THESIS

AN INVESTIGATION OF THE DIFFERENTIAL EFFECTS OF LEADER BEHAVIORS ON EMPLOYEE SAFETY

Submitted by

Krista Hoffmeister

Department of Psychology

In partial fulfillment of the requirements

For the Degree of Master of Science

Colorado State University

Fort Collins, Colorado

Spring 2012

Master's Committee:

Advisor: Kurt Kraiger

John Rosecrance
Alyssa Gibbons
Kim Henry

ABSTRACT

AN INVESTIGATION OF THE DIFFERENTIAL EFFECTS OF LEADER BEHAVIORS ON EMPLOYEE SAFETY

Leadership is frequently associated with positive safety outcomes such as improved perceptions of safety climate, increased safety behaviors, and decreased accidents and injuries. However, this research has mainly focused on the influence of general leadership on these safety outcomes. The present study sought to break down transformational and transactional leadership into their individual behavioral components and examine their unique influences on employee safety outcomes. From a sample of construction pipefitters and plumbers, results showed that idealized influence frequently explained the most variance in the safety outcomes, while individualized consideration and active management-by-exception were explained the least. Implications for leadership training and development are discussed.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

Hazards exist in every work environment, ranging from environmental, to physical, and even psychological, all of which can cause acute and long-term injuries to employees in an organization (CDC, 2011). In addition to humanitarian and moral reasons, organizations are economically motivated to reduce workplace injuries, as there are substantive direct costs (e.g. medical costs), indirect costs (e.g. lost productivity, lost workdays), and costs to overall employee well-being (e.g. job satisfaction, occupational stress). To take charge in the prevention of workplace injuries, organizations have turned towards key predictors of safety such as leadership (e.g. Zohar, 2002a). Due to the influence they hold in an organization, leaders have a unique responsibility for promoting safety at work. Based on social learning theory, when leaders engage in specific safety-related behaviors, they encourage employees to also engage in those behaviors (Bandura, 1977). Using leaders as role models, organizations can maintain a competitive advantage in striving for a safe and healthy work environment by improving the organizational safety climate and increasing the number of employee safety behaviors, thereby reducing the number of injuries and accidents on the job (Barling, Loughlin, & Kelloway, 2002).

While research on the relationship between leadership and safety has progressed substantially over the last 30 years, the majority of studies have focused on the influence that general leadership or different *types* of leaders have on a variety of safety outcomes. For example, the effect that transformational leaders have on safety (Barling et al., 2002) or the influence of transactional and transformational leadership on employee safety behaviors (Conchie & Donald, 2009). This research is useful for determining the broad influence of leadership on safety; however, it is not enough to inform organizations on the relative importance of specific leader behaviors within these general leader types. Recent research conducted by Inness, Turner, Barling and

Stride (2010) found that transformational leadership may be too general to predict certain safety outcomes, and they suggest that future research should examine the individual effects of leader behaviors on safety. Essentially, by breaking leadership down into *specific behaviors*, we may be able to determine the relative importance, or the differential effects, of individual leader behaviors on safety outcomes.

Determining the specific behaviors that are most important for safety can have critical implications for leadership development. With the knowledge of which behaviors have the most influence on safety at work, training initiatives can be optimized such that the information and skills conveyed will result in the most effective outcomes (Kirkpatrick, 1998). By focusing training efforts on specific behaviors, individuals are more likely to apply what they learned on the job, leading to meaningful transfer of training (Kraiger, 2003). Many organizations have limited resources, it is important to determine which leader behaviors are most important in predicting safety at work so that resources can be directed towards training those specific behaviors.

As the research examining this avenue is limited, the present study systematically and empirically explored the differential effects of specific leader behaviors on employee safety outcomes. We have assessed the association of the six behaviors within transformational and transactional leadership (Bass, 1985) with safety climate, safety behaviors, injury, and pain. In the following sections, we will review the relevant literature on leadership, followed by a discussion of the theoretical and empirical links between leadership and safety. Lastly, we will discuss the limited research on the specific leader behaviors that influence employee safety outcomes, fueling the need for the present study.

Leadership: The First Component

Leadership researchers have progressed through a number of different stages focusing on traits, behaviors, and situations, although much of the research in recent years has focused on transformational and transactional leadership (Bass & Riggio, 2006). Based on Burns' (1978) original conceptualization, the transactional leader recognizes the needs of followers and the needs of the organization, and then conveys to followers what they must do to meet both of these. Transformational leaders recognize the needs of both the organization and followers, but also go beyond these to arouse and satisfy higher needs within each individual. To explain further, individuals may have separate interests (met by transactional leaders); however, there is potential for individuals to unite in the pursuit of higher goals aimed at significant positive change in an organization. Through transformational behaviors, leaders can provoke significant change through the joint efforts of followers. These transformational leaders "shape, alter, and elevate the motives and values and goals of followers" by teaching them that together they can see powerful revolutions in their organization (Burns, 1978, pg. 425).

Both transactional and transformational leadership styles are related to leader effectiveness, with the best leaders demonstrating both transformational and transactional behaviors (Avolio, 1999; Bass, 1985). Based on a meta-analysis of studies examining the effectiveness of transformational and transactional leadership, Judge and Piccolo (2004) found that both were uniquely influential in predicting follower job satisfaction, follower leader satisfaction, follower motivation, leader job performance, group and organization performance, and leader effectiveness. All of these outcomes have links to safety, suggesting that an investigation of both transformational and transactional leadership behaviors is important for the purpose of the present study.

The Link between Leadership and Safety

Leadership and Safety Climate. Through their actions, leaders provide employees with the necessary guidelines for how to act and interact with their work environment, particularly regarding workplace safety (Lewin, Lippitt, & White, 1939; Luria, 2008). These norms and guidelines combine to form a level of safety climate that permeates throughout the organization and gives employees an idea of the priority of safety at work. Safety climate can be defined as the level of employee perceptions regarding the way the organization values safety (Zohar, 1980). Empirical studies provide support for the importance of leadership in establishing the safety climate in an organization (e.g., Hofmann, Morgeson, & Gerras, 2003; Kozlowski & Doherty, 1989; Luria, Zohar, & Erev, 2008; Zohar, 2002b). More specifically, employees with transformational leaders report higher levels of safety climate in their organization (Hofmann & Morgeson, 2004). However, it is still unclear which specific leader behaviors are more important in creating a positive safety climate.

Leadership and Safety Behaviors. When leaders engage in specific behaviors, they do more than establish a positive safety climate. Employees that observe their leader behaving safely at work will be more likely themselves to behave in a safe manner with that leader as a role model (Hofmann & Morgeson, 2004). Employee safety behaviors can generally be characterized by two forms: safety compliance and safety participation (Griffin & Neal, 2000). Safety compliance refers to following safety policies and procedures and engaging in required safety behaviors, while safety participation is demonstrated by going beyond procedures to help coworkers, promote safety and its principles, taking initiative to be safe, and putting effort into improving safety at work (Neal, Griffin, & Hart, 2000). Together, safety compliance and safety participation provide a complete picture of the ways in which employees may behave safely at work.

Leaders may engage in many different behaviors, and whether an employee engages in safety participation and/or safety compliance is dependent on the leader behavior they are modeling. It is therefore important to distinguish between the two safety behaviors as they have implications for the differential effects of leader behaviors on employee safety outcomes. More specifically, it is possible that some leader behaviors influence employees to engage in safety compliance *or* safety participation, while other behaviors influence employees to engage in safety compliance *and* safety participation. Furthermore, some research suggests that safety compliance and safety participation may have differential effects on injuries and pain (e.g., DeArmond, Smith, Wilson, Chen, & Cigularov, 2011). With an understanding of how specific leader behaviors influence safety performance, organizations may adapt leader development strategies to optimize the effects on additional safety and health outcomes.

Leadership, Injuries, and Pain. Last, there is an important series of links between leader behaviors and decreased occupational injuries and pain. While not all factors that may cause acute or long term injuries and pain are within an employee's control (e.g. the environment or machinery), employees do have control over their own safety behaviors at work, and these behaviors are critical determinants of accidents and injuries on the job (Neal et al., 2000). In a recent meta-analysis, Nahrgang, Morgeson and Hofmann (2008) reported that safety prevention (i.e. safety compliance) and safety engagement (i.e. safety participation) had significant effects on work-related injuries. When leaders engage in safety-promoting behaviors, employees perceive a positive safety climate and engage in more safety behaviors themselves, thus avoiding more injuries and pain due to of an increased awareness and focus on safety (Griffin & Neal, 2000). Barling et al. (2002) successfully tested a fully mediated model wherein injuries were predicted by safety behaviors, safety behaviors were predicted by safety climate, and safety

climate was predicted by safety-specific transformational leadership. Studies by Kelloway, Mullen and Francis (2006) and Wu, Chen and Li (2008) provide similar support for this model. While this model is well-supported, the focus of this study is how leader behaviors may influence injuries and pain directly. All of the above-cited models found direct links between leadership and injuries; however, it is still unclear how specific leader behaviors directly influence injuries and pain.

The Link between Specific Leader Behaviors and Safety at Work

Using improved safety as a measure of leader effectiveness, transactional leaders promote safety by helping employees understand how organizational safety policies and procedures relate to their individual interest of protecting their well-being. Transformational leaders help employees combine their individual interests to promote overall organizational safety and influence higher goals such as an improved safety climate (e.g., Griffin & Neal, 2000; Hofmann & Morgeson, 2004). To explore the relationship between specific leader behaviors and employee safety behaviors in depth, we will review each dimension individually.

Transactional leadership. Transactional leaders understand the goals of the organization and the steps necessary to meet those goals, and then they clarify those steps for employees. These leaders convey to employees how fulfilling goals will meet their individual needs, and encourage satisfactory performance in order to be rewarded with fulfillment of these needs (Bass, 1985). Based on existing organizational policies and procedures designed to meet specific safety standards and safety-related goals in the organization, transactional leaders have the potential to influence safety by understanding these safety-related goals and relating them to the needs of employees. Transactional leadership consists of two facets: contingent-reward and active management-by-exception, both of which may have different routes of influencing safe behaviors.

Contingent reward. This component of transactional leadership refers to leaders rewarding followers in exchange for their efforts. Leaders practicing contingent reward use the goals put in place by the organization to help set individual goals with employees and clarify to employees what is needed to reach those goals. This component specifies that leaders will then reward employees if these goals are met, as well as notify them when they are on the correct path to meeting their goals, and what they can do to improve if necessary (Bass, 1985). Rewards may take many forms, such as pay or promotion, as well as praise or recognition.

In terms of safety, leaders practicing contingent reward will help employees understand organizational safety-related goals, keep them on the track towards meeting these goals, and reward them for engaging in safety behaviors that will help meet these goals. By providing rewards for specific safety-related behaviors, for example through recognition, promotion, increased salary, future job contracts, or job security, employees will continue to engage in those safety behaviors (Fogas, Meliá, & Silva, 2011; Siegrist, 2010). Therefore, it is plausible to assume that leaders that reward their employees for engaging in safe behaviors will encourage increased employee safety compliance.

Active management-by-exception. Active management-by-exception represents an active monitoring of employee performance to detect deviances in performance before they occur. In the context of safety, active management-by-exception can serve to detect deviances from safety standards and procedures (Bass & Riggio, 2006). Avoiding safety mistakes could prevent accidents and injuries from occurring in the workplace. For this reason, it is possible that leaders engaging in active management-by-exception will encourage safety compliance from employees.

In summary, the components of transactional leadership have the potential to influence safety compliance on behalf of employees. This presumption is based on the idea that making

sure employees follow policies will likely lead to an increase in compliance with safety policies; similarly, rewarding employees for specific behaviors will lead to an increase in those behaviors, but not necessarily other behaviors. For example, if an employee is going into a confined space where a hard hat may be uncomfortable, a transactional leader engaging in active management-by-exception will remind that employee to wear his hard hat, and a transactional leader engaging in contingent reward will reward a worker for wearing her hard hat in that confined space. On both occasions, those employees may be more likely to continue wearing their hard hats in confined spaces, but they may not encourage other workers to wear their hard hats as well, because it is not related to their individual goals. Therefore, it is possible that active management-by-exception and contingent reward will be related to safety compliance but not safety participation, suggesting that other leader behaviors (i.e. transformational behaviors) may have an increased differential effect on safety outcomes, more specifically, on safety compliance *and* safety participation.

Transformational leadership. While transactional leaders recognize the needs of employees by rewarding them and monitoring their performance, transformational leaders go beyond this by uniting employees in a common purpose of taking an active role in promoting organizational safety (Bass, 1985). Transformational leaders motivate their employees to do more than they thought they could by raising awareness regarding what they need to do to maximally perform for the organization (Bass, 1985). Transformational leadership consists of four dimensions: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration.

Idealized influence. Idealized influence is expressed in leaders through their attributes and behaviors, which invoke feelings of integrity, trust, and respect in followers. While there is

not one set of idealized attributes or idealized behaviors, several suggestions from leadership researchers include self-confidence, self-determination, charisma, being willing to take risks, consistency, having integrity, and high ethical or moral values (Bass, 1985; Bass & Riggio, 2006). These attributes and behaviors, among others, influence employees to have faith and respect in their leader, use them as role models, and, following from observational learning theory, begin adopting these same attributes and behaviors (Bandura, 1986).

Although there is no specific leadership research on the effects of idealized influence on safety behaviors, there is some evidence to suggest that attributes and behaviors representative of idealized influence (e.g. having integrity, being trustworthy) could influence employee health. In a study conducted by Dellve, Skagert, and Vilhelmsson (2007) with over 3,000 human service workers, employees that perceived their leaders as more trustworthy and stable took less sick days per year, even one year later. In another study of over 9,000 working individuals, employees reporting that their leaders showed integrity, trustworthiness, and sincerity also took fewer sick days (Nyberg, Westerlund, Hanson, & Theorell, 2008). While the number of sick days taken is not a direct measure of employee health or injury and illness, it is possible to extrapolate from these findings to link behaviors and attributes associated with idealized influence to a potential measure of the well-being of employees. However, the field of leadership lacks an investigation of the direct links between idealized influence, employee safety behaviors, and safety outcomes. Furthermore, there is no evidence to suggest what type of effect idealized influence would have on employees, for example whether it would influence employees to engage in safety compliance, safety participation, or both.

Inspirational motivation. Inspirational motivation reflects a leader's clear articulation of a compelling vision and motivating followers to work towards this mission, resulting in more

inspired followers (Bass, 1985). Leaders practicing inspirational motivation encourage employees with challenging goals, provide identification with organizational goals, and communicate how employees can rise to meet the organizational vision (Avolio, 1999; Bass & Riggio, 2006). Inspirational motivation could have a direct relationship with employee health; in a Swedish sample of over 5,000 workers, inspirational leadership was associated with fewer instances of employee sick leave (Nyberg et al., 2008). Similar to above, while fewer spells of sick leave is not a direct measure of employee health, it is possible to make the theoretical link between leaders' inspirational motivation and employee outcomes.

Inspirational motivation may also influence safety indirectly through a chain of relationships. Leader inspirational motivation can increase employee self-efficacy (Yukl & Van Fleet, 1992), and with this increased self-efficacy, employees may engage in more safety behaviors. In a study conducted by Brown, Willis, & Prussia (2000), employees with higher safety self-efficacy (belief in their ability to influence their own safety as well as the safety of the entire organization) engaged in more safe work behaviors. A closer examination of the measure used for safe work behaviors, which asks workers: "About what percent of the time do you follow all of the safety procedures for the jobs that you do?" reveals a focus on safety compliance. Therefore, through self-efficacy, inspirational motivation may increase employee safety compliance at work. Inspirational motivation could also influence safety participation. In a study of over 3,000 employees, Detert and Burris (2007) found that certain components of transformational leadership (inspirational motivation and individualized consideration) were important in influencing an employee's willingness to voice their opinions and be open about their thoughts. These results indicate that inspirational motivation may play a key role in motivating employees to speak up if they see something unsafe at work (safety participation). While these are only

indirect links, it is possible that leader inspirational motivation could have an important effect on an employee engaging in safety compliance *and* safety participation.

Intellectual stimulation. Intellectual stimulation reflects the extent to which a leader solicits followers' perspectives on problems and considers a wide variety of opinions in making decisions (Bass, 1985). Leaders engaging in this behavior stimulate employee efforts to question assumptions and beliefs, then to think outside the box and be creative in thinking of new solutions (Avolio, 1999; Bass & Riggio, 2006). Empirically, research on the relationship between intellectual stimulation and safety performance is lacking. However, it is possible to theorize that leader intellectual stimulation may only contribute to employee safety participation. Leaders that ask for new ideas and encourage innovation will convey to employees that their opinions are valued, and they may be more likely to generate unique and valuable solutions to safety issues in the workplace. Yet this does not mean that they will also be more likely to comply with safety procedures. Therefore, leader intellectual stimulation may be limited in its ability to influence both aspects of employee safety performance.

Individualized consideration. Leaders engaging in individualized consideration pay attention to the individual differences in the needs of their employees and seek to coach or mentor them in an effort help them reach their full potential (Avolio, 1999; Bass & Riggio, 2006). While the conceptual link between individualized consideration and safety is feasible, there is a lack of empirical evidence to support this claim. Similar to inspirational motivation, individualized consideration has an important influence on an employee expressing their opinions and being open to new ideas (Detert & Burris, 2007). Based on this result, it is possible that when leaders consider their employees individually, employees are more open to generating ideas and

solutions to safety-related problems (safety participation); however, it is not evident based on the current research whether individualized consideration would influence safety compliance.

To summarize, transformational leadership consists of idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Based on the limited evidence, it is possible to theorize that inspirational motivation may influence both safety compliance and safety participation, intellectual stimulation and individualized consideration may only influence safety participation, and idealized influence may influence both or neither of the two types of employee safety behaviors.

The present study sought to systematically investigate the leader behaviors that were most associated with employee safety outcomes. More specifically:

Research Question 1: What individual leader behaviors contribute the most to the overall explained variance in safety climate?

Research Question 2: What individual leader behaviors contribute the most to the overall explained variance in safety compliance?

Research Question 3: What individual leader behaviors contribute the most to the overall explained variance in safety participation?

Research Question 4: What individual leader behaviors contribute the most to the overall explained variance in work-related injury?

Research Question 5: What individual leader behaviors contribute the most to the overall explained variance in work-related pain?

CHAPTER 2: METHODS

Participants and Procedure

Following Dillman's (2000) survey methodology, the research team and the partnering organizations in this study jointly announced the project to their members and encouraged participation. In total, surveys were distributed to 2,877 mechanical construction workers from five organizations in three different regions of the United States. Data were coded by organization rather than region. Broken down by role, 1,090 apprentices were recruited (870 completed; 80% response rate) along with 1,787 journeymen (658 returned; 37% response rate), with a total of 1,548 responses and an overall response rate of 53%. The demographics of the sample were representative of the mechanical construction industry, with mostly Caucasian (80.4%) males (96.8%) at an average age of 35. Participants had been working with their current supervisor for an average of 3 years.

The sample was 56% apprentices and 44% journeymen, which is unlike the general construction population, which tends to be around 75% journeymen. The differing response rates among apprentices and journeymen suggest that recruitment methods could have contributed to this discrepancy. The response rate for apprentices was 80%, while the response rate for journeymen was only 37%. All apprentices in all regions were enrolled in training classes at their respective union, and these individuals were recruited during their classes. Journeymen are not required to take classes (because they have already taken them), and thus the strategy was to distribute surveys to the membership through a mailing. Surveys were mailed to the journeymen membership list in one region; however, only 29% of surveys were returned. The researchers desired an even higher response rate, and so the procedures for the additional regions were modified. Journeymen in the other two regions had the opportunity to enroll in code classes designed

to update their training and skills, and while not all journeymen signed up for these classes, surveying those that did attend was thought to be a better strategy than using the resources to mail to everyone. The response rates for the other two regions were a large improvement over the initial response rates for journeymen (69% and 86%), and the overall response rate for the study was 53%.

Measures

Leadership. A shortened version of the Multi-Factor Leadership Questionnaire (MLQ) was used to measure leadership. The MLQ was originally developed by Bass (1985), and has since been revised and developed into what is now the MLQ5X (Avolio & Bass, 2004). Twenty items measuring transformational leadership were included in the survey: Idealized influence (8 items; Cronbach's α=.90 for this study; e.g. "My current, immediate supervisor instills pride in me for being associated with him"), inspirational motivation (4 items; α=.90; e.g. "My current, immediate supervisor articulates a compelling vision of the future"), intellectual stimulation (4 items; α=.91; e.g. "My current, immediate supervisor gets me to look at problems from many different angles"), individualized consideration (4 items; α=.89; e.g. "My current, immediate supervisor treats me as an individual rather than just as a member of a group"). Eight items measuring transactional leadership were included: Contingent reward (4 items; α=.89; e.g. My current, immediate supervisor makes clear what one can expect to receive when performance goals are achieved"), and active management-by-exception (4 items; α=.86; e.g. "My current, immediate supervisor concentrates his full attention on dealing with mistakes, complaints, and failures"). Individuals were asked to rate how often their current, immediate supervisor engaged in the given behavior on a 5-point scale ranging from 1 (not at all) to 5 (frequently, if not always).

Safety Outcomes. Safety outcomes in the present study were measured by examining employee perceptions of safety climate, self-reported safety behaviors (compliance and participation), and employee self-reported work-related pain and injury. All safety outcome measures used in this study are provided in Appendix A.

While safety climate is a multidimensional construct that has been measured with multiple instruments (e.g., Clarke, 2006; Neal & Griffin, 2006; Neal et al., 2000; Zohar & Luria, 2003), a common theme among the majority of measures is a focus on supervisor support and safety communication. Using research conducted by Neal and colleagues (Neal & Griffin, 2004, 2006; Neal et al., 2000) as a guide, supervisor support and safety communication were measured to represent safety climate in the present study. Supervisor support refers to the extent to which employees "perceive their supervisor to place a high priority on safety, respond to safety concerns, and provide support and encouragement for subordinates who comply with safety procedures and participate in safety activities" (Neal & Griffin, 2006; pg. 27). An example item for supervisor support is: "My current, immediate supervisor places a strong emphasis on workplace health and safety." Safety communication refers to "employee perceptions regarding the openness of communication between the supervisor and employees and the input sought from employees by the supervisor on safety and health issues at work" (pg. 27). An example item for safety communication is: "My current, immediate supervisor gives us sufficient opportunity to discuss and deal with safety issues in meetings." Supervisor support and safety communication were measured with three items each, forming a six-item scale of safety climate (α=.93). Participants were asked to rate to what extent they agreed with the statements from 1 (strongly disagree) to 5 (strongly agree).

Based on Neal and Griffin's (2006) definition of safety behaviors consisting of safety compliance and safety participation. Three items were used to measure safety compliance (e.g. "I use the correct safety procedures for carrying out my job"; α=.89), and three items were used to measure safety participation (e.g. "I voluntarily carry out tasks or activities that help to improve workplace safety"; α=.84). Participants were asked to rate to what extent they agreed with the statements from 1 (strongly disagree) to 5 (strongly agree).

Injury and pain at work were assessed with similar 6-item measures developed specifically for this study. Participants were first asked "Have you had an injury at work (e.g. cut, burn, sprain, etc.) in the past two months," and responded yes (scored as 1) or no (scored as 0). If the participant answered yes, they were instructed to continue to the next five questions. These five questions were used as indicators of the number of injuries with different severities. For example, "How often in the past two months did you have an injury at work and treated it at home (e.g. put a bandage on it)?", or "How often in the past two months did you have an injury at work and sought medical attention and also had to miss work?" Participants were asked to report the frequency on a 0 to 5+ scale. These questions attempted to address both frequency and severity of injuries; however, the items should not load on a single latent construct and were therefore scored individually. To explain further, if an individual said that they always had an injury at work and treated it at home, it was not expected that they would also respond that they always had an injury at work for which they sought medical attention and for which they missed work. Scoring these questions individually resulted in five different continuous items and one binary item to measure injury at work.

Work-related pain was assessed with a similar measure and scale, with minor changes in wording to reflect the different outcome. Participants were asked if they had experienced "any

work-related pain (e.g. back, shoulder, wrist pain, etc.) in the past two months" and responded yes (scored as 1) or no (scored as 0). The following five questions were identical to those used to measure injury, except that examples focused on pain-related symptoms rather than on injuries (e.g. took a painkiller). In addition, as pain is difficult to define as occurring "once" or "twice," the scale participants used to rate their pain for each question ranged from 1 (Never) to 6 (All the time). Similar to the injury scale, pain was scored as one binary item and five separate continuous items.

Data Analysis

Pearson *r* correlations were run among all variables, and then regression analyses were used to assess the overall relationship between the leadership variables and safety outcomes. While regression is a useful technique, limitations have been noted in its ability to accurately report the contributions of predictors that are highly correlated to each other (Johnson, 2000). High multicollinearity between predictor variables can cause serious modeling issues, resulting in regression coefficients that both under and overestimate the influence of individual predictors depending on the degree of relatedness. As it is well known that the individual factors within transformational and transactional leadership are highly correlated (e.g., Bass, 1985; Bass & Riggio, 2006), it is necessary to use another method of analysis to determine the distinct contribution of each individual leader behavior to the safety outcomes.

One method of overcoming the problem of multicollinearity is relative weights analysis. In a series of steps, relative weights analysis creates a set of orthogonal (i.e. uncorrelated) factors that are as close as possible to the original predictors, and then regresses these new predictors on the desired outcome. These new regression weights can then be rescaled back to the original values to produce an estimate of the relative importance for each original predictor variable

(LeBreton & Tonidandel, 2008). This produces a set of weights that can uniquely inform the researcher of the relative importance of each predictor. The raw weights can then be converted into relative importance percentages, which represent the unique contribution of each weight to the overall R^2. Even with this procedure, the "true" relative weight will still be unknown, and regression results will always have some ambiguity when the predictors are correlated. However, the results of this approach do overcome some limitations and difficulties with other methods of analysis (Johnson, 2000). For this study, multiple relative weights analyses were run to examine each outcome separately and provide results in terms of the isolated differential effects of leader behaviors on individual safety outcomes.

In order to determine the significance of relative weights, a procedure was used test whether each relative weight was significantly associated with the outcome in question (Tonidandel, LeBreton, & Johnson, 2009). This procedure is similar to testing the null hypothesis; however, because sample-based relative weights cannot practically equal zero, the relative weight is tested against a random variable that should not contribute unique variance to the criterion. To explain further, "zero is only a possible value if the correlations between a variable and all others is exactly zero, and because sampling error almost always yields non-zero correlations" (Tonidandel et al., 2009, p. 391). In addition, because relative weights are proportions, they can never be negative, meaning that the confidence interval around a relative weight will never include zero. Because of this, in order to test the significance of an individual weight, researchers have suggested that each weight be compared against a random variable entered into the regression equation. If an individual relative weight is significantly different from the relative weight of the randomly generated variable, the null hypothesis can be rejected. This procedure was used to determine if the relative weights were statistically significant.

CHAPTER 3: RESULTS

Before any formal analyses were run, data were checked for inconsistencies and outliers. Cases were inspected based on various indicators of their influence compared to the rest of the data. First, leverage values were calculated, which take into account how much a case influences the overall model; any case that exceeded the commonly used 2(p/n) standard was flagged as an outlier, where p is the number of predictors and n is the sample size. The studentized deleted residuals, which take into account how many standard deviations bigger a certain residual is compared to the average, were calculated next. If these values exceeded the common standard of two standard deviations, they were flagged as outliers. The next few indicators were used to determine if outliers were influential. DFFIT values were used to determine how influential a case was in predicting its own values, and if the value was above the standard of $2\sqrt{(p/n)}$, it was flagged as influential. Last, Cook's distances were also used to examine how influential a case was in predicting overall values, and if they exceeded 4/n, they were flagged as influential. Cases that were consistently flagged as outliers and influential data points were deleted from further analyses. After these deletions, the final usable data set consisted of 1,510 cases that did not significantly differ in age, gender, ethnicity, role, or time working with supervisor than the full set of data.

Preliminary Analyses

Descriptive statistics, intercorrelations, and Cronbach's alphas for key variables are reported in Table 1. Levels of leadership reported were slightly higher than the scale midpoint (i.e. 2.5) (M=3.20 to 3.60, SD=1.02 to 1.12), as were levels of safety climate (M=3.98, SD=.85), safety compliance (M=4.17, SD=.67), and safety participation (M=3.91, SD=.73). Overall, 21.8% of individuals reported having an injury in the past two months, and 40.4% of individuals

Table 1. Means, Standard Deviations, and Correlations of Key Variables

	M	SD	1	2	3	4	5	6	7	8
Age	35.31	12.30	--							
Gender	--	--	.01	--						
Time with Supervisor (Months)	36.01	61.11	.42*	-.04	--					
Role	--	--	.71*	-.02	.23*	--				
Organization 2	--	--	.16*	.01	.02	.14*	--			
Organization 3	--	--	.26*	.02	.11*	.24*	-.15*	--		
Organization 4	--	--	.11*	.03	.06	-.01	-.15*	-.24*	--	
Organization 5	--	--	-.01	-.01	-.03*	-.08*	-.00	-.05*	-.05	--
Idealized Influence	3.60	1.02	.00	.04	.04	.01	.01	.11*	-.01	.06
Inspirational Motivation	3.54	1.07	-.03	.03	.01	-.01	-.02	.10*	.00	.07*
Intellectual Stimulation	3.63	1.07	-.09*	.02	-.01	-.06	-.02	.03	.01	.05
Individualized Consideration	3.54	1.12	-.10*	.05	-.02	-.08*	.01	.04	.03	.06
Contingent Reward	3.44	1.08	-.08*	.06	-.02	-.05	-.00	.05	.00	.07
Active Management-by-exception	3.20	1.07	-.14*	-.02	-.01	-.10*	-.06	-.05	-.03	.10*
Safety Compliance	4.17	0.67	.15*	.02	.04	.17*	.04	.11*	.02	.05
Safety Participation	3.91	0.73	.24*	-.02	.14*	.25*	.07*	.16*	.03*	.07*
Safety Climate	3.98	0.85	.06	.03	.07*	.06*	.03	.11*	.03	.09*
Injury	0.22	0.41	-.20*	.03	-.08*	-.19*	-.04*	-.12*	-.01	-.06*
Pain	0.40	0.49	-.06	.02	-.03	-.09*	-.04	-.06*	.04	-.04

Note. For Gender, Male=1, Female=2. For Role, Apprentice=1, Journeyman=2. Organizations 2 – 5 are dummy variables, with Organization 1 as the reference group. For Injury and Pain, 0=No, 1=Yes.
*$p < .05$.

Table 1 Continued. Means, Standard Deviations, and Correlations of Key Variables

	9	10	11	12	13	14	15	16	17	18	19
Age											
Gender											
Time with Supervisor											
Role											
Organization 2											
Organization 3											
Organization 4											
Organization 5											
Idealized Influence	(.93)										
Inspirational Motivation	.83*	(.91)									
Intellectual Stimulation	.80*	.78*	(.91)								
Individualized Consideration	.79*	.72*	.79*	(.89)							
Contingent Reward	.81*	.78*	.79*	.83*	(.89)						
Active Management-by-exception	.35*	.37*	.31*	.29*	.37*	(.85)					
Safety Compliance	.37*	.32*	.31*	.24*	.30*	.16*	(.86)				
Safety Participation	.37*	.33*	.28*	.24*	.29*	.17*	.55*	(.81)			
Safety Climate	.62*	.55*	.56*	.51*	.55*	.20*	.52*	.45*	(.93)		
Injury	-.14*	-.14*	-.09*	-.07*	-.11*	-.07*	-.24*	-.16*	-.18*	--	
Pain	-.21*	-.21*	-.19*	-.18*	-.19*	-.15*	-.16*	-.10*	-.17*	.23*	--

Note. For Gender, Male=1, Female=2. For Role, Apprentice=1, Journeyman=2. Organizations 2 – 5 are dummy variables, with Organization 1 as the reference group. For Injury and Pain, 0=No, 1=Yes.
*$p < .05$.

reported having experienced pain the past two months. Correlations between leadership variables and safety outcomes were all significant and in expected directions (i.e. positively related to safety climate and safety behaviors; negatively related to injury and pain). Also as expected, intercorrelations among leadership variables were high (average r = .80), besides correlations with active management-by-exception (average r = .38). An examination of the scaled injury and pain variables revealed that the single-item continuous variables had both low means and high standard deviations. These variables were generally unrelated to leadership or other safety variables, perhaps as a consequence of their distributions. Therefore, only the binary items for injury and pain were included in the remainder of analyses.

Four of the descriptive variables, age, time with supervisor, role, and organization had significant correlations with leadership and safety variables. After an examination of these variables in regression equations, it was determined that when controlling for role, both age and time with supervisor were no longer significantly associated with the leadership or safety variables. Therefore, only role and organization were included in further analyses as covariates. While an examination of the correlations is not the main purpose of this paper, they are useful in highlighting the directionality of relationships with descriptive variables. More specifically, journeymen reported significantly less individualized consideration and active management-by-exception from their leaders than did apprentices. However, journeymen also reported higher levels of safety climate, more safety behaviors, fewer injuries, and less pain than did apprentices.

Because the "organization" variable was categorical with five categories, four dummy variables were created for entry into further analyses, labeled Organizations 2 – 5 (with Organization 1 as the reference group). As reported in the correlation table as well as in further analyses, membership in specific organizations often had main effects in the prediction of leadership

behaviors and safety outcomes. The details of these effects are reported in Table 2. While these relationships were significant, the effect sizes were small and lacked practical significance. However, in order to account for their effects, they were included as covariates in all further analyses.

Analysis of Research Questions

To examine the research questions, multiple linear regression and relative weights analyses were run to predict safety climate, safety compliance, and safety participation. Results of these analyses are presented in Tables 3 and 4.When safety climate was the dependent variable, the overall regression model was statistically significant ($F(11, 1331)=87.52$, $p<.001$, $R2=.42$). The covariates and leadership variables accounted for 42% of the variance in safety climate. Next, a relative weights analysis was run to examine the unique effects of each of the predictors. Since the raw weights were very small, an easier way to interpret the weights was by looking at their relative importance (RI). The relative importance of each weight is expressed as a percentage, which represents its unique contribution to the overall R2. The confidence intervals around these weights suggested that all of the leadership variables contributed significantly to the overall variance in safety climate. Idealized influence contributed the most to the variance explained in safety climate (RI=27%), followed by intellectual stimulation (19%), contingent reward (17%), inspirational motivation (16%), individualized consideration (13%), and finally active management-by-exception (2%). Role and membership in the organizations did not contribute significant unique variance to the safety climate model.

An identical multiple linear regression model was specified with safety compliance as the outcome; this model was also significant ($F(11, 1350)=24.92$, $p<.001$, $R2=.16$). Idealized influence contributed the most to the variance explained in safety compliance (24%), followed by role

Table 2. Means and Standard Deviations of Leadership and Safety Variables by Organization

	Organization 1[a]	Organization 2	Organization 3	Organization 4	Organization 5
Idealized Influence	3.63 (.98)	3.76 (1.03)	3.59 (.99)	3.51 (1.02)	4.26 (1.01)
Inspirational Motivation	3.44 (1.07)	3.69 (1.09)	3.55 (1.02)	3.48 (1.09)	4.32 (.86)
Intellectual Stimulation	3.52 (1.16)	3.67 (1.11)	3.59 (1.03)	3.63 (1.06)	4.29 (.94)
Individualized Consideration	3.56 (1.13)	3.58 (1.16)	3.56 (1.08)	3.49 (1.12)	4.29 (1.06)
Contingent Reward	3.42 (1.09)	3.51 (1.12)	3.44 (1.03)	3.40 (1.09)	4.32 (.93)
Active Management-by-Exception	3.06 (1.05)	3.09 (1.10)	3.10 (1.09)	3.30 (1.03)	4.29 (.96)
Safety Climate	4.04 (.80)	4.12 (.83)	4.03* (.75)	3.88* (.90)	4.69* (.43)
Safety Compliance	4.26 (.52)	4.28 (.65)	4.23 (.63)	4.08 (.73)	4.37 (.46)
Safety Participation	4.06 (.58)	4.10* (.72)	3.98* (.68)	3.76* (.76)	4.37* (.50)
Injury	.15 (.36)	.15 (.35)	.19* (.39)	.28 (.45)	.06 (.24)
Pain	.32 (.47)	.38 (.49)	.43 (.50)	.43 (.50)	.28 (.46)

Note. Standard deviations are reported in parentheses.

[a] As Organization 1 was the reference group, main effects were not calculated.

* $p<.05$ for a significant main effect

Table 3. Regression Results for Safety Climate and Safety Behaviors

	Safety Climate		Safety Compliance		Safety Participation	
	Unstandardized Coefficient (SE)	95% Confidence Interval	Unstandardized Coefficient (SE)	95% Confidence Interval	Unstandardized Coefficient (SE)	95% Confidence Interval
Constant	3.76* (.19)	3.39 – 4.12	2.95* (.09)	2.78 – 3.12	2.37* (.09)	2.19 – 2.56
Role	.24* (.08)	.09 – .39	.22* (.04)	.15 – .29	.35* (.04)	.27 – .42
Organization 2	.21 (.13)	-.04 – .46	.10 (.06)	-.02 – .21	.14* (.06)	.01 – .26
Organization 3	.25* (.10)	.06 – .45	.08 (.05)	-.01 – .17	.18* (.05)	.09 – .28
Organization 4	.20* (.09)	.02 – .38	.08 (.04)	-.01 – .16	.13* (.05)	.04 – .22
Organization 5	.90* (.33)	.26 – 1.54	.12 (.15)	-.18 – .41	.45* (.16)	.13 – .78
Idealized Influence	.75* (.08)	.60 – .91	.21* (.04)	.13 – .28	.22* (.04)	.14 – .30
Inspirational Motivation	-.03 (.07)	-.16 – .10	.01 (.03)	-.05 – .07	.04 (.03)	-.03 – .10
Intellectual Stimulation	.29* (.07)	.15 – .42	.06 (.03)	-.00 – .12	.02 (.03)	-.04 – .09
Individualized Consideration	-.14* (.07)	-.27 – -.01	-.13* (.03)	-.19 –-.07	-.08* (.03)	-.14 – -.01
Contingent Reward	.22* (.07)	.08 – .36	.07 (.03)	.00 – .13	.03 (.04)	-.04 – .10
Active Management-by-Exception	-.04 (.04)	-.12 – .03	.03 (.02)	-.01 – .06	.04* (.02)	.01 – .08
R-squared	.420		.169		.213	
Adjusted R-squared	.415		.162		.207	
No. observations	1,343		1362		1348	

Table 4. Relative Weights Reflecting the Relative Importance of Dimensions of Leadership in Predicting Safety Climate and Safety Behaviors

	Safety Climate				Safety Compliance				Safety Participation			
	β	RW	95% CI	RI (%)	β	RW	95% CI	RI (%)	β	RW	95% CI	RI (%)
Control Variables												
Role	.24*	.01	.00 – .01	1.44	.17*	.03*	.02 – .05	18.09	.24*	.06*	.04 – .09	28.93
Organization 2	.21	.00	-.00 – .01	.29	.04	.00	-.00 – .01	1.19	.06*	.00	-.00 – .01	1.59
Organization 3	.25*	.01	.00 – .01	1.41	.05	.00	-.00 – .01	2.8	.10*	.01	.00 – .03	6.87
Organization 4	.20*	.00	-.00 – .01	.30	.05	.00	-.00 – .01	.82	.07*	.00	-.00 – .01	1.42
Organization 5	.90*	.00	.00 – .01	1.04	.02	.00	-.00 – .00	.00	.07*	.00	-.00 – .01	1.86
Predictor Variables												
Idealized Influence	.75*	.12*	.10 – .13	27.44	.32*	.04*	.03 – .06	23.86	.31*	.04*	.03 – .06	19.03
Inspirational Motivation	-.03	.07*	.06 – .08	15.96	.02	.02*	.02 – .04	14.21	.05	.03*	.02 – .04	12.07
Intellectual Stimulation	.29*	.08*	.07 – .10	19.14	.10	.02*	.01 – .03	13.35	.03	.02*	.01 – .03	8.72
Individualized Consideration	-.14*	.06*	.05 – .07	13.46	-.21*	.01*	.01 – .02	7.50	-.12*	.01*	.01 – .02	5.98
Contingent Reward	.22*	.07*	.06 – .09	17.28	.11	.02*	.01 – .03	12.72	.05	.02*	.01 – .03	8.63
Active Management-by-exception	-.04	.01*	.00 – .02	2.24	.05	.01	.00 – .02	5.16	.06*	.01	.00 – .02	4.91
Total Model R^2	.42				.17				.21			

Note. B=Regression Coefficient, RW=Relative Weight, SE=Standard Error, RI=Relative Importance, as a percentage of total R^2, CI= Experimental confidence interval around the relative weight, representing the 2.5 percentile and the 97.5 percentile. For Role, Apprentice=1, Journeyman=2. Organizations 2 – 5 are dummy variables, with Organization 1 as the reference group.
*p< .05.

(18%), inspirational motivation (14%), intellectual stimulation (13%), contingent reward (13%), and individualized consideration (8%). Membership in the different organizations and active management-by-exception did not explain significant unique variance in safety compliance.

One last multiple linear regression model was specified for safety participation. This model was again significant ($F(11, 1336)=32.90$, $p<.001$, $R2=.21$) and the combined variables accounted for 21% of the variance in safety participation. Similar to the model for safety compliance, role contributed a substantial amount to the predicted variance in safety participation, however this time it accounted for the largest portion (29% of the variance). Idealized influence explained 19% of the variance, followed by inspirational motivation (12%), contingent reward (9%), intellectual stimulation (9%), and individualized consideration (6%). Also similar to the previous model, membership in organizations and active management-by-exception did not explain unique variance in safety participation.

To examine the relationships with injuries and pain, multiple logistic regression and logistic relative weights analysis were utilized. The results of these analyses are presented in Tables 5 and 6. The first logistic regression model was used to examine whether leadership was significantly associated with an individual reporting an injury in the past two months ($\chi2=99.76$, $df=11$, $p<.001$). Based on the regression results, only two variables, role and membership in Organization 3, were significantly associated with having an injury at work. Results of the logistic relative weights analysis demonstrated that while all of the variables combined explained 7% of the variance in work-related injury (pseudo R2), role was the only variable that explained significant unique variance (53%). The second logistic regression model was used to examine whether leadership was related to whether an individual had any work-related pain in the past two months ($\chi2=86.29$, $df=11$, $p<.001$). Regression results again suggested that only two variables, role and

Table 5. Regression Results for Injury and Pain

	Injury			Pain		
	Unstandardized Coefficient (SE)	Exp (B)	95% CI for Exp (B)	Unstandardized Coefficient (SE)	Exp (B)	95% CI for Exp (B)
Constant	1.42* (.37)	4.12		2.32* (.34)	10.16	
Role	-.99 (.16)	.37	.27 – .51	-.56* (.13)	.57	.44 – .75
Organization 2	-.53 (.27)	.59	.35 – 1.01	-.36 (.23)	.70	.44 – 1.10
Organization 3	-.56* (.22)	.57	.37 – .87	-.16 (.18)	.85	.60 – 1.20
Organization 4	-.35 (.18)	.71	.50 – 1.00	.13 (.16)	1.14	.83 – 1.55
Organization 5	-1.67 (1.04)	.19	.02 – 1.46	-.56 (.60)	.57	.18 – 1.85
Idealized Influence	-.25 (.15)	.78	.58 – 1.04	-.08 (.13)	.92	.71 – 1.20
Inspirational Motivation	-.17 (.13)	.84	.66 – 1.08	-.14 (.11)	.87	.70 – 1.08
Intellectual Stimulation	.06 (.13)	1.06	.83 – 1.36	-.07 (.11)	.93	.75 – 1.17
Individualized Consideration	.22 (.13)	1.24	.97 – 1.59	-.07 (.11)	.94	.75 – 1.17
Contingent Reward	-.07 (.14)	.93	.71 – 1.22	-.02 (.12)	.98	.77 – 1.25
Active Management-by-Exception	-.13 (.07)	.88	.76 – 1.01	-.19* (.06)	.83	.73 – .94
χ^2 (df)	99.76* (11)			86.29* (11)		
Pseudo R-squared	.07			.07		
No. observations	1,348			1,216		

Table 6. Relative Weights Reflecting the Relative Importance of Dimensions of Leadership in Predicting Injury and Pain

	Injury				Pain			
	β	RW	95% CI	RI (%)	β	RW	95% CI	RI(%)
Control Variables								
Role	-.99*	.04*	.01 – .08	52.77	-.56*	.01	.00 – .03	18.08
Organization 2	-.53*	.00	.00 – .02	4.20	-.36	.00	-.00 – .02	5.30
Organization 3	-.56	.01	.00 – .03	11.79	-.16	.00	-.00 – .01	3.00
Organization 4	-.35	.00	-.00 – .01	1.60	.13	.00	-.00 – .01	2.28
Organization 5	-1.67	.00	-.01 – .08	5.02	-.56	.00	-.00 – .02	1.12
Predictor Variables								
Idealized Influence	-.25	.00	.00 – .02	6.52	-.08	.01	.00 – .02	12.56
Inspirational Motivation	-.17	.00	.00 – .02	6.34	-.14	.01	.00 – .02	13.44
Intellectual Stimulation	.06	.00	-.00 – .01	2.21	-.07	.01	.00 – .01	9.58
Individualized Consideration	.22	.00	-.00 – .01	2.29	-.07	.01	.00 – .01	9.13
Contingent Reward	-.07	.00	.00 – .01	2.85	-.02	.01	.00 – .01	9.38
Active Management-by-exception	-.13	.00	.00 – .02	4.40	-.19*	.01	.00 – .03	16.12
Total Model R^2	.08				.07			

Note. B=Regression Coefficient, RW=Relative Weight, RI=Relative Importance, as a percentage of total R^2, CI=Experimental confidence interval around the relative weight, representing the 2.5 percentile and the 97.5 percentile. For Role, Apprentice=1, Journeyman=2. Organizations 2 – 5 are dummy variables, with Organization 1 as the reference group.
*p< .05.

active management-by-exception, were significantly associated with experiencing work-related pain. However, results of the logistic relative weights analysis demonstrated that none of the leadership or control variables contributed a significant amount of unique variance in the model with work-related pain.

Once these analyses were run, an additional research question was tested to see if including leadership variables as individual behaviors explained more variance in safety outcomes than a model in which leadership was included as an overall summed variable. The results of these regression analyses are presented in Tables 7 and 8. A comparison of the overall adjusted R^2 values suggested that including leadership in the model as individual behaviors explained more variance than including leadership as one single variable. This was true for all of the outcomes: safety climate (R^2=.415, .373, respectively), safety compliance (.162, .140), safety participation (.207, .191), injury (.071, .064), and pain (.069, .066).

Table 7. Regression Results for Leadership, Safety Climate and Safety Behaviors

	Safety Climate		Safety Compliance		Safety Participation	
	Unstandardized Coefficient (SE)	95% Confidence Interval	Unstandardized Coefficient (SE)	95% Confidence Interval	Unstandardized Coefficient (SE)	95% Confidence Interval
Constant	3.52 (.19)	3.15 – 3.88	2.94 (.09)	2.77 – 3.11	2.37 (.09)	2.19 – 2.55
Role	.30 (.08)	.15 – .46	.25 (.04)	.18 – .32	.37 (.04	.30 – .45
Organization 2	.28 (.13)	.02 – .53	.09 (.06)	-.02 – .21	.14 (.06)	.02 – .27
Organization 3	.36 (.10)	.16 – .56	.10 (.05)	.01 – .19	.21 (.05)	.11 – .30
Organization 4	.23 (.09)	.04 – .41	.07 (.04)	-.01 – .16	.13 (.05)	.04 – .22
Organization 5	.77 (.34)	.11 – 1.44	.11 (.15)	-.18 – .41	.46 (.17)	.14 – .78
Leadership	1.11 (.04)	1.03 – 1.19	.24 (.02)	.20 – .28	.26 (.02)	.23 –.30
R-squared	.376		.144		.195	
Adjusted R-squared	.373		.140		.191	
No. observations	1343		1362		1348	

Table 8. Regression Results for Leadership, Injury, and Pain

	Injury			Pain		
	Unstandardized Coefficient (SE)	Exp (B)	95% Confidence Interval	Unstandardized Coefficient (SE)	Exp (B)	95% Confidence Interval
Constant	1.35 (.36)	3.87		2.18 (.32)	8.88	
Role	-1.02 (.16)	.36	.26 – .49	-.56 (.13)	.57	.44 – .74
Organization 2	-.49 (.27)	.61	.36 – 1.04	-.33 (.23)	.72	.46 – 1.13
Organization 3	-.60 (.21)	.55	.36 – .84	-.14 (.17)	.87	.62 – 1.22
Organization 4	-.33 (.18)	.72	.51 – 1.02	.14 (.16)	1.15	.85 – 1.57
Organization 5	-1.75 (1.04)	.17	.02 – 1.34	-.61 (.60)	.54	.17 – 1.74
Leadership	-.31 (.08)	.74	.63 – .86	-.52 (.07)	.60	.52 – .68
χ^2 (df)	88.72 (6)			82.96 (6)		
Pseudo R-squared	.064			.066		
No. observations	1510			1510		

CHAPTER 4: DISCUSSION

The purpose of this study was to determine the leader behaviors that had the largest influence on employee safety. Based on the results, it is clear that different leader behaviors do have differential effects on safety outcomes. The leadership variables together had the largest association with the most theoretically proximal outcome, safety climate. In this relationship, idealized influence contributed the most, followed by intellectual stimulation, contingent reward, inspirational motivation, individualized consideration, and active management-by-exception. Leadership behaviors and role at work contributed less to the total variance explained in safety behaviors. For safety compliance, idealized influence again contributed the most, followed by role, inspirational motivation, intellectual stimulation, contingent reward, and individualized consideration. For safety participation, role contributed the most to the overall explained variance, followed by idealized influence, inspirational motivation, contingent reward, intellectual stimulation, and individualized consideration. In the relationship with injury, role was the only variable that contributed significant unique variance, and in the relationship with pain, none of the variables contributed significant variance. Last, it was found that including leader behaviors as individual predictors explained more variance in all safety outcomes than when leader behaviors were included as one overall leadership variable.

It is evident that the transformational leader behavior of idealized influence may be one of the most important predictors of safety at work, as it frequently contributed a large portion to the variance explained. When a leader displays attributes and behaviors that convey a sense of integrity, employees learn to trust and respect that leader. Using that leader as a role model, employees are more likely to display those same attributes and behaviors, contributing to a safer workplace. Although the leader behaviors examined in this study were not safety-specific, it

appears that idealized influence in general could promote safety at work. This finding is consistent with research supporting the importance of social learning theory; employees habitually look to their leader for direction on how to behave, especially in regards to safety (Bandura, 1977). The importance of idealized influence in this study also echoes earlier findings suggesting that employees were healthier if they thought their leader was trustworthy and had high integrity (Dellve et al., 2007; Nyberg, Bernin, & Theorell, 2005; Nyberg et al., 2008). Overall, this finding suggests that who a leader is may be more important than what he or she does; that is, that values are more important than behaviors. This echoes the current direction of leadership research with a focus on the importance of core values in establishing oneself as an authentic leader (e.g., Gardner, Avolio, Luthans, May, & Walumbwa, 2005).

An individual's role at work (i.e., whether an individual was an apprentice or a journeyman) explained a large portion of the variance in safety behaviors, and was the only variable that contributed significant variance to having an injury at work. Based on the direction of these relationships, it appears that journeymen reported seeing less leadership behaviors from their foremen; however, the higher levels of safety climate, safety behaviors, and less injury and pain reported suggest that they might be better able to interpret these leadership behaviors and funnel them into improved safety outcomes. With additional experience in the field, journeymen seem to need less guidance from their leaders in promoting workplace safety, which makes their individual roles in communicating safety to their apprentices even more important. To extrapolate beyond the current sample, perhaps middle management is the key link for influencing safety at work because of their pivotal position between upper management and lower-level employees.

Intellectual stimulation, inspirational motivation, and contingent reward varied in the strength of their relationships to the safety outcomes. This could be a reflection of the research in

these areas that suggests that there are complicated relationships among creativity, motivation, rewards, and performance outcomes. The lack of consistency of these behaviors in their relationships with safety at work suggests that there may be important variables that moderate these relationships. For example, if a leader engages in inspirational motivation, whether this translates into increased employee safety behaviors may be dependent on employee individual differences, such as self-efficacy or self-esteem (e.g., Judge & Bono, 2001; Yukl & Van Fleet, 1992). In addition, willingness to speak up on behalf of the employee may be a key moderator in the relationship between intellectual stimulation and safety (Arboleda, Morrow, Crum, & Shelley, 2003). In the case of contingent rewards, the type of reward (e.g. monetary versus intangible rewards, such as praise) may have an important role in the prediction of improved safety performance. If an employee does not value the reward that safety performance is contingent upon, he or she is unlikely to continue engaging in those safety behaviors. In sum, the relationship among safety outcomes, intellectual stimulation, inspirational motivation, and contingent reward is inconsistent, likely due to additional important moderating variables.

Individualized consideration seldom contributed a large amount to the overall variance explained in safety outcomes, suggesting that it may not be as effective in promoting safety at work. It is interesting that in a field where apprenticeship training is highly valued, the leadership behavior most similar to mentoring was not extremely important in predicting safety. Previous studies have noted the key role that mentors play in construction (Meliá & Becerril, 2007; Sobeih, Salem, Daraiseh, Genaidy, & Shell, 2006); however, it is possible that construction mentors engage in specific behaviors that are better encompassed under the other leadership dimensions than the act of mentoring itself (Hoffmeister, Cigularov, Sampson, Rosecrance, & Chen, 2011). More specifically, the act of caring about individual employees (i.e. individualized

consideration) may not be as important as the message that is sent through other more important characteristics and behaviors (i.e. idealized influence, inspirational motivation, intellectual stimulation, and contingent reward).

Active management-by-exception explained the least amount of unique variance in safety climate, and did not contribute any unique variance to the other safety outcomes. This finding is similar to previous studies on the effectiveness of leadership; active management-by-exception is typically the least influential of all of the leader behaviors, and sometimes the relationship is negative (Avolio, Jung, Murry, & Sivasubramaniam, 1996; Bass, 1985; Judge & Piccolo, 2004). Factor analyses of transformational and transactional leadership behaviors often reveal that all of the transformational behaviors as well as contingent reward load on the same factor, while active management-by-exception loads on a separate one (e.g., Bass, 1985; Bycio, Hackett, & Allen, 1995). This suggests that active management-by-exception could be tapping into a different construct that has little influence on safety at work.

Limitations and Directions for Future Research

While this study does apply a unique method of analysis to the study of leadership, it is not without its limitations. First, it was a cross-sectional study, and therefore it can only assess the association between leadership and safety variables. However, there is a significant amount of research in the leadership-safety arena that supports the causal order of leadership predicting safety outcomes, and these prior studies can be used as a guide for the interpretation of the results of this study. Future research should continue to examine the relationships between individual leader behaviors and safety outcomes using longitudinal designs to assess whether the relationships are similar or different from those reported here.

Next, it is important to note that relative weights analysis is not meant as a replacement for regression analysis and model building. More specifically, the leadership behaviors shown here to contribute the most to individual safety outcomes are not necessarily the combination of leadership behaviors that yield the highest R^2 in the prediction of safety at work (Johnson, 2000). Therefore, the results of this study should not be used to suggest that idealized influence, inspirational motivation, intellectual stimulation, and contingent reward together predict the most variance in any of the safety outcomes. However, this study did provide some unique information beyond that provided by the regression analyses. The regression results frequently suggested that not all of the leader behaviors contributed unique variance to the safety outcomes, yet the relative weights analyses were able to tease apart these relationships and show that most of the time, the individual leader behaviors had something unique to contribute, even if it was very small. This supports the belief that leaders must engage in all of the transformational and transactional behaviors to be the most effective (Avolio, 1999). In addition, the results of the relative weights analyses can be used to suggest that of the leadership variables, idealized influence may be an important and unique predictor of safety at work.

It is worth acknowledging that while some leader behaviors contributed a large amount to the overall variance explained, the raw weights of all behaviors were very small. The raw weights were largest when predicting safety climate, smaller when predicting safety behaviors, and insignificant when predicting injury and pain. This makes conceptual sense, as leadership should be a stronger predictor of the outcome that is theoretically closest to it (i.e. safety climate) than those that are more distal (i.e. safety behaviors, injury, and pain). The small weights of leader behaviors imply that other variables, for instance job demands and job control, may be better at predicting safety at work (Parker, Axtell, & Turner, 2001). However, many individual

leader behaviors did significantly contribute to the overall variance explained, suggesting that while leadership may not be the strongest predictor of workplace safety, it is an important one. In demanding industries, such as construction, it may be difficult for an organization to change the high pressure and steep demands that employees work under, and it may be equally as difficult to give them more control over their work when safety is such a high priority. Therefore, while changing job demands or job control may be more influential in improving safety, it is oftentimes impractical. Leader development is one way that organizations can have an impact on safety at work, and better leaders will oftentimes lead to additional improvements such as increased job satisfaction and motivation (Judge & Piccolo, 2004).

Another potential limitation of this study (and perhaps leadership research in general) is the degree of correlation between the individual leader behaviors. Even though relative weights analysis can statistically separate the effects of one behavior from the others, if the leadership behaviors are too highly correlated, it may not make sense to separate them. Numerous researchers in the past have argued that while the dimensions of transformational and transactional leadership are highly correlated, they should remain separate for theoretical reasons (e.g., Bass, 1985; Bass & Riggio, 2006). However, the results presented here suggest that the contribution of the other dimensions are sometimes negligible (e.g. with individualized consideration and active management-by-exception). Future research should examine the individual contributions of these behaviors in different industries and populations to untangle the real contribution of each behavior separately. If factor analyses show that only one or two factors emerge from all of these behaviors, and these behaviors are not contributing a significant amount of unique variance, it may not be useful to distinguish them in a safety context. Nonetheless, the results from the final regression analyses provide an interesting perspective on this research question. While the

leadership variables are highly correlated, including them individually rather than as one factor may help us explain more variance in the outcomes in which we are interested.

Furthermore, while it is empirically possible to separate the behaviors within leadership, the question is whether it is theoretically relevant. Leadership researchers have argued that all leaders possess varying degrees of each leader behavior, and in order to be successful, they must balance all of them (e.g., Avolio, 2011). Therefore, if one interprets the results of this study as suggesting that only idealized influence is important, this may not be as useful as interpreting the results to mean that *more* focus should be placed on idealized influence when developing leaders. Leaders will probably not exemplify one behavior but never the other, and the purpose of this study is not to suggest that they do. Rather, this study has investigated the unique contributions of each leader behavior in an attempt to highlight the varying importance each has in contributing to safety at work. When developing leaders in the context of safety, resources would better be spent by focusing on some areas (i.e. idealized influence, inspirational motivation, intellectual stimulation, and contingent reward) more than others.

An important area for future research lies in the further investigation of the dimension of idealized influence. If it is the most important predictor of safety in the construction industry, it would be useful to have a thorough understanding of what it is so that organizations may focus their training resources on it. The idealized influence dimension is not new in leadership theories, and has been a part of trait theories (i.e. integrity, trust, respect, honesty), behavioral theories (i.e. concern for people), contingency theories (i.e. ethical decision-making), and more recent theories such as charismatic and authentic leadership. However, there has yet to be any well-defined list of what constitutes idealized influence. Future research should attempt to understand what distinguishes an ethical leader, an honest leader, a leader with integrity, or a leader that holds

respect among employees from anything not "idealized." Only with a clear path towards idealized influence can organizations begin to allocate their resources appropriately.

One last direction for future research, as mentioned above, is expressed in the varying results for many of the dimensions of leadership – why do some variables contribute more sometimes but not others? An understanding of the potential moderators of the relationships between inspirational motivation, intellectual stimulation, contingent reward, and safety outcomes is needed to better understand how organizations may utilize the results discussed here to their benefit.

Conclusion

This study used relative weights analysis to investigate the influence that individual leader behaviors have on safety. Idealized influence is an important predictor of safety at work, while individualized consideration and active management-by-exception are not as influential. The results outlined here suggest that organizations may want to focus more of their resources on developing the integrity and moral character of leaders so that they may gain respect from their employees and serve as role models for a safer and healthier workplace.

REFERENCES

Arboleda, A., Morrow, P. C., Crum, M. R., & Shelley, M. C. (2003). Management practices as antecedents of safety culture within the trucking industry. *Journal of Safety Research, 34*, 189-197.

Avolio, B. J. (1999). *Full leadership development: Building the vital forces in organizations*. Thousand Oaks, CA: Sage.

Avolio, B. J. (2011). *Full-range leadership development*. Thousand Oaks: Sage.

Avolio, B. J., & Bass, B. M. (2004). *Multifactor Leadership Questionnaire: Manual and sampler set* (3rd ed.). Redwood City: Mind Garden.

Avolio, B. J., Jung, D. I., Murry, W., & Sivasubramaniam, N. (1996). Building highly developed teams: Focusing on shared leadership processes, efficacy, trust, and performance. *Advances in Interdisciplinary Studies of Work Teams, 3*, 173-209.

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs: Prentice-Hall.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs: Prentice-Hall.

Barling, J., Loughlin, C., & Kelloway, E. K. (2002). Development and test of a model linking safety-specific transformational leadership and occupational safety. *Journal of Applied Psychology, 87*, 488-496.

Bass, B. M. (1985). *Leadership and performance beyond expectation*. New York: Free Press.

Bass, B. M., & Riggio, R. E. (2006). *Transformational leadership*. Mahwah, NJ: Erlbaum.

Brown, K. A., Willis, P. G., & Prussia, G. E. (2000). Predicting safe employee behavior in the steel industry: Development and test of a sociotechnical model. *Journal of Operations Management, 18*, 445-465.

Burns, J. M. (1978). *Leadership*. New York: Harper & Row.

Bycio, P., Hackett, R., & Allen, J. (1995). Further assessments of Bass's (1985) conceptualization of transactional and transformational leadership. *Journal of Applied Psychology, 80*, 468-478.

CDC. (2011), from www.cdc.gov.

Clarke, S. (2006). The relationship between safety climate and safety performance: A meta-analytic review. *Journal of Occupational Health Psychology, 11*, 315-327.

Conchie, S. M., & Donald, I. J. (2009). The moderating role of safety-specific trust on the relation between safety-specific leadership and safety citizenship behaviors. *Journal of Occupational Health Psychology, 14*, 137-147.

DeArmond, S., Smith, A. E., Wilson, C. L., Chen, P. Y., & Cigularov, K. P. (2011). Individual safety performance in the construction industry: Development and validation of two short scales. *Accident Analysis & Prevention, 43*, 948-954.

Dellve, L., Skagert, K., & Vilhelmsson, R. (2007). Leadership in workplace health promotion projects: 1- and 2-year effects on long-term work attendance. *European Journal of Public Health, 17*, 471-476.

Detert, J. R., & Burris, E. R. (2007). Leadership behavior and employee voice: Is the door really open? *Academy of Management Journal, 50*, 869-884.

Dillman, D. A. (2000). *Mail and internet surveys: The tailored design method* (2nd ed.). New York, NY: Wiley.

Fogas, C. S., Meliá, J. L., & Silva, S. (2011). The "is″ and the "ought": How do perceived social norms influence safety behaviors at work? *Journal of Occupational Health Psychology, 16*, 67-79.

Gardner, W. L., Avolio, B. J., Luthans, F., May, D. R., & Walumbwa, F. O. (2005). "Can you see the real me?" A self-based model of authentic leader and follower development. *The Leadership Quarterly, 16*, 343-372.

Griffin, M., & Neal, A. (2000). Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of Occupational Health Psychology, 1*, 347-358.

Hoffmeister, K., Cigularov, K., Sampson, J., Rosecrance, J. C., & Chen, P. Y. (2011). A perspective on effective mentoring in the construction industry. *Leadership and Organization Development Journal, 32*, 673-688.

Hofmann, D. A., & Morgeson, F. P. (2004). The role of leadership in safety. In J.Barling & M. R. Frone (Eds.), *Psychology of workplace safety* (pp. 159-180). Washington, DC: American Psychological Association.

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

Inness, M., Turner, N., Barling, J., & Stride, C. B. (2010). Transformational leadership and employee safety performance: A within-person, between-jobs design. *Journal of Occupational Health Psychology, 15*, 279-290.

Johnson, J. W. (2000). A heuristic method for estimating the relative weight of predictor variables in multiple regression. *Multivariate Behavioral Research, 35*, 1-19.

Judge, T. A., & Bono, J. E. (2001). Relationship of core self-evaluation traits—self-esteem, generalized self-efficacy, locus of control, and emotional stability—with job satisfaction and job performance: A meta-analysis. *Journal of Applied Psychology, 86*, 80-92.

Judge, T. A., & Piccolo, R. F. (2004). Transformational and transactional leadership: A meta-analytic review of their relative validity. *Journal of Applied Psychology, 89*, 755-768.

Kelloway, E. K., Mullen, J. E., & Francis, L. (2006). Divergent effects of transformational and passive leadership on employee safety. *Journal of Occupational Health Psychology, 11*, 76-86.

Kirkpatrick, D. L. (1998). *Evaluating training programs: The four levels*. San Francisco, CA: Berret-Koehler.

Kozlowski, S. W., & Doherty, M. L. (1989). Integration of climate and leadership: Examination of a neglected issue. *Journal of Applied Psychology, 74*, 546-553.

Kraiger, K. (2003). Perspectives on training and development. In W. C. Borman, D. R. Ilgen & R. J. Klimoski (Eds.), *Handbook of psychology* (pp. 171-192). New York: Wiley.

LeBreton, J. M., & Tonidandel, S. (2008). Multivariate relative importance: Extending relative weight analysis to multivariate criterion spaces. *Journal of Applied Psychology, 93*, 329-345.

Lewin, K., Lippitt, R., & White, R. (1939). Patterns of aggressive behaviour in experimentally created "social climates". *Journal of Social Psychology, 10*, 271-299.

Luria, G. (2008). Climate strength - How leaders form consensus. *The Leadership Quarterly, 19*, 42-53.

Luria, G., Zohar, D., & Erev, I. (2008). The effect of workers' visibility on effectiveness of intervention programs: Supervisory-based safety interventions. *Journal of Safety Research, 39*, 273-280.

Meliá, J. L., & Becerril, M. (2007). Psychological sources of stress and bunout in the construction sector: A structural equation model. *Psicothema, 19*, 679-686.

Nahrgang, J. D., Morgeson, F. P., & Hofmann, D. A. (2008). *A meta-analytic investigation of individual and contextual influences on workplace safety, satisfaction, and well-being.* Paper presented at the Society for Industrial and Organizational Psychology, San Francisco.

Neal, A., & Griffin, M. A. (2004). Safety climate and safety at work. In M. R. Frone & J. Barling (Eds.), *The psychology of workplace safety* (pp. 15-34). Washington, D.C.: American Psychological Association.

Neal, A., & Griffin, M. A. (2006). A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. *Journal of Applied Psychology, 91*, 946-953.

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

Nyberg, A., Bernin, P., & Theorell, T. (2005). *The impact of leadership on the health of subordinates*. Stockholm: National Institute for Working Life.

Nyberg, A., Westerlund, H., Hanson, L. L. M., & Theorell, T. (2008). Managerial leadership is associated with self-reported sickness absence and sickness presenteeism among Swedish men and women. *Scandinavian Journal of Public Health, 36*, 803-811.

Parker, S. K., Axtell, C. M., & Turner, N. (2001). Designing a safer workplace: importance of job autonomy, communication quality, and supportive supervisors. *Journal of Occupational Health Psychology, 6*, 211-228.

Siegrist, J. (2010). Effort-reward imbalance at work and cardiovascular diseases. *International Journal of Occupational Medicine and Environmental Health, 23*, 279-285.

Sobeih, T. M., Salem, O., Daraiseh, N., Genaidy, A., & Shell, R. (2006). Psychosocial factors and musculoskeletal disorders in the construction industry: A systematic review. *Theoretical Issues in Ergonomics Science, 7*, 329-344. doi: 10.1080/14639220500090760.

Tonidandel, S., LeBreton, J. M., & Johnson, J. W. (2009). Determing the statistical significance of relative weights. *Psychological Methods, 14*, 387-399.

Wu, T. C., Chen, C. H., & Li, C. C. (2008). A correlation among safety leadership, safety climate and safety performance. *Journal of Loss Prevention in the Process Industries, 21*, 307-318.

Yukl, G., & Van Fleet, D. D. (1992). Theory and research on leadership in organizations. In M.Dunnette & L. Hough (Eds.), *Handbook of Industrial and Organizational Psychology* (Vol. 3, pp. 147-197). Palo Alto, CA: Consulting Psychologists Press.

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

Zohar, D. (2002a). The effects of leadership dimensions, safety climate, and assigned priorities on minor injuries in work groups. *Journal of Organizational Behavior, 23*, 75-92. doi: 10.1002/job.130

Zohar, D. (2002b). Modifying supervisory practices to improve submit safety: A leadership-based intervention model. *Journal of Applied Psychology, 87*, 156-163.

Zohar, D., & Luria, G. (2003). The use of supervisory practices as leverage to improve safety behavior: a cross level intervention model. *Journal of Safety Research, 34*, 567-577.

APPENDIX A: MEASURES USED IN THE PRESENT STUDY

Safety Climate (Neal & Griffin, 2006)

(1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)

Supervisor Support

1. My current, immediate supervisor places a strong emphasis on workplace health and safety
2. Safety is given a high priority by my current, immediate supervisor
3. My current, immediate supervisor considers safety to be important

Safety Communication

1. My current, immediate supervisory gives us sufficient opportunity to discuss and deal with safety issues in meetings
2. There is open communication about safety issues between my current, immediate supervisor and me
3. I am regularly consulted by my current, immediate supervisory about workplace health and safety issues

Safety Compliance (Neal & Griffin, 2006)

(1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)

At my current workplace…

1. I use all the necessary safety equipment to do my job
2. I use the correct safety procedures for carrying out my job
3. I ensure the highest levels of safety when I carry out my job

Safety Participation (Neal & Griffin, 2006)

(1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree)

At my current workplace…

1. I promote the safety program within my contractor
2. I put in extra effort to improve the safety of the workplace
3. I voluntarily carry out tasks or activities that help to improve workplace safety

Pain (Developed for this study)

1. Have you had any work-related pain (e.g. back, shoulder, wrist pain, etc.) in the past TWO MONTHS? *(1=Yes, 0=No)*
2. How often in the past 2 months did you have work-related pain (e.g. back, shoulder, wrist pain, etc.) and you…? *(1=Never, 2=Once in a while, 3=Sometimes, 4=Quite often, 5=Almost all the time, 6=All the time)*
    a. Did not treat it in any way
    b. Treated it at home (e.g. took a pain medication)
    c. Sought medical attention but did not miss work
    d. Had to miss work but did not seek medical attention
    e. Sought medical attention and also had to miss work

Injury (Developed for this study)

1. Have you had an injury at work (e.g. cut, burn, sprain, etc.) in the past TWO MONTHS? *(1=Yes, 0=No)*

2. How often in the past 2 months did you have work-related pain (e.g. back, shoulder, wrist pain, etc.) and you…? *(0, 1, 2, 3, 4, 5+)*
    a. Did not treat it in any way
    b. Treated it at home (e.g. put a bandage on it)
    c. Sought medical attention but did not miss work
    d. Had to miss work but did not seek medical attention
    e. Sought medical attention and also had to miss work