms of recognizing critical patient problems. Commitment to care was measured using another eight items that asked RNs to evaluate the ability of nurses on their unit to initiate actions independently in response to patient problems. A sample item from this scale is “Nurses on this unit act on the basis of their clinical understanding to get needed tests and/or implement immediate intervention when there is a decline in patient status.” Items are anchored to response options ranging from “strongly agree” to “strongly disagree,” with higher scores indicative of greater expertise and commitment to care.

Work conditions was measured as a composite factor-summated variable based on aggregated scores obtained using three instruments in which RNs rated the level of autonomy, participation in decision-making, and relational coordination in the nursing workgroup on their unit. Autonomy was measured with the 16-item Control over Nursing Practice Scale modified by Gerber (1990). This six-point Likert-type scale assesses the extent to which nurses feel free to engage in activities such as consulting with others about complex care problems, influencing standards of care, and acting on their own decisions related to care-giving. Higher scores on this scale indicate greater autonomy. Participation in decision-making was measured with a six-item, five-point summated rating scale asking RNs to rate the extent of nursing involvement in unit decisions (Mark & Hagenmueller, 1994). Higher scores indicate greater participation. Relational coordination was measured using the Relational Coordination Scale (Gittell et al., 2000). This five-point Likert-type scale asks RNs to rate the quality of collaboration between the nursing workgroup and other professional groups based on four communication (frequency, timeliness, accuracy, and problem-solving) and three relationship dimensions (shared goals, shared knowledge, and mutual respect). Higher scores indicate greater relational coordination.

2.4.5 Safety climate—Safety climate was measured using 25 items from Zohar’s (1980) measure of safety climate as revised by Mueller, DaSilva, Townsend and Tetrick (1999) and the Error Orientation Scale (Rybowiak, Garst, Frese, & Batinic, 1999). These scales focus on such safety climate dimensions as job duties that allow for safe performance, social standing, management’s attitude toward safety, employee willingness to reveal errors, degree of open communication about errors, and extent to which employees actively think about and diagnose the sources of errors. Items on this Likert-type scale are anchored by response options ranging from “strongly disagree” to “strongly agree,” with higher scores indicative of a stronger safety climate.

2.4.6 Organizational effectiveness—Organizational effectiveness was measured using the number of unit-level needlesticks or back injuries documented by incident report for six consecutive months. *Needlesticks* were defined as any break in the skin from a needle or sharp object used on a patient. *Back injuries* were defined as any musculoskeletal disorder of the back caused or made worse by the physical demands of the work of caring for patients.

2.5 Data analysis

The Mplus program was used for model testing. Parameter estimates for the structural equation model were obtained using three approaches. These approaches included multilevel modeling, identified as “complex” in the Mplus program, which computes standard errors and chi-square tests that account for the clustering of nursing units within hospitals. We also ran Poisson and zero-inflated Poisson models for count data. All approaches yielded similar results. In order to conduct post hoc tests for the interaction terms, we report results from the complex multilevel modeling. To facilitate interpretation of significant interactions and reduce potential problems due to multicollinearity between safety climate and unit capacity, and between work engagement and work conditions, these variables were centered (i.e., subtracted from their means). Consistent with the recommendation of Cohen, Cohen, West, and Aiken (2003) for plotting significant interactions between two continuous predictors, we used the mean for safety climate and one standard deviation above and below the mean to generate regression lines. Post hoc tests were used to determine whether the slope of the simple regression lines significantly differed from zero (Aiken & West, 1991).

3. Results

The full model we tested is illustrated in Figure 1. Descriptive statistics, alpha reliability estimates, and where appropriate, the ICC(1), ICC(2), and r_{wg} for the variables in the model are reported in Table 1. Parameter estimates for the structural equation model are provided in Table 2. We report our findings in three sections: results describing relationships between organizational context and structure, those between organizational structure and safety climate, and then, those between organizational structure and effectiveness, including the moderating effect of safety climate on the structure-effectiveness relationship.

3.1 Relationships between organizational context and structure

3.1.1 Unit capacity—Among characteristics of the external environment, urban or rural status and managed care penetration were significantly related to unit capacity. Hospitals in urban areas had higher levels of unit capacity than did hospitals in rural areas. Managed care penetration was significantly related to unit capacity, with higher levels of penetration associated with higher levels of unit capacity. The only region that had a significant relationship with unit capacity was the Pacific region, which had higher levels of unit capacity than did the reference region of the South Atlantic. Among characteristics of the hospital environment, teaching hospitals had higher levels of unit capacity than did nonteaching hospitals. In contrast, hospitals in a declining life cycle had lower levels of unit capacity than did stable hospitals. Hospital size, magnet certification, and technological complexity were not significantly related to unit capacity. Among nursing unit characteristics, greater work complexity was associated with lower levels of unit capacity. Remaining unit characteristics (support services availability, patient acuity, and size) were not significantly related to unit capacity. Overall, characteristics of the external, hospital, and nursing unit environments explained 36% of the variance in unit capacity.

3.1.2 Work engagement—Hospitals in the New England, Middle Atlantic, East North Central, and Pacific regions had significantly higher levels of work engagement than did those in the South Atlantic region. Urban or rural status and managed care penetration were not related to work engagement. Organizational life cycle was the only hospital characteristic significantly associated with work engagement. In comparison to hospitals in a “stable” life cycle, “highly unstable” hospitals had higher levels of work engagement. Remaining hospital characteristics (hospital size, magnet certification, teaching status, and technological complexity) were not related to work engagement. Among nursing unit characteristics, greater support services availability was associated with higher levels of work engagement, whereas greater work complexity was associated with lower levels of work engagement. Unit size and patient acuity were not related to work engagement. Overall, characteristics of the external, hospital, and nursing unit environments accounted for 23% of the variance in work engagement.

3.1.3 Work conditions—Urban or rural status and managed care penetration as characteristics of the external environment were not related to work conditions. Hospitals in the West South Central region, however, had significantly better work conditions than did those in the South Atlantic. Two characteristics of the hospital environment were significantly related to work conditions. Magnet certified hospitals had more positive work conditions than non-magnet hospitals, while hospitals labeled as "decliners" had poorer work conditions than "stable" hospitals. Hospital size was not related to work conditions. Findings for technological complexity, measured using case mix index and the Saidin index, were mixed. While hospitals with a higher case mix had better work conditions, values of the Saidin index were not related to work conditions. Finally, the unit characteristics of support services availability and work complexity were significantly related to work conditions, with greater availability of support services and lower work complexity associated with better work conditions. Approximately 31% of the variance in work conditions was explained by characteristics of the external, hospital, and nursing unit environments.

3.2 Relationships between organizational structure and safety climate

Safety climate was significantly related to work engagement and work condition, but not unit capacity. Hospitals with higher levels of work engagement and better work conditions had higher levels of safety climate. Approximately 57% of the variance in safety climate was explained by the structural variables in our model.

3.3 Relationships between organizational structure and effectiveness

3.3.1 Needlesticks—Unit capacity, work engagement, work conditions, and safety climate did not have a direct effect on needlesticks. However, safety climate interactions with both work engagement and work conditions were significantly related to needlesticks. As shown in Figure 2, at higher levels of safety climate, higher levels of work engagement were associated with fewer needlesticks ($\beta = -0.0798$, $t = -4.6301$, $p = 0.001$). In contrast, at lower levels of safety climate, higher levels of work engagement were associated with more needlesticks ($\beta = 0.0458$, $t = 2.4092$, $p = 0.017$). We found no relationship between work engagement and needlesticks at average levels of safety climate.

The interaction effect of safety climate on the relationship between work conditions and needlesticks is shown in Figure 3. At higher levels of safety climate, better work conditions were related to more needlesticks ($\beta = 0.0625$, $t = 2.9038$, $p = 0.004$). At lower levels of safety climate, however, better work conditions were related to fewer needlesticks ($\beta = -0.0505$, $t = -2.0235$, $p = 0.044$). As with work engagement, we found no relationship between work conditions and needlesticks at average levels of safety climate. Overall, 11% of the variance in needlesticks was explained by the structural variables in our model and the interaction effects of safety climate.

3.3.2 Back injuries—None of the structural variables in our model had a direct effect on back injuries. However, we found a significant relationship between safety climate and back injuries, with higher levels of safety climate associated with fewer back injuries. Additionally, we found that safety climate had a significant effect on the relationship between work conditions and back injuries as shown in Figure 4. At higher levels of safety climate, better work conditions were related to fewer back injuries ($\beta = -0.085$, $t = -1.9363$, $p = 0.05$), whereas at lower levels of safety climate, better work conditions were associated with more back injuries ($\beta = 0.123$, $t = 3.2988$, $p = 0.001$). Coefficients for this interaction are consistent with the pattern that Cohen et al. (2003) described as buffering, suggesting that a strong safety climate buffered the negative effect of poor work conditions on the number of back injuries. The relationship between work conditions and back injuries was not statistically significant at average levels of safety climate. Overall, 5.4% of the variance in back injuries was explained by the structural variables in our model and the interaction of safety climate with work conditions.

4. Discussion

Using structural contingency theory to guide variable specification, we tested a theoretical model in which organizational context (characteristics of the external, hospital, and nursing unit environments) was expected to predict structure (unit capacity, work engagement, and work conditions), which, in turn, was anticipated to predict effectiveness (needlesticks and back injuries). In addition, we thought safety climate would moderate the effect of structure on effectiveness.

4.1 Effect of organizational context on structure

We found significantly higher levels of unit capacity among urban hospitals, hospitals in the Pacific region, and hospitals in areas with greater managed care penetration, consistent with studies documenting that, in comparison to urban hospitals, rural hospitals have difficulty recruiting RNs outside their geographic area and employ more RNs prepared at the associate degree level (Fuszard, Slocum, & Wiggers, 1990;Newhouse, 2005). Our findings for managed care penetration are consistent with this explanation since hospital markets with higher penetration rates typically are located in urban rather than rural areas suggesting that nursing, like medicine, may be subject to geographical variation in practice, a research area unexplored in nursing.

The effect of the hospital environment on structure was limited, with organizational life cycle as the only characteristic significantly related to all three structural variables in the model. In comparison to "stable" hospitals, we found that "highly unstable" hospitals had higher levels of work engagement while "decliners" had lower levels of unit capacity and poorer work conditions. Short-term staffing adjustments, implemented in response to changes in the number of admissions, may contribute to the explanation of these findings. When admissions increase, hospitals increase staffing by imposing mandatory overtime and supplementing permanent staff with temporary or agency nurses. When admissions decrease, hospitals reduce staffing by redistributing nurses to other patient care areas and restricting the hours that full time nurses are scheduled to work, which may have negative implications for the delivery of quality patient care. Consequently, it is possible that, during a cycle of highly unstable admissions, nurses may more strongly voice their commitment to patient care. In contrast to the effect of admission instability on work engagement, we found that a decline in admissions had a negative effect on nursing unit structure in terms of unit capacity and work conditions. Contingency theorists argue that organizations use different approaches to human resource management depending on their life cycle stage. During periods of decline, for example, organizations tend to adopt a rational or control-oriented approach to personnel management in an effort to increase efficiency and minimize variability in job performance (Jackson, Schuler, & Rivero, 1989;Liao, 2006). Our finding that hospital "decliners" had poorer work conditions supports this argument.

In terms of other hospital characteristics, we found higher levels of unit capacity among teaching hospitals. Because most teaching hospitals are located in urban areas, this finding is consistent with the argument that urban hospitals are at an advantage in terms of recruiting both RNs in general and RNs prepared at the baccalaureate level. In addition, magnet hospitals had better work conditions than non-magnet hospitals. This finding is not surprising since evidence of work conditions that promote professional nursing practice is an essential criterion for magnet certification (Cimiotti et al., 2005;Havens & Aiken, 1999). In contrast, hospital size had no effect on structure. Finally, our findings with respect to the effect of technological complexity on structure were equivocal. We used both the case mix index and the Saidin index to measure technological complexity. While better work conditions were found among hospitals with a higher case mix index, values for the Saidin index were not associated with any of our structural variables. Although the Saidin index was developed to measure change in high technology services over time, we used it as a static measure, which may account for the inconsistency in our findings.

Characteristics of the nursing unit were of modest benefit in predicting unit-level structure. Both work complexity and support services availability had a direct effect on the structural variables in the model. Greater work complexity was associated with lower levels of unit capacity, lower levels of work engagement, and poorer work conditions. In contrast, greater availability of support services was associated with higher levels of work engagement and better work conditions. These findings have been similarly documented in other studies (Cimiotti et al., 2005;Choi, Bakken, Larson, Du, & Stone, 2004;Mark et al., 2003;McCusker, Dendukuri, Cardinal, Laplante, & Bambonye, 2004). Patient acuity and unit size, however, did not have a direct effect on structure because we limited the sample to medical-surgical units, and in so doing, restricted variability in patient acuity and unit size in our sample.

4.2 Effect of organizational structure and safety climate interactions on effectiveness

While previous researchers have documented a relationship between nurse staffing and work-related injuries (Clarke et al., 2002;Geiger-Brown et al., 2004;Trinkoff et al., in press), we found that unit capacity had no effect on the number of needlesticks or back injuries. Similarly, the interaction of safety climate with unit capacity did not predict these injuries. This may be because our measure of unit capacity did not capture information about the actual number of employees who participate in providing patient care. It may be that the physical- and time-related demands of the work, which have been consistently linked to work-related injuries, are influenced to a greater extent by the absolute number rather than the qualifications of the nurses on the unit. As such, measures that capture information about staffing levels, in addition to those that reflect the adequacy of staffing, may be important in explaining work-related injuries among nurses.

Like unit capacity, work engagement did not have a direct effect on needlesticks or back injuries. However, the interaction between work engagement and safety climate significantly predicted the number of needlesticks, with the combination of high work engagement and high safety climate predicting fewer needlesticks. In contrast, the combination of high levels of work engagement and low safety climate as well as the combination of high safety climate and low work engagement predicted more needlesticks. These findings support DeJoy's (1996) conceptualization of safety climate as a reinforcing variable that augments the effect of work setting factors that are conducive to safe work practices. For example, on units where safety is strongly emphasized, a highly engaged workgroup may be more proactive about providing feedback to co-workers who violate safety precautions and participating in the identification and resolution of work setting factors that jeopardize employee safety. It is also possible that a highly engaged workgroup fosters the development of a safety climate that is effective in reducing work-related injuries since highly engaged employees are more likely to take workplace safety seriously and comply voluntarily with safe work practices. In other words, when safety climate is effectively communicated as a strategic priority, a highly engaged workgroup may be more likely to enact safe work behaviors resulting in fewer needlesticks. However, when safety is not a strategic priority (i.e., low levels of safety climate), a highly engaged workgroup may focus on other priorities, such as responding to patient needs, and may cut safety corners to accomplish that priority, resulting in more needlesticks.

Like the other structural variables in our model, work conditions did not have a direct effect on needlesticks or back injuries. However, the interaction of work conditions with safety climate significantly predicted both of these work-related injuries. As expected, lower levels

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of safety climate along with poor work conditions were associated with more needlesticks. We also expected that fewer needlesticks would be reported for units with a strong safety climate and work conditions that promote professional nursing practice. In fact, we found the opposite -- with more rather than fewer needlesticks for these units. This finding fails to support the argument that a strong safety climate reinforces the positive effect of better work conditions on needlestick injuries. Nurses who have greater autonomy and more actively participate in unit decisions (dimensions that reflect better work conditions) may resist managerial initiatives that emphasize compliance with safety protocols, especially when such initiatives restrict nurses from using their own judgment to decide, based on the specific patient situation, when adherence to safe work practices is appropriate and when it is not. On the other hand, better work conditions in combination with lower levels of safety climate also predicted fewer needlesticks. There are two possible explanations for this finding. First, nurses who are accustomed to greater job autonomy may be more willing to participate voluntarily in safe work practices when the decision to do so is left to their own discretion. Second, positive work conditions in terms of greater autonomy and participation in decision-making have been linked in previous studies to fewer work-related injuries (DeJoy, Gershon et al., 2004;Parker et al., 2001;Shannon et al., 1997), leading researchers to argue that such work conditions enhance the ability of employees to appropriately respond to situations that might result in injury (Parker et al., 2001). Therefore, it is possible that nurses who work on units where autonomy is encouraged are better able to anticipate patients problems and, thus, avoid situations in which failure to adhere to safe work practices is thought to be justified.

Safety climate had an independent effect on back injuries, with fewer injuries reported for units characterized by a strong safety climate. In addition, the interaction between safety climate and work conditions was significantly related to the number of back injuries. At higher levels of safety climate, better work conditions were associated with fewer back injuries. This finding suggests that safety climate augmented the effect of better work conditions on back injuries, again supporting DeJoy's (1996) conceptualization of safety climate as a reinforcing variable. In contrast, at lower levels of safety climate, better work conditions were associated with more back injuries. Nurses who practice in settings that promote autonomy and participation in decision-making may be more proactive in terms of initiating actions that both promote patient comfort but also increase the risk of back injury. For example, some nurses are more willing than others to take the initiative in terms of repositioning or turning a patient at regular intervals even though such actions might put them at higher risk for a back injury. In settings where safety is not strongly emphasized, such nurses may give priority to performing such patient care actions even though adequate assistance and safe lifting devices may not be available.

Differences in the findings for needlesticks and back injuries may be explained by factors that substantively differentiate these work-related injuries. Unlike back injuries, needlesticks have been much more amenable to reduction through equipment redesign using passive technologies that function in the absence of user activation. Needleless systems for medication administration, for example, have been highly successful in preventing needlesticks precisely because their effectiveness does not depend on what the nurse does or does not do. In contrast, manual lifting is the most frequent cause of back injuries among nurses. While patient lifting devices can reduce the risk of injury, their effectiveness depends on the willingness of a nurse to expend the time and energy required to use them. Devices that reduce the risk of back injury are less readily accessible at the point of care than are devices that reduce the risk of needlesticks like needle guards, resheathing devices, and puncture-resistant disposal containers. Hospitals typically purchase only a few lifting devices that are stored in a central location for use by all nursing units. For this reason, nurses may decide that the obstacles associated with using a lifting device outweigh the benefit in terms of minimizing the risk of injury. Further, nurses are responsible for their own individual adherence to safe needle precautions while adherence to work practices that reduce the risk of back injury depends on the active participation of the entire workgroup. Such participation is needed because manual lifting is less likely to result in injury when a nurse has the assistance of at least one other person. Further, lifting devices typically require the assistance of at least two, if not more, people to insure that they are used safely and effectively. Finally, while nurses can avoid almost all needlesticks by adhering to safe needle precautions, the same can not be said for back injuries. Nurses can sustain a back injury even when they have followed safe lifting precautions and, in contrast, can ignore such precautions over a long period of time without obvious injury. These differences suggest that back injuries, to a greater extent than needlesticks, may be more amenable to reduction through exposure to a strong safety climate that is effective in promoting a voluntary change in employee safety-related attitudes and behaviors.

5. Conclusions and impact on industry

Our findings contribute to the occupational safety literature in several ways. While studies have investigated the independent effect as well as the mediating effect of safety climate on workplace safety, we found preliminary evidence that safety climate moderates the impact of structural attributes of the work unit on employee safety outcomes. Additional research is needed to more fully explain the structural conditions under which safety climate is effective in reducing employee injuries. Second, while managerial behaviors have been emphasized as critical to the development of a strong safety climate, less attention has been given to workgroup characteristics that foster a strong safety climate. Our findings suggest that workgroup attributes, such as work engagement, may be of critical importance in developing a strong safety climate. Thus, studies to examine the relative contributions of both managerial behaviors and structural characteristics of the work unit are certainly warranted. In addition, further studies are needed to identify additional workgroup attributes that provide the foundation upon which a strong safety climate is created. Third, employee safety outcomes typically have been studied by grouping all types of injury into a single global measure. For this reason, few studies have examined differences in the factors associated with employee safety outcomes according to injury type. Our findings indicate that organizational structure and safety climate may have differing effects on employee safety depending on the type of injury. As such, organizational approaches to injury reduction may depend on supplementing strategies that are effective in reducing all type of injury with strategies that are specifically targeted to a particular type of injury.

There are limitations to our study. While we used a national random sample of general, short-term, not for profit, acute care hospitals, thus enhancing the relevance and generalizability of our findings at the hospital level, we also limited the sample to medical-surgical nursing units, thus restricting the interpretation of our findings to other types of nursing units. Future research should attempt to include additional units, such as those offering different types of services (i.e., ambulatory surgery units) or nursing care intensity (intensive care). Second, the effectiveness variables in our study – needle sticks and back injuries – were measured using data from hospital incident reports, which may be less reliable than data collected through direct observation. However, the potentially serious sequelae associated with needlesticks and back injuries may make under-reporting less likely than it is with medication errors, for example. Nurses who work in settings that enact work conditions supportive of professional nursing practice may be less reluctant to report needlesticks and back injuries than are nurses who work in settings where employees perceive that they are not valued or supported. Some of our unexpected findings, therefore, may be more indicative of nurses' behavior in terms of adverse event reporting than their actual behavior in terms of adhering to safe medication administration and patient lifting practices.

Because our model predicted only a small amount of the variation between nursing units in our sample for needle stick injuries (11%) and back injuries (5.4%), in terms of clinical practice, it may be necessary to look at additional mechanisms to reduce these injuries. For example, in terms of back injuries, the American Nurses Association's *Handle With Care* campaign highlights three key points. These are that manual patient handling is unsafe and directly responsible for musculoskeletal injuries among nurses, that patient handling can be performed safely with the use of assistive equipment, and, finally, that reducing risk for back injuries among nurses contributes to improved quality of care for patients (diCastro, 2006). The campaign identifies characteristics of the patient, such as height, weight, body composition, and condition, as well as properties of the care environment, such as limited workspace due to the placement of hospital furniture and equipment and the presence of other staff and visitors as potentially contributing to back injury. These are important factors that need to be considered not only in future research on back injuries, but in the design of injury prevention programs as well. With regard to the prevention of errors, the Centers for Disease Control makes publicly available a step-by-step approach that hospitals can implement to develop a comprehensive, organization-wide sharps injury reduction program (CDC 2004). The steps include developing organizational capacity by creating an institution-wide program, establishing a multidisciplinary leadership team, and involving senior-level management; assessing program operation processes that include developing a culture of safety within the organization and implementing procedures for reporting and examining sharps injuries as well as careful selection and use of sharps injury prevention devices. Other activities include determining the institution's priorities for intervention, developing and implementing action plans, and monitoring performance improvement.

Thus, there are numerous administrative and management strategies that can be implemented to enhance employee safety on nursing units. These strategies must focus on creating a work setting in which unit-level nurse retention is encouraged and maintaining a well staffed nursing workforce that consists of nurses who are both committed to patient care and have a high level of nursing expertise. In addition, work conditions that foster nurses' autonomy and active participation in decision-making as well as support excellent cross-disciplinary collaborative relationships also can contribute to the development of a strong safety climate, which, in turn can contribute to improved safety for nurses.

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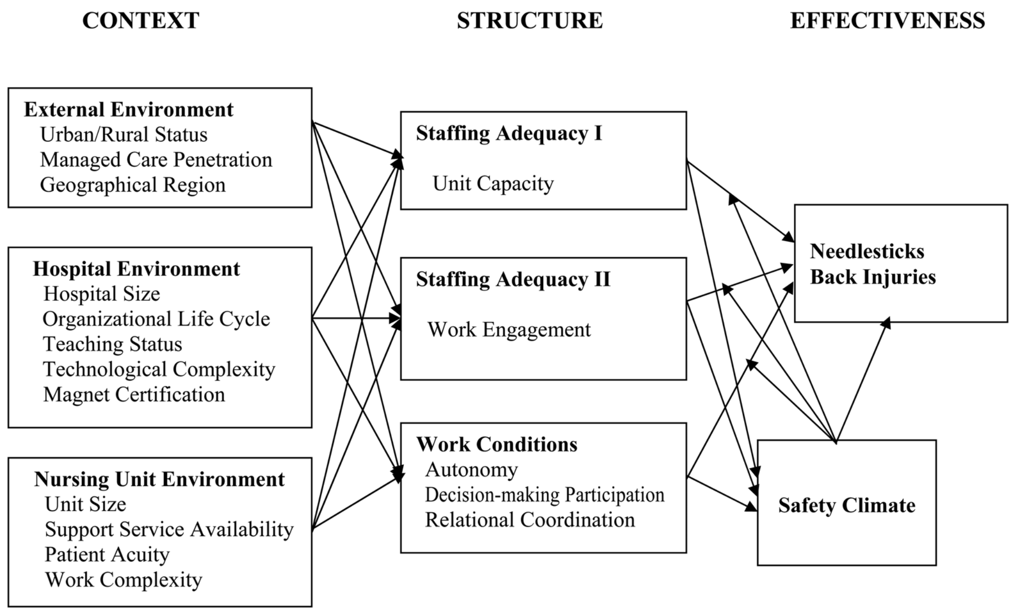

Figure 1.
Research Model

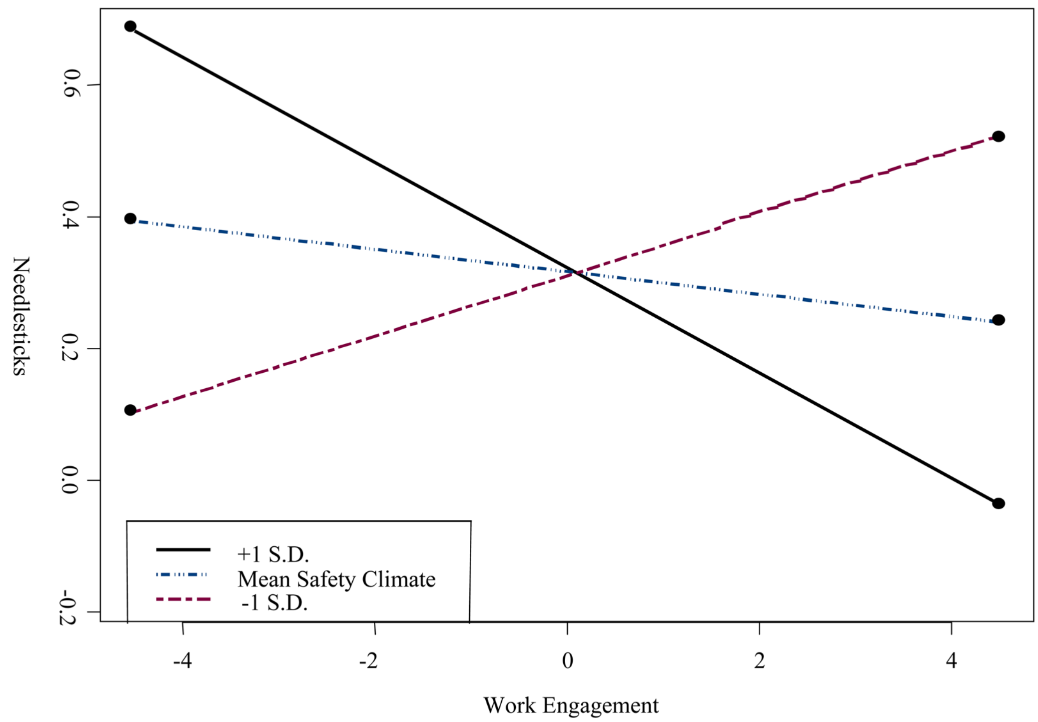

Figure 2.
Moderating Effect of Safety Climate on Work Engagement and Needlesticks

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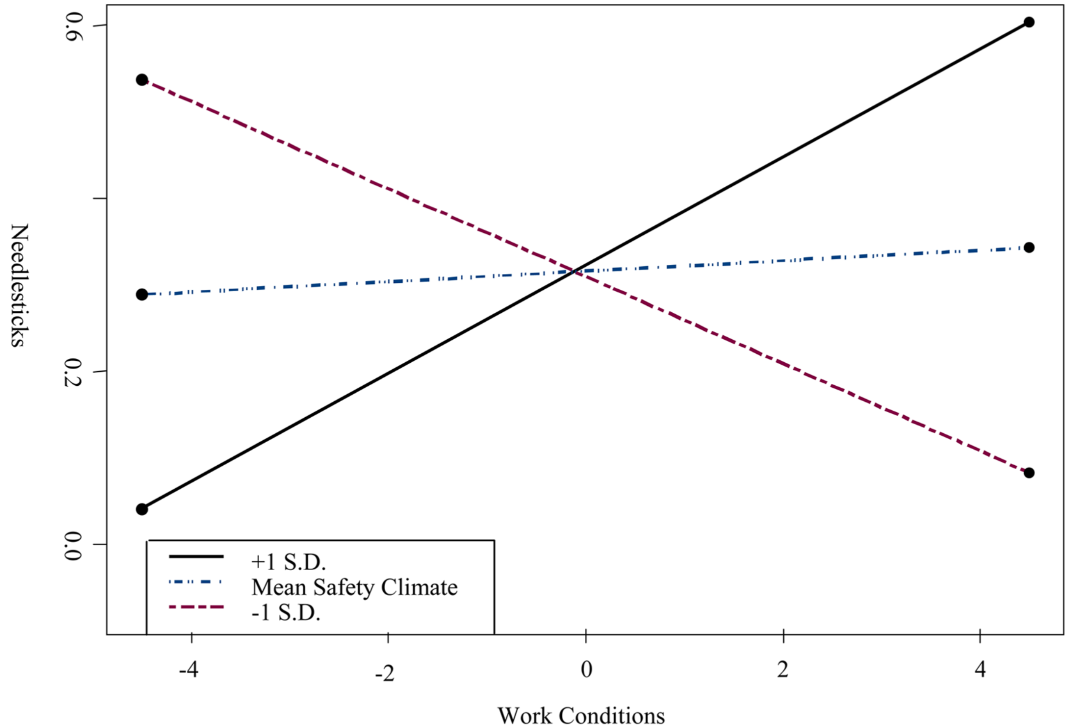

Figure 3.
Moderating Effect of Safety Climate on Work Conditions and Needlesticks

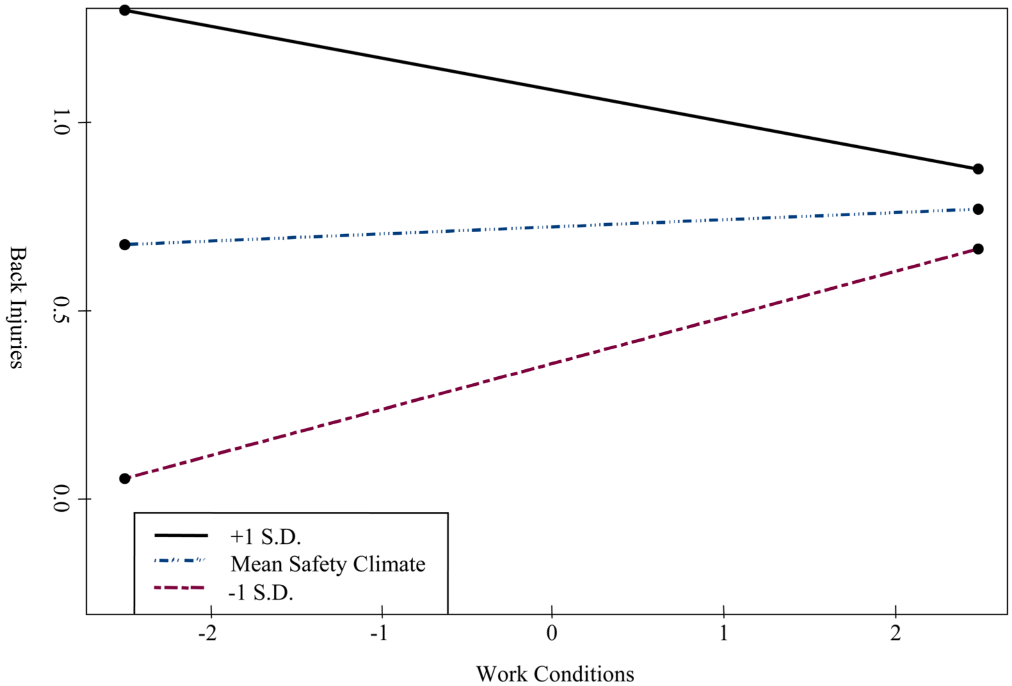

Figure 4.
Moderating Effect of Safety Climate on Work Conditions and Back Injuries

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Table 1

Descriptive Statistics and Reliability Estimates for Variables in the Model

Variables	Mean	SD	Alpha	ICC(1)	ICC(2)	Rwg
External Environment						
Urban/Rural Status	0.843	0.364				
Managed Care Penetration	19.809	15.629				
Geographic Region						
South Atlantic	0.295	0.457				
New England	0.043	0.203				
Middle Atlantic	0.089	0.285				
East North Central	0.185	0.389				
East South Central	0.103	0.305				
West North Central	0.114	0.318				
West South Central	0.071	0.258				
Mountain	0.057	0.232				
Pacific	0.043	0.203				
Hospital Environment						
Hospital Size	345.922	185.618				
Organizational Life Cycle						
Stable	0.577	0.495				
Growers	0.050	0.218				
Decliners	0.028	0.167				
Highly unstable	0.021	0.145				
Unstable	0.324	0.469				
Teaching Status	0.134	0.254				
Technology Complexity						
Case Mix Index	1.445	0.319				
Saidin.index	4.617	1.792				
Magnet Certification	0.132	0.339				
Nursing Unit Environment						
Unit Size	33.644	11.210	-	-	-	-
Support Services Availability	32.360	2.512	0.80	0.15	0.75	0.71
Patient Acuity	45.552	3.581	0.81	0.10	0.65	0.74
Work Complexity	26.819	3.499	0.85	0.14	0.74	0.69
Nursing Unit Structure						
Unit Capacity	0.015	1.556				
Work Engagement	−0.016	2.341				
RN Unit Tenure			-	-	-	-
Nursing Expertise			0.92	0.11	0.66	0.89
Commitment to Care			0.82	0.10	0.67	0.84
Work Conditions	−0.031	2.487				
Autonomy			0.92	0.25	0.81	0.87
Participation in Decision-Making			0.78	0.30	0.85	0.83
Relational Coordination			0.95	0.20	0.77	0.86
Safety Climate	90.587	6.289	0.95	0.35	0.88	0.81
Nursing Unit Effectiveness						
Needlesticks	0.772	1.311	-	-	-	-
Back Injuries	0.349	0.727	-	-	-	-

Table 2

Unstandardized Parameter Estimates and Standard Errors for Variables in Model

	Unit Capacity		Work Engagement		Work Conditions		Safety Climate		Needlesticks		Back Injuries	
	Estimate	**S.E**	**Estimate**	**S.E**	**Estimate**	**S.E**	**Estimate**	**S.E**	**Estimate**	**S.E**	**Estimate**	**S.E**
External Environment												
Urban/Rural Status	0.710 *	0.298	0.548	0.537	0.542	0.388						
Managed Care Penetration	0.016 *	0.005	−0.007	0.008	−0.006	0.011						
Geographic Region												
South Atlantic (reference)	--											
New England	0.265	0.458	1.471*	0.708	0.792	0.702						
Middle Atlantic	0.060	0.386	2.882*	0.569	0.841	0.557						
East North Central	0.227	0.249	1.387*	0.467	−0.042	0.363						
East South Central	−0.345	0.277	1.004	0.603	0.305	0.586						
West North Central	−0.082	0.302	0.734	0.516	−0.541	0.451						
West South Central	0.630	0.420	0.066	0.422	1.615*	0.410						
Mountain	0.241	0.411	−0.014	0.551	0.059	0.461						
Pacific	1.124 *	0.552	1.011*	0.504	−0.242	1.064						
Hospital Environment												
Hospital Size	0.001	0.001	0.001	0.001	0.001	0.001						
Organizational Life Cycle												
Stable (reference)												
Growers	0.340	0.398	−1.171	0.615	−0.670	0.446						
Decliner	−0.819 *	0.387	−0.661	0.351	−1.952*	0.779						
Highly unstable	−0.400	0.385	1.261*	0.623	−0.292	0.747						
Unstable	−0.251	0.194	0.141	0.345	−0.095	0.309						
Teaching Status	1.281 *	0.397	−0.251	0.548	−0.102	0.900						
Technological Complexity												
Case Mix	0.420	0.243	0.510	0.489	0.835*	0.368						
Saidin Index	0.070	0.066	−0.006	0.110	−0.091	0.103						
Magnet Certification	0.267	0.279	0.223	0.473	0.950*	0.410						
Nursing Unit Environment												
Unit Size	−0.006	0.007	−0.001	0.012	−0.001	0.011						
Support Services Availability	0.001	0.039	0.143*	0.061	0.206*	0.064						
Patient Acuity	0.008	0.019	0.008	0.035	0.027	0.038						
Work Complexity	−0.058 *	0.024	−0.117*	0.048	−0.224*	0.039						
Nursing Unit Structure												
Unit Capacity							−0.159	0.171	0.028	0.025	0.076	0.053
Work Engagement							0.430*	0.110	−0.017	0.013	−0.012	0.023
Work Conditions							1.751*	0.099	0.006	0.022	0.019	0.036
Safety Climate									0.000	0.009	−0.028 *	0.014
Moderating Effect												
Unit Capacity*Safety Climate									0.000	0.003	−0.007	0.006
									−0.010 *	0.002	−0.004	0.003
Work Engagement*Safety Climate												
									0.009 *	0.001	0.008 *	0.001
Work Conditions*Safety Climate												
Intercept	−0.837	1.621	−3.895	3.383	−3.312	2.948	0.097	0.242	0.316	0.045	0.723	0.094
R^2	0.359		0.227		0.313		0.571		0.113		0.054	