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Supportive Leadership, Employee Engagement and Occupational Safety: A Field Study

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To the Graduate Council:

I am submitting herewith a dissertation written by Lauren Elizabeth Baxter entitled "Supportive Leadership, Employee Engagement and Occupational Safety: A Field Study." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Psychology.

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Supportive Leadership, Employee Engagement and Occupational Safety: A Field Study

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DEDICATION

To my grandmother, Eve R. Kommel (aka AB)

It is impossible to put this level of inspiration and support into words.

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ABSTRACT

This archival field study examined the relationships of supportive leadership, employee engagement, and safety outcomes in order to address the current knowledge gap regarding these concepts and also to test predictions of and extend the Job Demands-Job Resources Model. Participants were 3,312 employees from multiple departments located at 11 different locations of a large southeastern utility company. Data were collected on supportive leadership, employee engagement, and safety climate using archival data from self-report questionnaires. Recordable injuries and first-aid instances were collected through the organization's archival safety records. Three consecutive years of data were included in the study. As expected, supportive leadership and employee engagement both showed a negative relationship with safety outcomes, as measured by first-aid instances and injury rates. Partial support was found for the main hypothesis, which predicted employee engagement would mediate the relationship between supportive leadership and safety outcomes. Significant mediation was found in two of the three years included in this study, as well is when all years were combined. The current study was the first to empirically test the relationship between supportive leadership and safety outcomes mediated by employee engagement. The findings have implications for theory, research and, perhaps most importantly, practical application.

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CHAPTER I
INTRODUCTION

The cost of workplace fatalities, injuries, and illnesses is substantial, both financially and personally. According to the World Health Organization (as cited in Nahrgang, Morgeson, & Hofmann, 2011), it is estimated that such safety-related outcomes result in economic losses amounting to 4-5% of GDP. In 2011, there were 4,609 workplace fatalities and nearly three million injuries and illnesses in the United States (Bureau of Labor Statistics, U.S. Department of Labor, 2012). Given these statistics, it is no surprise that occupational safety has generated a great deal of research, including multiple meta-analyses just in the past decade (Christian, Bradley, Wallace, & Burke, 2009; Clarke, 2006; Clarke, 2012; Clarke & Robertson, 2005; Nahrgang et al., 2011), and hundreds of empirical studies (Nahrgang et al., 2011). Since the mid twentieth century, researchers have put forth a great deal of effort in the investigation of the antecedents of a safe workplace. Some key predictors of safety behaviors have emerged, such as leadership (Barling, Loughlin, & Kelloway, 2002; Hofmann & Morgeson, 1999; Zohar & Lurie, 2004), safety climate (Evans, Michael, Wiedenbeck, & Ray, 2005; Goldenhar, Williams, & Swanson, 2003; Hofmann & Stetzer, 1996), and employee engagement (Harter, Schmidt, & Hayes, 2002, Laschinger & Leiter, 2006; Nahrgang et al., 2011).

Though progress has been made in the area of occupational safety, there is still room for further research, especially surrounding the interrelationships among the key predictors of safety behavior. Using the Job Demands-Job Resources (JDR) model (Bakker & Demerouti, 2007; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), several empirical studies have been conducted investigating the relationship between a supportive environment (including leadership), employee engagement, and multiple performance outcomes (Bakker, Demerouti, &

Euwema, 2005; Bakker, Demerouti, & Verbeke, 2004; Hofmann & Stetzer, 1996; Schaufeli, Bakker, & Van Rhenen, 2009). However, there is a lack of research investigating the direct relationship between supportive leadership, employee engagement, and safety behaviors. In Nahrgang and colleagues' (2011) meta-analysis of 203 independent samples, leadership explained a significant amount of variance in the "satisfaction" facet of employee engagement, and engagement significantly related to adverse events and unsafe behaviors. Unfortunately, there was no further investigation into the possible mediation of the leadership-to-safety relationship by employee engagement. The current study seeks to build upon the JDR model by investigating a specific path proposed by the model which has yet to be supported, the link between supportive leadership, employee engagement, and safety outcomes.

The primary purpose of the current study is to understand the influence of employee engagement as a mediator of the relationship between the antecedent, supportive leadership, and the outcome variable, safety outcomes. This study seeks to provide additional support to the JDR model by investigating the relationship between these three variables, which to this date has not been specifically addressed in research.

The following five sections include: 1) a review of the occupational safety literature, 2) a review of leadership and occupational safety, 3) a review of employee engagement and occupational safety, 4) the proposed theoretical link between supportive leadership, employee engagement, and occupational safety, and 5) a summary of hypotheses.

Occupational Safety

Four meta-analyses focusing on occupational safety published in the past decade have found many predictors of safety behaviors and other safety outcomes. Clarke (2006) looked at

safety climate as an important predictor of safety performance (participation and compliance), and accidents/injuries. The researcher hypothesized safety performance would moderate the relationship between safety climate and accidents/injuries. While safety climate was related to both the participation and compliance aspects of safety performance, the relationship between safety performance and accidents and injuries was not well supported. The relationship was found to be moderated by research design. These findings clearly indicate a need for more, and perhaps more thoughtfully designed, research studies in the area of safety climate and occupational injuries and accidents.

Christian et al. (2009) provides another example of the importance of moderating factors when studying occupational safety by looking at multiple predictors of safety performance and safety outcomes in a meta-analysis of 90 studies. Predictors were categorized as either distal or proximal and situation-related or person related. They hypothesized distal situation-related factors (safety climate and leadership) and distal person-related factors (personality characteristics and job attitudes) would predict proximal person-related factors (safety motivation and safety knowledge) which would relate to safety performance (compliance and participation) which, in the end, would predict safety outcomes (accidents and injuries). Predictions were generally supported. Weak to moderate correlations between distal person- and situation-related factors and safety performance were found. Similar to Clarke's (2006) findings, safety climate was more strongly related to safety participation compared to safety compliance. This was also true for leadership. Some distal person- and situation-related factors were weakly related to safety outcomes, others had no relationship. Safety knowledge and safety motivation were the best predictors of safety performance. Group-level safety climate, defined as shared perceptions of work environment characteristics as they pertain to safety matters that affect a

group of individuals, was found to be the strongest predictor of accidents and injuries. The researchers concluded that their original hypothesis was supported based on the support for their exemplar model and pattern of meta-analytic correlations.

In another meta-analysis, Clarke (2005) looked at the relationship between the big five personality traits and accidents. The researcher looked at both occupational and non-occupational accidents, such as car accidents. The findings indicated the relationship between personality traits and accidents was moderated by accident type. Further analysis showed low agreeableness and neuroticism were related to occupational accidents, while extraversion, low agreeableness and low conscientiousness proved to be significant predictors of car accidents.

One of the most recent and largest meta-analyses related to safety was conducted by Nahrgang et al. (2011). Using 203 independent samples the researchers looked at how job demands and job resources relate to workplace safety through health impairment and motivational processes. Overall, they found general support for their model. Job demands impaired health, positively related to burnout, and negatively related to engagement. The opposite was true for job resources, which showed a positive relationship with employee engagement and a negative relationship with burnout. Furthermore, the research showed burnout was negatively related to working safely, while employee engagement was positively related to working safely.

In Nahrgang and colleagues' (2011) meta-analysis the job demands category consisted of risks and hazards, physical demands, and complexity. The job resources category included knowledge, autonomy, and a supportive environment (i.e., social support, leadership, and safety climate). The researchers hypothesized that both burnout and employee engagement would

mediate the relationship between job demands/resources and safety outcomes. To test these hypotheses a meta-analytic path model was estimated using the job demand and job resource that accounted for the most variance in the mediators and/or outcomes. In this case, risks/hazards was treated as the job demand and safety climate was treated as the job resource for the meta-analytic path model. Results suggest burnout and engagement partially mediated the relationship between job demands/resources and safety behaviors.

Nahrgang et al. (2011) included four different types of industries in their meta-analysis: construction, healthcare, manufacturing/processing, and transportation. Risks and hazards was the most consistent job demand in explaining variance in burnout, engagement, and safety outcomes. However, the specific job demand that accounted for the most variance did differ across industries. A supportive environment was the job resource that consistently explained the most variance in burnout, engagement, and safety outcomes. This did not vary across industries.

The four meta-analyses discussed above begin to show a picture of the current state of the occupational safety literature. Neal and Griffin (2002) proposed a summary of the relationships among antecedents, determinants, and components of safety performance. This summary includes leadership, conscientiousness, and safety climate as antecedents, motivation and knowledge and skill as determinants, and safety compliance and participation as components of safety. It is clear the research has focused more so on some aspects of Neal and Griffin's (2002) model than others. For instance, there is a great deal of focus placed on the importance of safety climate, and less on leadership, conscientiousness, or other possible antecedents. Nahrgang et al. (2011) looked at leadership as part of the supportive environment job resource, but did not use leadership to conduct any additional analysis. With the amount of resources organizations spend

on leadership training and safety training (individually), understanding the relationship between the two will be very beneficial.

Leadership and Occupational Safety

Leadership has been a topic of interest to researchers since the early part of the twentieth century, and therefore has accumulated hundreds of studies (Avolio, Reichard, Hannah, Walumbwa, & Chan, 2009). For the purpose of the current study, leadership studies of most interest are those that focus on safety as the criterion measure. Transformational leadership has been shown to predict injury rates in many different populations, including both military and non-military (Barling et al., 2002; Kelloway, Mullen, & Francis, 2006; Zohar, 2002; Zohar & Luria, 2004). However, this relationship has been found to be moderated or mediated by many other variables, such as leader-member relationships (Zohar & Luris, 2004), safety priorities (Zohar, 2002) safety climate (Barling et al., 2002; Kelloway et al., 2006; Zohar, 2002), and safety consciousness (Barling et al., 2002; Kelloway et al., 2006).

Though transformational leadership is the most popular type of leadership that has been studied in relation to occupational safety, other types have been investigated as well. Hofmann and Morgeson (1999) looked at the relationship between leader-member exchange (LMX), safety communication, safety commitment, and accidents. They hypothesized a model in which perceived organizational support and LMX lead to safety communication, which in turn leads to safety commitment, and finally to accidents. The researchers found support for their model, as well as significant relationships between LMX and safety communication, safety commitment, and accidents (Hofmann & Morgeson, 1999). Similarly, Mohamed's (2002) study found both

management commitment and communication around safety was significantly related to safety climate, with safety climate being a significant predictor of safe work behaviors.

Safety climate has been shown to be one of the ways leader behaviors can impact safety outcomes (Barling et al., 2002; Kelloway et al., 2006; Zohar, 2002). In a study of restaurant workers, safety specific transformational leadership predicted injuries through the effects of perceived safety climate (Barling et al., 2002). Kelloway and colleagues (2006) found passive and transformational leadership had opposite effects on safety climate, which then predicted safety events and injuries. In another study, line supervisors were trained to better monitor and reward safety, after the training a significant increase in safety climate scores was reported (Zohar, 2002b). Thompson, Hilton, and Witt (1998) looked at a more general "organizational climate" instead of specific safety climate, but found similar results; managers and supervisors can impact safety through the climate they foster.

Many studies on leadership and safety have been conducted in the medical field, due to the amount of importance placed on safety in this industry. Künzle, Kolbe, and Grote (2010) reviewed the literature specifically related to leadership and safety in critical care teams. The authors drew the conclusion that "…effective leaders play a pivotal role in promoting team performance and safety" (p. 1). The authors defined effective leadership as consisting of clear and unambiguous behavior, which was also adaptive to the situation and shared between team members. In an empirical study on nurses, researchers examined leaders as safety role-models, measured by the distribution of safety information and the leader's priority given to safety (Katz-Navon, Naveh, & Stern, 2007). The level of role modeling in which the leader engaged was related to nurses' safety self-efficacy, which predicted patient safety.

The leadership – safety relationship is often times mediated or moderated by a third variable. However, in one study, trust in leadership mediated the relationship between high-performance work systems and safety performance and incidents (Zacharatos, Barling, & Iverson, 2005). In this study, safety performance was measured in terms of personal-safety orientation, which consisted of safety knowledge, safety motivation, safety compliance, and safety initiative; safety incidents included injuries that required first aid and near misses.

In a longitudinal field study, Zohar (2002b) looked at the impact of training line supervisors to better monitor and reward safety. This included making safety its own performance goal, not putting speed or schedule demands above safety, and increasing safety-oriented interactions. After training there was a significant decrease in minor injury rates and significant increases in safety climate scores and specific safety behaviors (e.g., earplug use).

One thing that many types of leadership have in common is that they all offer some kind of support. Common types of support include inspirational support, transformational leadership, and support by communication and offering information and knowledge. The variable 'leadership' often falls into the category of supportive environment in studies looking at multiple environmental and organizational factors (Nahrgang et al., 2011; Parker, Axtell, & Turner, 2001). In their study, Parker and colleagues (2001) did not make a distinction between the multiple types of leadership. Instead, they measured a more general concept of leadership, which they called supportive supervision. Results showed that supportive supervision had a lagged (one year later) positive effect on safe working.

Through decades of research and hundreds of studies it has become the consensus that leadership is related to safety outcomes. The relationship has proven complex, with multiple

mediators and moderators, including leader-member relationships, safety climate, and safety consciousness. The goal of this study is to add to the body of literature by examining the relationship between supportive leadership, employee engagement, and safety. The review of the leadership and occupational safety literature leads to the first two hypotheses:

H1: *Supportive leadership is positively related to safety climate*

H2: *Supportive leadership is negatively related to total injury rate*

Employee Engagement and Occupational Safety

Employee engagement has recently been defined as a positive, fulfilling, work-related state of mind characterized by vigor, dedication, and absorption (Schaufeli, Salanova, González-Romá, & Bakker, 2002). The majority of the most recent meta-analyses and reviews on occupational safety do not mention employee engagement (Christian, 2009; Clarke, 2005; Clarke, 2006; DeJoy, 2005). A meta-analysis consisting of 7,939 business units in 36 different companies found only three studies measuring employee engagement and safety (Harter et al., 2002). Though there is not a great deal of research, the studies that have been conducted have clearly found a relationship between employee engagement and safety behaviors.

One meta-analysis looked specifically at employee engagement and its effects on multiple business-unit outcomes (Hater et al., 2002). Findings indicated business-unit level employee engagement predicted multiple business-unit outcomes, including accidents. This meta-analysis used studies conducted by The Gallup Organization that used the Gallup Workplace Audit to measure employee engagement. The items that make up the Gallup Workplace Audit are typically used as a measure of job satisfaction. However, in this meta-

analysis the researchers "refer to them as measures of employee engagement to differentiate these actionable work-group-level facets from the more general theoretical construct of job satisfaction" (Harter et al., 2002, p. 269). The safety variable was a lost workday/time incident rate or a percentage of workdays lost because of incidents. As noted previously, safety data were available for only three studies. Significant relationships were found between employee engagement and customer satisfaction-loyalty, employee turnover, safety, productivity, and profitability, with safety being one of the strongest findings.

In a more recent meta-analysis Nahrgang and colleagues (2011) were interested in the link between job demands, job resources, burnout, employee engagement, and safety outcomes. The study included 203 independent samples, though the researchers did not clearly state how many of those were used to analyze the employee engagement – safety relationship. The researchers found that employee engagement significantly related to safety outcomes. Furthermore, a facet of employee engagement (compliance) partially mediated the relationship between job demands and job resources and safety outcomes. A relationship between other job demands/resources, facets of employee engagement, and safety outcomes was not investigated.

Although the academic research on employee engagement and safety is limited, organizations appear to be conducting internal research on these relationships. Through their research in multiple organizations, The Gallup Organization has found negative safety outcomes (e.g., accidents, etc.) down by 50 percent among engaged employees compared to nonengaged and actively disengaged employees (Kimbell & Nink, 2006). In a case study at the MolsonCoors beverage company, engaged employees were five times less likely to have a safety incident and seven times less likely to have a lost-time safety incident (Lockwood, 2007). Translating safety

into dollar amounts, at MolsonCoors the average cost of a safety incident for engaged employees was $63, compared to $392 for nonengaged employees (Lockwood, 2007). "Consequently, through strengthening employee engagement, the company saved $1,721,760 in safety costs in 2002" (Lockwood, 2007, p. 3).

Employee Engagement and Other Business Outcomes

While there is relatively little research on the relationship between employee engagement and safety, there is plenty of research relating employee engagement to other organizational outcomes. For example, the Gallup Organization found employee retention up 44 percent and productivity up 50 percent for engaged employees compared to those employees classified as nonengaged or actively disengaged (Kimbell & Nink, 2006). In a brief review of literature, Bakker and Schaufeli (2008) note that engaged employees are more creative, more productive, and more willing to go the extra mile. In another review, researchers propose a performance management model emphasizing improving employee engagement in order to achieve higher business performance (Gruman & Saks, 2011).

Employee engagement has been shown to predict business outcomes in multiple fields. In a study on Spanish hotel employees, engagement predicted customer-rated employee performance and customer loyalty, through service climate (Salanova, Agut, & Peiró, 2005). In fire-fighters, engagement mediated the relationships of value congruence, perceived organizational support, and core self-evaluations with both task performance and organizational citizenship behaviors (Rich, LePine, & Crawford, 2010). In another study, Xanthopoulou, Bakker, Demerouti, and Schaufeli (2009) asked Greek restaurant workers to keep daily diaries. Findings showed that performance was better and daily financial returns were higher on days

employees were more engaged. A study conducted using participants from multiple different sectors and jobs found colleagues rated engaged employees higher on both in-role and extra-role behavior (Bakker et al., 2004).

The review of the employee engagement literature leads to this study's third hypothesis.

H3: *Employee engagement is negatively related to total injury rate*

Linking Leadership, Employee Engagement, and Occupational Safety through the Job-Demands Job-Resource Model

There is a fair amount of research looking at how leadership relates to safety and at how leadership may interact with other variables (e.g., safety climate, leader-member relationships, safety consciousness) in relation to safety. Leadership had been found to be related to employee engagement. However, there are no empirical studies investigating how supportive leadership behaviors and employee engagement function to predict safety behaviors.

The JDR model is a useful conceptual model for understanding how a job resource, such as supportive leadership, may relate to safety behaviors through the motivational mechanism of employee engagement (Bakker & Demerouti, 2007; Demerouti et al., 2001). The first premise of the JDR model is that in every job there are certain job demands and job resources, which is a well-supported claim (Schaufeli, Bakker, & Van Rhenen, 2009). Job demands are "physical, psychological, social, or organizational aspects of a job that require sustained physical and/or psychological (cognitive or emotional) effort or skills" and are therefore associated with physiological and psychological costs (Bakker & Demerouti, 2007, p. 312). Examples include: intense work pressure, unfavorable working conditions, and physically or emotionally

demanding tasks. Job resources are "physical, psychological, social or organizational aspects of the job that are either/or: functional in achieving work goals, reduce job demands, stimulate personal grown, learning, and development" (Bakker & Demerouti, 2007, p. 312). Some examples are a supportive environment, autonomy, and job knowledge.

The second premise of the JDR model is that two different underlying psychological processes play a role in developing job strain and job motivation. The first is the health impairment process, in which constant job demands exhaust employees (emotionally and physically), and can lead to burnout. The other process is the motivational process. Under the JDR model, job resources are assumed to increase motivation and lead to outcomes such as employee engagement and high performance. Put simply, job demands lead to exhaustion and burnout, while job resources lead to motivation and employee engagement. However, the two processes are not mutually exclusive. Job demands can negatively affect employee engagement, while job resources decrease the likelihood of burnout.

Finally, the JDR model posits that burnout and employee engagement will be related to multiple organizational outcomes. Burnout, caused by the strain of job demands and/or lack of job resources, has a negative impact on organizational outcomes. Conversely, employee engagement, caused by the motivational aspects of job resources, has a positive relationship with organizational outcomes. Just as the JDR model is not limited to certain types of work or jobs, nor is it limited to predicting specific organizational outcomes. Empirical support for the JDR model has been growing over the past decade.

Evidence supporting the JDR Model

The initial assumption of the JDR model is that all jobs have certain demands they place on employees, and that these job demands relate to burnout. Bakker, Demerouti, and Euwema (2005) found evidence of this in their study of employees at a university, using work overload, emotional demands, physical demands, and work-home interference as job demands. Work overload is a common job demand, though how it is measured varies from industry to industry. In a study with nurses, work overload was measured by staffing adequacy (Laschinger & Leiter, 2006). Researchers found that staffing adequacy had a significant inverse relationship with emotional exhaustion (e.g., burnout), which was in turn related to patient safety outcomes. Another study looking at work overload, along with emotional demands, found these job demands related to burnout, and burnout to be predictive of future sickness duration (Schaufeli et. al., 2009).

Increasing job resources is one way to attempt to weaken the relationship between job demands and burnout and buffer against the negative effects job demands can have on engagement. In one study conducted in Finland, researchers looked at student misconduct as a job demand and how it related to work engagement in teachers (Bakker, Hakanen, Demerouti, & Xanthopoulou, 2007). Out of six job resources measured, four (supervisor support, innovativeness, appreciation, and organizational climate) helped to buffer against the negative effect student misconduct had on teacher work engagement. In an earlier study, Bakker and colleagues (2005) looked at a more complex relationship between job demands and job resources. This study included multiple job demands, multiple job resources, and three different facets of burnout. Job demands and resources interacted differently depending on the facet of

burnout. However, the majority of the time, job resources did buffer against the affects job demands had on two of the facets of burnout (exhaustion and cynicism). These studies show that job resources are not only important because of their relationship with employee engagement, but also with their positive effects on employee burnout.

The impact job resources have on employee engagement has been shown in multiple studies across many occupational groups. An early study of the JDR model looked at this relationship in the service industry, the production/manufacturing industry, and the transportation industry (Demerouti et al., 2001). In all three industries researchers looked at feedback, rewards, job control, participation, job security, and supervisor support as job resources. In all three industries a clear relationship between job resources and employee engagement was found.

One of the few longitudinal studies looking at the JDR model was conducted by Schaufeli and colleagues (2009) on telecommunications managers. Researchers measured three job demands and four job resources at one point in time, along with two facets of both burnout and engagement. All variables were measured again one year later. Analysis showed that changes in job demands and resources predicted future burnout and work engagement. When job demands increased and job resources decreased, future burnout scores increased (after controlling for time one burnout scores). When job resources increased, future work engagement also increased (after controlling for work engagement scores in time one). Additionally, burnout was related to future sickness duration, while engagement related to future sickness frequency. Overall, their study supports the motivational process proposed by the JDR model.

A recent meta-analysis sought to understand the link between both job demands and resources with employee engagement and burnout (Crawford et al., 2010). The meta-analysis

consisted of 55 manuscripts and articles and looked at multiple job demands and job resources. Using meta-analytic structural modeling, the results indicated that all types of job resources (feedback, support, autonomy, etc.) were significantly related to employee engagement, whereas only some job demands showed a significant negative relationship with engagement. Job resources also consistently displayed a negative relationship with burnout, while job demands showed a consistent positive relationship with burnout. The importance of job resources for employee engagement was highlighted again in a recent view of engagement (Bakker, 2011). The author noted job resources, such as performance feedback, social support, autonomy, skill variety, and learning opportunities have consistently been related to engagement. In addition, personal resources (i.e., positive self-evaluations) are also important for engagement, which led to the researcher's conclusion "that job and personal resources are the main predictors of engagement" (Bakker, 2011, p. 265).

Though the link between job resources and engagement has been supported in a number of studies, the role leadership plays as a job resource has not attracted much attention in the JDR literature. Social support, or a supportive environment, is a fairly common and well supported job resource (Crawford et al., 2010; Nahrgang et al., 2011). Leadership is generally assumed to fall under the umbrella of supportive environment or social support. According to the premises of the JDR model, if leadership is a job resource, it is related to employee engagement, which is related to performance outcomes. There is already some evidence that supports this idea.

In two very recent studies conducted abroad, one in China and the other in Korea, researchers found transformational leadership was related to performance outcomes, via its relationship with engagement (Ayree, Walumbwa, Zhou, & Hartnell, 2012; Song, Kolb, Lee, &

Kim, 2012). Ayree and colleagues (2012) collected data from a large telecommunications company in China to examine the leadership—engagement—performance relationship. Their results showed transformational leadership predicted engagement, which in turn related to innovative behavior and task performance. Similar results were found in a study in which data were collected from multiple organizations within Korea (Song et al., 2012). Their results showed transformational leadership related to both engagement and their performance variable, referred to as organizational knowledge creation. Moreover, engagement mediated the relationship between transformational leadership and knowledge creation. These two studies lend support to leadership as a job resource and how it fits into the JDR model.

The support for the relationship between job resources and employee engagement is strong and leads to the fourth hypothesis of the present study.

H4: *Supportive leadership is positively related to employee engagement.*

The JDR Model and Occupational Safety

With research on the JDR model growing in the past decade, studies have used it to predict multiple performance outcomes, including innovative behavior (Ayree et al., 2012), in-role and extra-role performance (Bakker et al., 2004), customer loyalty (Salanova et al., 2005) turnover intention (Schaufeli & Bakker, 2001), sickness frequency and duration (Schaufeli et al, 2009), and financial returns (Xanthopoulou et al., 2009). Very few studies have used the JDR model in relation to occupational safety outcomes.

A study conducted on construction workers looked at multiple work-related stressors (job demands) and how they related to self-reported injuries and near misses (Goldenhar et al, 2003).

Of the 12 work stressors measured, 10 significantly predicted injuries and near misses. Another study, conducted before the introduction of the JDR model, investigated how a supportive environment (a job resource) was related to unsafe behaviors and accidents in a chemical processing plant (Hofmann & Stetzer, 1996). Results showed aspects of a supportive environment, namely work group process and safety climate, significantly related to unsafe behaviors and actual accidents.

Recently, Nahrgang and colleagues (2011) conducted a meta-analysis focusing on workplace safety, using the JDR model to link job demands, job resources, burnout, engagement, and safety outcomes. In their model, job demands consisted of risks and hazards, physical demands, and task complexity. Job resources were knowledge, autonomy, and a supportive environment (including social support, leadership, and safety climate). The safety outcomes they examined were accidents and injuries, adverse events, and unsafe behaviors. Analysis showed all job resources were significantly related to burnout, engagement, and safety outcomes. Risk and hazards and task complexity were also related to burnout, engagement, and safety outcomes. Researchers then took the job demand (risks and hazards) and job resource (safety climate) that accounted for the most unique variance in the mediator/outcome to test the mediation hypotheses of the JDR model. Burnout and engagement partially mediated the relationship between risk and hazards and safety climate with safety outcomes.

Safety Climate and Safety Behaviors

Similar to leadership, safety climate has been a popular area of study for decades (Zohar, 2010). The research relating safety climate with safety behaviors draw clear conclusions regarding the importance of safety climate on safety related outcomes (Zohar, 2010). In

Christian and colleague's (2009) meta-analysis, group safety climate proved to be the strongest predictor of occupational injuries. Another meta-analysis showed a strong relationship between safety climate and safety performance (compliance and participation), but a weak relationship between safety climate and accidents (Clarke, 2006).

Also similar to leadership, safety climate is considered a job resource in the JDR model (Nahrgang et al., 2011). There have been multiple studies using safety climate as a job resource supporting the JDR model. Hofmann and Stetzer (1996) measured safety climate as part of a supportive environment, which predicted unsafe behaviors in a chemical processing plant. Safety climate has also been shown to relate to safety communication (Hofmann & Stetzer, 1998). In a study conducted with nurses, safety climate weakened the relationship between client variability and occupational strain, which was then related to injury (Chowdhury & Enders, 2010). Another study found when there was a strong safety climate incident rates were lower among production workers (Evans et al., 2005). Law, Dollard, Tuckey, and Dormann (2011) tested part of the JDR model (the link between job resources and engagement) using safety climate as the job resource and found support for the relationship between safety climate and employee engagement. Also testing the JDR model, a study on aviation maintenance personnel found the relationship between safety climate and errors to be at least partially mediated by psychological strain (Fogarty, 2004). The safety climate research supports the following two hypotheses.

H5: *Safety climate is positively related to employee engagement*

H6: *Safety climate is negatively related to total injury rate*

Nahrgang and colleagues' (2011) recent meta-analysis is the most comprehensive look at how the JDR model may help in understanding and reducing accidents in the work place. However, many relationships were not fully tested in the analysis. One relationship of interest is the leadership, employee engagement, and safety outcomes relationship. Leadership accounted for a significant amount of unique variance in engagement as well as the safety outcomes, but there was no further analysis. In most organizations, leadership is viewed as one of the most important antecedents to many performance outcomes, including safety. A study aimed specifically at examining the leadership—safety relationship, and its possible meditation by engagement, would be a valuable addition to the JRD model literature, and could have practical implications to work place safety, which leads to the following hypotheses:

H7: *Employee engagement will mediate the relationship between supportive leadership and total injury rate.*

H8: *Employee engagement will mediate the relationship between safety climate and total injury rate.*

Table 1

Summary of Hypotheses

1	Supportive leadership is positively related to safety climate
2	Supportive leadership is negatively related to total injury rate
3	Employee engagement is negatively related to total injury rate
4	Supportive leadership is positively related to employee engagement
5	Safety climate is positively related to employee engagement
6	Safety climate is negatively related to total injury rate
7	Employee engagement will mediate the relationship between supportive leadership and total injury rate
8	Employee engagement will mediate the relationship between safety climate and total injury rate

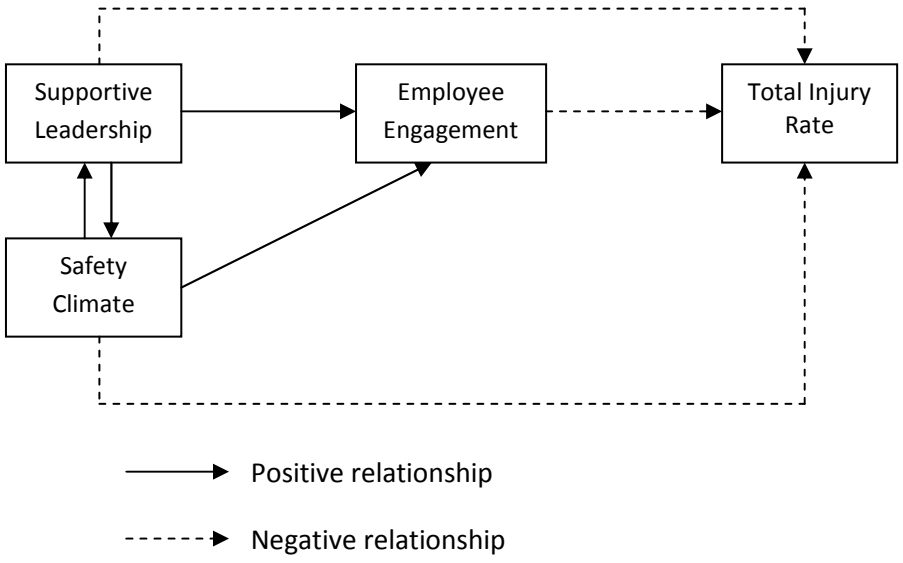

Figure 1: Graphical depiction of hypotheses.

CHAPTER II
METHODS

Research Design

The current archival field study examined the relationships among supportive leadership, employee engagement, and first-aid and injury rates in a work environment. Supportive leadership, employee engagement, safety climate, and first-aid and injury rates are the measured variables. Supportive leadership, employee engagement, and safety climate data were gathered through self-report questionnaires, completed once per year over the course of three fiscal years (October-September), 2007-2009. The questionnaire used to collect data on supportive leadership, safety climate, and employee engagement was designed by a psychologist working for the organization. Past research, theory, and common best practices for employee engagement surveys were used to design the survey items. The employee population responding to the questionnaire varied across years due to turnover, and the archival data did not include identifies to link individual employee responses over the course of the three years. Because of this, the extent to which the populations overlap from year to year cannot be determined. Supportive leadership, employee engagement, and safety climate data were all measured at the individual level.

The organization's archival records were used to gather first-aid and recordable injury data for multiple locations within the organization for three fiscal years, 2007-2009, which overlap with the survey data. First aid and recordable injury data were only available as an aggregate at the site level. Individual level injury data were not available from the organization's archival records. Therefore, individual level data were obtained for the predictor measures and aggregated site level data were obtained for the criterion measures.

Participants

The population for this study consisted of 1,577 employees in 2007, 569 employees in 2008, and 1,166 employees in 2009. Because the archival dataset did not provide unique identifiers for employees from year to year and due to turnover it cannot be known the total number of unique individuals included in the study. Employees came from multiple departments located at 11 different locations of a utility company.[1] Locations spanned three states and were power generation sites. The respondent population was 82% male and 76% identified themselves as white. Seventy-nine percent of employees had tenures with the company of more than five years, with 16% having tenures greater than 30 years. The majority of respondents were trades, labor, and craft workers, at 72%

Procedures

For each of the three survey administrations supportive leadership, employee engagement, and safety climate were measured at one time, as part of a larger organizational health survey. Employees had two weeks to complete the survey. Employees were notified of the survey via email, which included a link to complete the survey. Employees also received two reminder emails during the course of the survey window. It was made clear via the emails that participation in the survey was voluntary and that one's responses were confidential. Employees completed the survey during regular working hours. Paper copies of the survey were provided for employees who wished to participate but did not have regular access to a work computer.

In 2007, all employees in the organization were invited to participate in the survey, with a

[1] At three sites within the company total injury was near zero and was consistently significantly lower than the other sites within the organization, because of this those sites were not included in data analysis.

response rate of 80.2%. In 2008, only half of the employees of the organization were asked to participate. Employees invited to participate were chosen at random. The response rate in 2008 was 69%. In 2009, again, all employees were invited to participate, and the survey ended with a 73.8% response rate.

First-aid rates and injury rates were gathered from the organization's archival records for each year.

Measures

Supportive Leadership

Supportive Leadership was measured using a five-item scale. The response format for this measure was a 5-point Likert scale (1=strongly disagree to 5=strongly agree) with an "N/A" response option. The reliability of this 5-item scale for this sample was $\alpha = .88$. A sample item from the scale is: "My supervisor takes the time often enough to talk about my progress on the job".

Employee Engagement

Employee Engagement was measured using a six-item scale. The response format for this measure was a 5-point Likert scale (1=strongly disagree to 5=strongly agree) with an "N/A" response option. The reliability of this 6-item scale for this sample was $\alpha = .85$. A sample item from the scale is: "I am proud to work at [organization]".

Safety Climate

Safety Climate was measured using a two-item scale. The response format for this measure was a 5-point Likert scale (1=strongly disagree to 5=strongly agree) with an "N/A" response option. The reliability of this 2-item scale for this sample was $\alpha = .77$. A sample item from the scale is: "I feel comfortable reporting an unsafe act or condition".

Recordable Injuries

Recordable injuries were gathered from the company's Occupational Safety and Health Administration (OSHA) Injury Report for each year. Injuries are classified as recordable if the injury or illness results in one of the following: death, days away from work, restricted work or transfer to another job, medical treatment beyond first aid, loss of consciousness, or a significant injury or illness diagnosed by a physician or other licensed health care professional. Injury classifications include: amputation; bite, sting; bruise, contusion; burn; concussion, unconscious; cut, laceration, puncture; exhaustion, heat stroke; electric shock; foreign body; fracture, crush, dislocate; hernia; loss of senses; occupational illness/disease; scratch, abrasion; sprain, strain, torn; suffocation, inhalation.

First Aid Injuries

First aid injuries were gathered from the company's First Aid Injury Log for each year. An injury or illness is categorized as a first aid injury if it requires only basic first aid and does not result in any of the criteria listed above for a recordable injury. Over-the-counter medication, cleaning of wounds, eye patches, and hot/cold treatment are some examples of first-aid. Injury classifications include: bite, sting; bruise, contusion; burn; cut, laceration, puncture; exhaustion,

heat stroke; foreign body; facture, crush, dislocate; occupational illness/disease; scratch, abrasion; sprain, strain, torn.

Variables

Supportive leadership was measured with a five-item scale. All responses were scored from 1 to 5 with a maximum aggregated average score of 5.0 representing the highest level of supportive leadership and a minimum aggregated average score of 1.0 representing the lowest level of supportive leadership. Scores were averaged for each respondent each of the three years.

Employee engagement was measured with a six-item scale. All responses were scored from 1 to 5 with a maximum aggregated average score of 5.0 representing the highest level of employee engagement and a minimum aggregated average score of 1.0 representing the lowest level of employee engagement. Scores were averaged for each respondent each of the three years.

Safety climate was measured with a two-item scale. All responses were scored from 1 to 5 with a maximum aggregated average score of 5.0 representing the highest level of safety climate and a minimum aggregated average score of 1.0 representing the lowest level of safety climate. Scores were averaged for each respondent each of the three years.

Total injury rate was created as an aggregate of recordable injuries and first aid injuries per site per year. Recordable injuries and first-aid injuries were aggregated to create one total injury rate variable for two reasons. First, there is no theoretical reason to assume the predictor variables (supportive leadership, safety climate, and employee engagement) would differently affect recordable injuries versus first-aid injuries. Second, both types of injuries are rare and have little variance, combining them into one total injury rate variable allowed for increased variance in a single outcome measure.

In order to create total injury rates for each site for all three years, recordable and first aid injury rates were first computed. Recordable injury rates were computed for each site by dividing the total number of recordable injuries at the site by the number of employees at the site in the same year. This was done for each of the three years. First aid injury rates were computed for each site by dividing the total number of first-aid injuries at the site by the number of employees at the site in the same year. This was done for each of the three years. Recordable injury rate and first aid injury rate were then combined to create total injury rate with a maximum aggregated average of .1049 representing the highest level of total injury rate and a minimum aggregated average of .01188 representing the lowest level of total injury rate. All participants at a given site in a given year had the same total injury rate. This was because injury data were only available at the site level, and not the individual level.

CHAPTER III
RESULTS

Data Analysis and Results

Hypotheses were analyzed using two statistical methods. Hypotheses 1-6 were analyzed using the Pearson *r* correlation coefficient. Hypotheses 7 and 8 were analyzed using the bootstrap method of mediation. The bootstrap method of mediation involves the random sampling of the data several times and testing for mediation each time (Preacher & Hays, 2008). Estimates from the bootstrap method are more robust and form the basis of the confidence intervals that are reported (Balkundi, Barsness, & Michael, 2009). This method is applicable when sample size is small, the effect size is predicted to be small, or, as is the case with the current study, when assumptions of classical statistical methods are not met (MacKinnon, Lockwood, & Williams, 2004; Mallinckrodt, Abraham, Wei, & Russell, 2006; Shrout & Bolger, 2002). In the current study, the criterion measure, total injury rate, is not normally distributed. One can also assume the effect size will be small, given the low injury rate and restricted variance. Based on these considerations, bootstrapping is the appropriate statistical method to test for mediation for hypotheses 7 and 8.

Descriptive Statistics

The N, mean, standard deviation, and minimum and maximum values for all variables in the study can be found in Table 2. The descriptive statistics are also broken down by year, 2007, 2008, and 2009, as well as a composite of all years, 2007-2009. As can be seen in Table 2, out of the three predictor variables, safety climate was the highest scoring variable throughout the three years, with an average of 3.75. Safety climate also had the highest average standard

deviation, 1.03. Supportive leadership was the lowest scoring predictor, with a three year average of 3.21. Employee engagement averaged the lowest standard deviation of the predictor variables at 0.77.

Table 2

Study Variables: Descriptive Statistics for Years 2007-2009

		Mean	SD	Min	Max
Safety Climate	2007	3.81	0.97	1	5
	2008	3.79	1.01	1	5
	2009	3.64	1.1	1	5
	2007-2009	3.75	1.03	1	5
Supportive Leadership	2007	3.26	0.91	1	5
	2008	3.24	0.91	1	5
	2009	3.12	0.97	1	5
	2007-2009	3.21	0.93	1	5
Employee Engagement	2007	3.67	0.75	1	5
	2008	3.66	0.74	1	5
	2009	3.58	0.8	1	5
	2007-2009	3.63	0.77	1	5
Total Injury Rate	2007	0.0385	0.0141	0.0150	0.0686
	2008	0.0359	0.0174	0.0119	0.0662
	2009	0.0565	0.0243	0.0124	0.1049
	2007-2009	0.0445	0.0209	0.0124	0.1049

2007 N = 1,577; 2008 N = 569; 2009 N = 1166; 2007-2009 N = 1322

A one-way ANOVA was conducted to investigate any differences there may have been across years. Results of the ANOVA show the average of all three predictor variables (safety climate, supportive leadership, and employee engagement) were significantly lower in 2009 than the previous two years ($p < .05$). Average predictor scores from 2007 and 2008 did not significantly differ from one another.

Average total injury rates were also significantly different from year to year. Results of the ANOVA showed the average total injury rate was significantly higher in 2009 than in 2007 or 2008 ($p < .001$). Average total injury rate was also significantly higher in 2007 than in 2008 ($p < .05$). Therefore, total injury rate significantly differed across all three years, with 2008 having the lowest average total injury rate and 2009 having the highest average total injury rate.

Correlations and Hypotheses 1-6 Testing

Hypotheses 1- 6 were tested using the Pearson *r* correlations coefficient. The correlations matrices for each year, as well as the composite for all years, can be seen in table 3. Hypotheses 1, 4, and 5 predicted supportive leadership, safety climate, and employee engagement would be positively related to one another. Theses hypotheses were fully supported with all three variables having significantly positive relationships ($p < .01$) with one another for all three years, as well as the composite for 2007-2009. Correlations ranged from $r = .716$, for supportive leadership and safety climate, to $r = .532$, for employee engagement and safety climate.

Hypothesis 2 predicted supportive leadership relates negatively to total injury rate, this relationship was partially supported. In 2007, supportive leadership showed a slightly positive relationship with total injury rate, though the correlation was not significant ($r = .036$, $p = .150$).

Supportive leadership had a non-significant negative correlation with total injury rate in 2008 (r = -.058, p = .168). In 2009, and overall (2007-2009), supportive leadership showed a significantly negative relationship with total injury rate at the $p < .01$ level (r = -.125 and r = -.079, respectively). Thus, data partially supported hypothesis 2, supportive leadership and total injury rate have a negative relationship with one another.

Hypothesis 3 predicted employee engagement would have a negative relationship with total injury rate. This hypothesis was partially supported. In 2008, 2009, and the 2007-2009 composite, employee engagement showed a significant negative relationship with total injury rate with r = -.112, r = -.155, and r = -.091, respectively ($p < .01$ for all). However, in 2007, employee engagement had a non-significant positive correlation with total injury rate (r = .047, p = .061). Due to the 2007 correlation, hypothesis 3 was only partially supported.

Hypothesis 6 stated safety climate relates negatively to total injury rate, this hypothesis was partially supported. Safety climate showed a negative, though non-significant, correlation with total injury rate in both 2007 and 2008 (r = -.013, p =.600; r = -.06, p = .154, respectively). In 2009, and when all years were combined, safety climate had a significant negative relationship with total injury rate (r = -.068, $p < .05$; r = -.075, $p < .05$, respectively). Though all correlations were in the predicted direction, only two of the four were significant, therefore hypothesis 6 was partially supported.

Table 3

Correlation Matrices

Variable	1	2	3	4
	2007			
1. Safety Climate	**.78**			
2. Supportive Leadership	.713**	**.87**		
3. Employee Engagement	.587**	.702**	**.85**	
4. Total Injury Rate	-.013	.036	.047	--
	2008			
1. Safety Climate	**.76**			
2. Supportive Leadership	.716**	**.88**		
3. Employee Engagement	.586**	.689**	**.86**	
4. Total Injury Rate	-.060	-.058	-.122**	--
	2009			
1. Safety Climate	**.77**			
2. Supportive Leadership	.703**	**.88**		
3. Employee Engagement	.532**	.668**	**.86**	
4. Total Injury Rate	-.068*	-.125**	-.155**	--
	2007-2009			
1. Safety Climate	**.77**			
2. Supportive Leadership	.711**	**.88**		
3. Employee Engagement	.567**	.688**	**.85**	
4. Total Injury Rate	-.075**	-.079**	-.091**	--

2007 N = 1,577; 2008 N = 569; 2009 N = 1,166; 2007-1009 N = 3,312

Bold diagonal entries show scale reliabilities calculated using Cronbach's Alpha

* = p< .05

** = p< .01

Tests for Mediation

Hypothesis 7 predicted employee engagement would mediate the relationship between supportive leadership and total injury rate. To test this hypothesis the bootstrapping test for mediation was conducted for each year of the study as well as all years combined, 2007-2009. The results suggest that the indirect (mediated) effects of supportive leadership on total injury rate through employee engagement are statistically significant in three out of the four analyses, given that none of the 95% confidence intervals contain zero. Confidence intervals can be seen in table 4. For all significant meditation analyses regression weights for supportive leadership to employee engagement are positive, and all regression weights for employee engagement to total injury rate are negative. This indicates higher supportive leadership is related to increased employee engagement which is related to lower total injury rates. Regression weights for supportive leadership to total injury rate are all non-significant, which is consistent with mediation. Regression weights can be seen in table 6. The only year where the mediated relationship is not significant is 2007, which would be expected based on the 2007 correlations discussed earlier in the section. The other three bootstrapping analyses suggest the relationship of supportive leadership on total injury rate is mediated by employee engagement. Therefore, hypothesis 7 was partially supported.

Hypothesis 8 predicted employee engagement would mediate the relationship between safety climate and total injury rate. To test this hypothesis the same bootstrapping analyses were conducted as to test hypothesis 7. The results suggest that the indirect (mediated) effects of safety climate on total injury rates through employee engagement are statistically significant for all three years as well as overall, given that none of the 95% confidence intervals contain zero.

Confidence intervals can be seen in table 5. Interestingly, the 2007 results show the relationship in the opposite direction of the other three years, with positive confidence intervals instead of negative. Regression weights for the 2007 analysis show the direct path from safety climate to total injury rate is significantly negative ($\beta = -.062$, $p<.05$). However the direct path from employee engagement to total injury rate is significantly positive ($\beta = .084$, $p< .01$). Taking into consideration the confidence intervals and the regression weights, this analysis suggests partial mediation by employee engagement on the relationship between safety climate and total injury rate in 2007. For 2008, 2009, and 2007-2009, regression weights for safety climate to employee engagement are all positive, and regression weights for employee engagement to total injury rate are negative, indicating higher safety climate is related to increased employee engagement which is related to decreased total injury rates. All regression weights for safety climate to total injury rate are non-significant, supporting mediation. Regression weights can be seen table 7. The analyses testing hypothesis 8 are mixed, with three of the analyses supporting mediation and one supporting only partial mediation and in the inverse direction of the other three analyses. Thus, only partial support was found for hypothesis 8.

Table 4

Bootstrapping-Based Mediation of Supportive Leadership on Total Injury Rate Through Employee Engagement

	Bootstrap Results			
	Percentile 95% CI		Bias Corrected 95% CI	
Year	Lower	Upper	Lower	Upper
2007	-0.013	0.071	-0.015	0.070
2008	-0.158	-0.032	-0.158	-0.033
2009	-0.131	-0.043	-0.130	-0.042
2007-2009	-0.075	-0.021	-0.074	-0.021

CI = confidence interval

Table 5

Bootstrapping-Based Mediation of Safety Climate on Total Injury Rate Through Employee Engagement

	Bootstrap Results			
	Percentile 95% CI		Bias Corrected 95% CI	
Year	Lower	Upper	Lower	Upper
2007	0.017	0.079	0.017	0.079
2008	-0.118	-0.021	-0.118	-0.022
2009	-0.12	-0.058	-0.12	-0.057
2007-2009	-0.06	-0.021	-0.06	-0.021

CI = confidence interval

Table 6

Standardized Regression Weights for Supportive Leadership and Total Injury Rate Mediated by Employee Engagement

	Employee Engagement				Total Injury Rate			
Variable	2007	2008	2009	07-09	2007	2008	2009	07-09
Supportive Leadership	.702***	.689***	.668***	.688***	.006	.037	-.04	-.032
Employee Engagement	--	--	--	--	.043	-.138*	-.128***	-.069**

*p<.05. **p<.01. ***p<.001

Table 7

Standardized Regression Weights for Safety Climate and Total Injury Rate Mediated by Employee Engagement

	Employee Engagement				Total Injury Rate			
Variable	2007	2008	2009	07-09	2007	2008	2009	07-09
Safety Climate	.587***	.586***	.668***	.567***	-.062*	.009	.02	-.035
Employee Engagement	--	--	--	--	.084**	-.118*	-.165***	-.071***

*p<.05. **p<.01. ***p<.001

CHAPTER IV
DISCUSSION

The primary purpose of the current study was to understand the influence of employee engagement as a mediator of the relationship between supportive leadership and safety outcomes. This study seeks to provide additional support to the JDR model by investigating the relationship between supportive leadership, employee engagement, and safety outcomes, which to this date had not been specifically addressed in research. The current study also sought to provide further support for the mediated relationship of safety climate on safety outcomes through employee engagement (Nahrgang et al., 2011). The following section provides a summary of the results, post hoc analyses, general discussion, limitations and implications of the current field study.

Summary of Results

The current study hypothesized that supportive leadership, safety climate, and employee engagement relate positively to one another. Support was found for all three of these relationships. Moderate to strong significant positive correlations were found between supportive leadership, safety culture, and employee engagement each year over the course of three years. This result adds to the current body of knowledge regarding supportive leadership and safety climate (Barling et al., 2002; Kelloway et al., 2006; Zohar, 2002), and supportive leadership and employee engagement (Ayree et al., 2012; Song et al., 2012). The results also lend support to the less studied relationship between safety climate and employee engagement (Law et al., 2011; Nahrgang et al., 2012).

It was also hypothesized that supportive leadership would negatively relate to total injury rate. Through decades of research and hundreds of studies it has become the general consensus that leadership is related to safety outcomes, though the relationship has proven complex, with multiple mediators and moderators (Barling et al., 2002; Hofmann & Morgeson, 1999; Kelloway et al., 2006; Nahrgang et al., 2011; Zohar, 2002). In this study, only partial support was found for the negative relationship between supportive leadership and total injury rate. In 2007, supportive leadership had a non-significant positive correlation with total injury rate. A non-significant negative relationship was found between the two variables in 2008. In 2009 and in the composite correlation, including all data from 2007 to 2009, supportive leadership was found to have a significant negative relationship with total injury rate. Therefore, the hypothesis was supported by one of the three years of data, as well as by the combined data.

Employee engagement was hypothesized to have a negative relationship with total injury rate as well. While the research on employee engagement and safety outcomes in not as pervasive as that of leadership and safety outcomes, some studies, and at least one meta-analysis, have found support for the negative relationship between the two constructs (Harter et al. 2002; Nahrgang et al., 2011). Only partial support for the negative relationship between employee engagement and total injury rate was found in the current study. In 2007, employee engagement had a non-significant positive relationship with total injury rate. For 2008, 2009, and the overall correlation for 2007-2009 employee engagement did prove to have a significant negative relationship with total injury rate. Therefore, due to the 2007 non-significant correlation, partial support was found for the employee engagement and total injury rate relationship.

In the current study, safety climate and total injury rate were hypothesized to relate negatively to one another. Though the relationship between safety climate and safety outcomes is well supported in the literature (Christian et al., 2009; Clark, 2006; Nahrgang, 2011; Zohar, 2010), only partial support for the relationship was found. Safety climate and total injury rate did have a negative relationship in all three years, as well as the 2007-2009 overall correlation. However, the correlations for 2007 and 2008 were non-significant. Only in 2009 and in the composite correlation did safety climate and total injury rate have a significant negative relationship. Though all correlations were in the predicated direction, only partial support was found for the negative relationship between safety climate and total injury rate.

The main hypothesis for the current study was that employee engagement would mediate the relationship between supportive leadership and total injury rate. Theory, such as the Job-Demands Job-Resources Model, supports the existence of this mediated relationship, though this study was the first to investigate the relationship empirically. The bootstrapping method for mediation was used to test this hypothesis, due the skewed distribution of the criterion measure, as well as the assumed small effect size. Partial support was found for the mediated relationship of supportive leadership on total injury rate by employee engagement. The confidence intervals created by the bootstrapping analyses supported the mediated relationship in 2008, 2009, and while using all data from 2007-2009. In none of these instances did the confidence intervals include zero, suggesting the mediated effects of supportive leadership on total injury rate through employee engagement are statistically significant. The regression weights created by the bootstrapping analyses indicate higher supportive leadership related to increased employee engagement and decreased total injury rate. However, the confidence intervals created for the 2007 analysis did include zero, suggesting the mediated relationship was not significant.

Therefore, only partial support was found for the mediated relationship of supportive leadership on total injury rate by employee engagement.

The final hypothesis in the study stated employee engagement would mediate the relationship between safety climate and total injury rate. Nahrgang and colleagues found support for this relationship in their 2011 meta-analysis. Only partial support was found for the mediated relationship in the current study. Again, the bootstrapping method for mediation was used to test this mediation hypothesis. None of the confidence intervals created for 2007, 2008, 2009, and all data from 2007-2009 included zero, suggesting the indirect (mediated) effects of safety climate on total injury rate through employee engagement are statistically significant. The regression weights created by the bootstrapping analyses for 2008, 2009, and 2007-2009 indicate higher safety climate related to increased employee engagement and decreased total injury rate. However, the regression weights for 2007 suggest higher safety climate related to decreased employee engagement which was then related to increased total injury rate. The regression weights also indicated safety climate was significantly related to injury rate, even after including employee engagement in the analysis. Therefore the support for the relationship of safety climate on total injury rate through employee engagement was mixed.

Table 8

Summary of Results

Hypothesis		Support
1	Supportive leadership is positively related to safety climate	Full support
2	Supportive leadership is negatively related to total injury rate	Partial support
3	Employee engagement is negatively related to total injury rate	Partial support
4	Supportive leadership is positively related to employee engagement	Full support
5	Safety climate is positively related to employee engagement	Full support
6	Safety climate is negatively related to total injury rate	Partial support
7	Employee engagement will mediate the relationship between supportive leadership and total injury rate	Partial support
8	Employee engagement will mediate the relationship between safety climate and total injury rate	Partial Support

Post Hoc Analyses

Analysis of the data shows that all hypotheses were supported by the 2009 data as well as the overall data combining 2007-2009. Six of the eight hypotheses were supported by the 2008 data. Results for the two hypotheses that were not supported in 2008 were both in the predicted direction but did not reach significance. Only three of the eight hypotheses were supported by 2007 data. These results led to a need for a more in-depth analysis of the year to year data.

Though the descriptive statistics for 2007 did not significantly differ from 2008, 2007 data did not support three of the hypotheses that were supported by 2008 data. Because of this a more in-depth investigation of the descriptive statistics at the individual site level by year was conducted. Descriptive statistics for all of the variables in the study, broken down by site, for all years, as well as overall for years 2007-2009, can be seen in table 9.

Sites were rank ordered on scores for each variable for each year of the study to examine patterns across sites. The average total injury rate was then calculated for both the five highest

and the five lowest scoring sites on each predictor variable for each year (see Figures 2-4). As is clear from these figures, the data from these sites follow the expected pattern in 2008 and 2009. For each of employee engagement, supportive leadership, and safety climate, the average total injury rate for the five highest scoring sites on that particular variable was lower than the average total injury rate for the five lowest scoring sites on that particular variable. However, in 2007, for each of the predictor variables, the average total injury rate for the five highest scoring sites was higher than the average total injury rate for the five lowest scoring sites. Based on current knowledge, the 2007 results are the opposite of what one would expect to see and could be a contributing factor to the lack of support for many of the hypotheses in 2007. Sites with lowest total injury rates would be expected to be amongst the highest in the predictor variables, and vice versa.

The ANOVA investigating whether there were differences in the descriptive statistics by year indicated the 2007 and 2008 data were more similar to one another than either was to the 2009 data. However, analyzing the patterns of the descriptive statistics by sites across the different years suggests the 2008 and 2009 data are quite similar in this regard and the 2007 data is different. This analysis helps to explain why all of the hypotheses were supported by the 2009 data, six of the eight hypotheses were supported by the 2008 data, and only three of the eight were supported by the 2007 data. Without including the 2007 data, full support was found for hypotheses 1, 3, 4, 5, 7 and 8, with partial support for hypotheses 2 and 6. Including the 2007 data, full support was found for only hypotheses 1, 4, and 5, with partial support for the rest.

One possibility as to why the 2007 data does not follow the predicted pattern could be the rotational leadership policy at the utility company. In 2005, the utility instituted a program in

which managers at the different sites rotated positions on a set schedule. Leadership rotated between various manager/supervisor positions roughly every six to 12 months, depending on person, sites, and other circumstances. This resulted in a high level of turnover among leadership, while working groups stayed relatively consistent. It is possible employees were still getting used to this program in 2007, and had become more acclimated by 2008 and 2009, thus having less of an impact on survey results in later years.

Another possible reason the 2007 data does not follow a predictable pattern could stem from random variability. When talking about occupational safety, Krause (2005) states "a given exposure today has a different result than it will tomorrow, simply by chance" (p.14). This is to say, the same mistake may lead to an incident one day and not the next, just by chance alone. Krause (2005) is also quick to state he does not mean to say safety is ultimately luck, but that "incident frequency is subject to random variability" (p. 14). Random variability could be one way to explain the patterns of the 2007 dataset and furthermore the lack of support of the majority of hypotheses by the 2007 data.

Since the patterns of the 2008 and 2009 data are so similar the question arises of why did the 2009 data support all of the hypotheses when the 2008 data supported only six of the eight. There are two possible explanations for this. The first goes back to the AVONA of the descriptive statistics by year. The ANOVA indicated the average of all of the 2009 predictor variables were significantly lower than the 2008 predictor averages. Also, the average total injury rate in 2009 was significantly higher than in 2008. It could be possible the total injury rates were too small in 2008 for the Pearson *r* correlate coefficient to be able to detect an effect. This would also explain why the mediation analyses were significant in 2008 when the

correlations were not, the bootstrapping method for mediation is designed to increase the likelihood of detecting small effect sizes.

The second possible explanation for why results that were significant in 2009 were not in 2008 is a simple one: sample size. In 2008 only half of the population was invited to participate in the survey, whereas in 2009 the entire population was invited. Accordingly, this resulted in the 2008 sample being roughly half the size of the 2009 sample (569 compared to 1,133). In 2009 there was more data, and in general more variance, which increases the chance of finding smaller effect sizes. Two hypotheses were not supported by the 2008 data set, supportive leadership and safety climate negatively relating to total injury rate. In both cases the relationship between the two variables was in fact found to be negative, but was non-significant. It is possible that if the 2008 data had included more data these correlations would have reached significance.

Taking the above information into account, if bootstrapping had been used to test hypotheses 2 and 6, instead of the Pearson *r* correlation coefficient, it is possible support would have been found for these hypotheses that were not originally supported by the 2008 data. Bootstrapping is able to detect smaller effect sizes and does not need as large of a sample size as the Pearson *r* correlation coefficient. Based on this idea, bootstrapping was used to test the direct relationships predicted in hypotheses 2 and 6 for the 2008 data. Hypothesis 2 predicted supportive leadership would have a negative relationship with total injury rate and hypothesis 6 predicted safety climate would have a negative relationship with total injury date. Bootstrapping results can be seen in table 10. Unfortunately, results were similar to those results from the Pearson *r* correlations. Regression weights were in the predicted direction (negative), but failed

to reach significance for both of the relationships. Confidence intervals for both relationships included zero and therefore were not significant. The rest of the relationships predicted in hypotheses 1-6 were also tested using bootstrapping and similar results were found, there were no meaningful differences between the bootstrap correlations and the Pearson *r* correlations.

Contribution to Current Knowledge

The main purpose of the current study was to test the mediation of supportive leadership on safety outcomes by employee engagement. The theory supporting the Job-Demands Job-Resources Model supports this mediated relationship, but to this date it had not been tested empirically. Previous studies have looked at parts of the relationship individually. Many studies have looked at leadership and its relationship with safety outcomes through multiple mediators and moderators (Barling et al., 2002; Hofmann & Morgeson, 1999; Kelloway et al., 2006; Nahrgang et al., 2011; Zohar, 2002;). Two recent studies have found a significant relationship between leadership and employee engagement (Ayree et al., 2012; Song et al., 2012). Studies relating employee engagement to safety outcomes are not as prevalent as those around leadership and safety outcomes, but the few studies that have been conducted have shown a negative relationship between the two variables (Harter et al. 2002; Nahrgang et al., 2011). This study integrated these lines of research as well as lent support to one part of the JRD model that had yet to be tested, the relationship between leadership and safety outcomes as mediated by employee engagement.

Another purpose of the study was to add support to the relationship of safety climate and safety outcomes mediated by employee engagement. Many studies support parts of this relationship. The safety climate and safety outcomes relationship is one of the most well

supported findings in the safety literature, including multiple meta-analyses and reviews (Christian et al., 2009; Clark, 2006; Nahrgang et al., 2011; Zohar, 2010). The relationship between safety climate and employee engagement is not commonly studied, however there is some support for a positive relationship between the two constructs (Law et. al., 2011). A recent meta-analysis looking at the JDR model and safety outcomes found support for the mediation of the safety climate and safety outcomes relationship by employee engagement (Nahrgang et al., 2011). The current study lent additional support to this relationship.

In addition to the main purpose of the study, support was also found for the significant positive relationships between supportive leadership, employee engagement, and safety climate. These findings are consistent with studies regarding leadership and safety climate and their relationship with employee engagement (Ayree et al., 2012; Law et. al., 2011; Nahrgang et al., 2011; Song et al., 2012). This study also lends further support to the relationship between leadership and safety climate (Barling et al., 2002; Kelloway et al., 2006; Zohar, 2002).

The results from the current study have some important contributions to current knowledge. This study demonstrated the importance of employee engagement regarding safety outcomes. In the occupational safety literature, the majority of the focus surrounds determining how leadership and safety climate relate to safety outcomes. The current study lends support to the theory that both leadership and safety climate relate to safety outcomes through employee engagement. This is an important development in the safety literature and should help to guide researchers in their future exploration of these constructs.

Limitations

The current study tested the meditated relationship of supportive leadership on safety outcomes by employee engagement, a relationship that had not been empirically tested before now, and also lends further support to the JDR model. However, as in all research, there are limitations.

Design

The first limitation of the study was that it employed a survey in which participation was self-selected. This can result in bias if the answers of those who participated in the survey differ from the potential answers of those who chose not to participate. For example, it is possible individuals who chose not to participate did so because they are disengaged, or, perhaps those who did participate were highly engaged. Either of these scenarios would lead to a bias in the survey data. Those who chose to participate versus those who did not participate may also differ on characteristics not directly related to the current study, such as work load or conscientiousness. Any difference between the two groups could lead to bias in the data. Because participation in the questionnaire portion of this study was voluntary volunteer and non-response bias become possible limitations of the study.

The current study used a field study design. While a field study has the benefit of being in a natural setting, it does have some drawbacks. First, there was not a manipulated variable, which, along with the natural setting, prevents the implication of causation. Second, the correlational design also prevents the establishment of causation. Additionally, though this study used archival data collected over the course of three years, individuals could not be tracked over time and the criterion measure only existed at the site level. The study of the relationship

between supportive leadership and safety outcomes mediated by employee engagement would benefit from a longitudinal design to account for changes over time.

Another limitation would be that alternative constructs that are known to be related to constructs within the study were not controlled for in the current study. For example, meta-analyses have shown the significance of personality characteristics, job attitudes, safety motivation, safety knowledge, risks and hazards, physical demands, complexity, and autonomy in predicting safety outcomes (Christian et al., 2009; Clark, 2005: Nahrgang et al., 2011). Since these constructs were not included in the study the ability to offer other explanations for the significant relationships is limited.

Measures

To measure supportive leadership, safety climate, and employee engagement this study used archival data from a questionnaire designed by a psychologist within the organization of study. Since the scales used in this study were not scales that were already supported by the literature and prior research reliability and validity are called into question. All scales had acceptable internal consistency reliabilities, ranging from α=.76 to α=.88. Regarding validity, while scales were created through theory and common best practices for employee engagement surveys, criterion related validity has not been established. Future research on studied relationships would benefit from using already existing and proven measures of the predictor variables, supportive leadership, safety climate, and employee engagement. Multiple heavily researched scales measuring safety climate and employee engagement are available. However, a well tested and supported scale to measure the construct of supportive leadership does not exist in the current literature.

The current study employed self-report measures which are associated with several limitations. Participants completed surveys regarding their views on supportive leadership, safety climate, and employee engagement. Common method variance could artificially inflate the associations between these constructs. Self-report measures are also thought to be subjective and influenced by social desirability bias. Levels of variables thought to be more socially desirable by the organization could be inflated and levels of variables thought to be less socially desirable could be deflated. In the case of this study, all predictor variables could be viewed as socially desirable by the organization and therefore could be inflated. Participants were assured of confidentially of survey responses; however, there is no way to know if they believed that to be true. Injury and first aid instances are also at least partially self-reported, are not anonymous, and are most likely seen as less desirable by the organization. Employees may also fear negative consequences for reporting an injury. Due to the previously stated factors, it is possible injury and first aid instances could be attenuated.

The sample of participants used in this study makes generalization of the findings somewhat limited. This study utilized employees of a single organization. While participants worked at multiple locations and in different job types, all locations were the same type of power generation site. Therefore, generalizing to a different type of environment could be problematic. Additionally, as noted previously, participation in the survey aspect of the study was voluntary. This could result in volunteer bias and limit the ability to generalize the results of this study to an entire population.

Implications for Future Research and Practice

The current study has multiple implications. First, hundreds of empirical studies and multiple meta-analyses have attempted to discover the antecedents of safety outcomes. A great deal of the research has focused on leadership and safety climate. The connection between these two constructs and multiple types of safety outcomes is well supported. However, there is little research investigating employee engagement as a possible antecedent of safety outcomes (Christian et al., 2009; Clark, 2006; Nahrgang et al., 2011), even though the JDR model would argue it is the motivational mechanism through which leadership and safety climate relate to safety outcomes, thus making employee engagement an essential piece of the puzzle. The current study showed employee engagement as a significant predictor of safety outcomes, as well as a mediator of the relationship between safety outcomes and two of the most well supported antecedents, leadership and safety climate. This finding is in direct support of fundamental assumptions of the JDR and clearly poses a question for future research, what is the role of employee engagement in the leadership and safety relationship and the safety climate and safety relationship.

The results of the current study indicate the need for future research to increase the focus on employee engagement as an important construct in the safety literature. The JDR model posits employee engagement as a mediator between the relationships of multiple different job demands and job resources and performance. The current study looked specifically at the job resources of safety climate and supportive leadership and used injuries as the performance measure. Future research on the JDR model should look to replicate these findings as well expand them to include other job resources and job demands. Though many job resources and

job demands have been studied in relation to safety outcomes, very few of these studies have also included measures of employee engagement or burnout (Christian et al., 2009). Fully integrating the JDR model into the occupational safety research has at least three possible benefits: 1) building greater and more diverse support for the JDR model, 2) painting a more complete picture of occupational safety by incorporating a theoretical structure that logically integrates multiple constructs, and 3) reducing the incidence of accidents, injuries, and deaths in the workplace through a better understanding safety.

In addition to an increased focus on employee engagement, the current study also has implications for future research on the relationship between leadership and safety outcomes. Many studies in the occupational safety field focus specially on safety related leadership behaviors, such as management commitment and communication around safety (Mohamad, 2002) and leaders as safety role-models (Katz-Navon et al., 2007). Parker and colleagues (2001) took a different approach, looking at supportive supervision not directly linked to safety. Their results showed supportive supervision was predictive of working safely one year later. The current study took a similar view, by measuring supportive leadership, which was not safety specific. The results of the current study, supporting the relationship between supportive leadership and safety outcomes, suggest the occupational safety literature would benefit from an expanded view of leadership; with future studies incorporating more diverse types of leadership, not just those that are specific to safety. Some examples of various types of leadership that have not been heavily studied in regards to safety outcomes are dark side traits (Dalal & Nolan, 2009; Furrnham, Trickey, & Hyde, 2012) and authentic leadership (Eid, Mearns, Larsson, Laberg, & Johnsen, 2012). Research on a variety of leadership types and how they relate to occupational

safety would help increase the overall understanding of the leadership and safety relationship, which would hopefully lead to fewer accidents and injuries over time.

There are also applied implications to a stronger focus on various types of leadership behaviors. While leadership behaviors around safety are important, it is possible a strong focus on these would only be a short-term fix for improving safety. A more long-term and sustainable solution for improving safety could be improving leadership behaviors in general. Better leadership overall would create a healthy culture and high employee engagement, which would then support an environment where safety is simply a way life, instead of just something a frontline worker is always hearing about from their manager. This would be especially beneficial for organizations where managers have short tenures with their subordinates, due to rotational leadership programs (which was the case for the organization in the current study), or otherwise. Leaders and employees having to acclimate themselves to one every 12 to 18 months could have detrimental effects on safety performance, due to the instability and possible turmoil change can bring to a group. If high employee engagement and safety are already embedded as part of the culture of the organization, they can serve as buffers against the negative effects brief leadership tenures could have on safety outcomes.

Another research implication of the current study is its multiple year design. Data were analyzed from three consecutive years at the same organization. This is important because it can show the stability of an effect over time. Unfortunately, the data for the current study did not allow individuals to be tracked over the course of the three years, so year to year comparisons could not be made. Future research regarding occupational safety should include more longitudinal studies. In one longitudinal study Zohar (2002b) found training supervisors to better

monitor and reward safety lead to a significant decrease in minor injuries and an increase in safety behaviors (i.e., wearing ear plugs). Longitudinal studies would allow researchers to imply cause and effect, rather than just predictive relationships. Gaining a better understanding of the causes of accidents could have a monumental affect on reducing injuries and fatalities within organizations.

There are several applied implications of the current study. Safety is of paramount importance to all organizations, especially those who have employees working in situations with increased risk. The cost of workplace injuries and fatalities is substantial, both financially and personally. The current study helps in the understanding of what constructs are predictive of injuries and increases the current knowledge of this topic. Organizations could use this information in inform their decisions on leadership training, employee engagement initiatives, and other activities around the company. The current study shows leader behavior does not have to be solely focused on safety in order to be related to safety outcomes. Leaders who are supportive of their employees tend to have more engaged employees and a lower injury rate. Leadership training could be designed to incorporate this information, helping leaders understand it is not just their behaviors around safety that are related to injuries, but their actions in general.

The results of the current study also offer leaders a way to discuss safety with their employees. It is not just researchers or managers that want to know what relates to accidents and injuries, employees want to understand as well. Employees working on the front lines are in high risk situations every day and they want to do whatever they can to help ensure they make it home every night. Discussing psychological theories, such as the Job-Demands Job-Resources model, does not resonate with employees. However, presenting workers with data and numbers,

or what one could call "proof," has the possibility of gaining their attention. Having the information and results from the current study, and hopefully subsequent studies, allows managers to clearly tell their employees why their engagement and safety climate are important, with numbers to back them up. Once frontline workers are focused on these concepts they can be more aware of their behaviors, and safer overall.

The current study focuses on the importance of employee engagement on safety outcomes. Organizations that use the information gained from the current study might introduce initiatives to increase employee engagement in order to decrease injury rates. The results of successful employee engagement initiatives could not only lead to fewer injuries but could also affect many other organizational outcomes. A brief review of the engagement literature stated that engaged employees are more creative, more productive, and more willing to go the extra mile (Bakker & Schaufeli, 2008). Employee engagement has also been found to be related to overall performance, and in-role and extra-role behavior (Bakker et al., 2004; Kimbell & Nink, 2006; Xanthopoulou et al., 2009). Employee engagement is also related to employee retention, which is important to organizations given the high cost of turnover. According to The Gallup Organization employee retention is 44% higher for engaged employees over nonengaged and actively disengaged employees (Kimbell & Nink, 2006). A focus on employee engagement could not only lead an organization to fewer injuries but to increased performance in multiple performance areas.

CHAPTER V
CONCLUSION

In conclusion, the current study lends partial empirical support for the previously untested relationship between supportive leadership, employee engagement, and safety outcomes, in which the relationship between supportive leadership and safety outcomes is mediated by employee engagement. This finding adds important information to the literature on the topic and suggests further research is needed to conclusively determine the relationship between the three constructs. The current findings also have applied implications. Previously, employee engagement has not been considered a major predictor of safety outcomes. The current study draws much needed attention to employee engagement and showcases it as an important factor in regards to safety outcomes. While one study, which showed only partial support for the key hypotheses, cannot determine the true relationship between these constructs, the current research lends added support for the JDR model and suggests there are unexplained associations between the constructs of supportive leadership, safety climate, employee engagement, and safety outcomes which merit future exploration.

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APPENDIX

Table 10

Bootstrapping of Correlations with Total Injury Rate for 2008

	Bootstrap Results				Regression Weights
	Percentile 95% CI		Bias Corrected 95% CI		
	Lower	Upper	Lower	Upper	
Safety Climate	-0.128	0.002	-0.128	0.002	-0.060
Supportive Leadership	-0.126	0.004	-0.126	0.004	-0.058

CI = confidence interval

*p<.05. **p<.01. ***p<.001

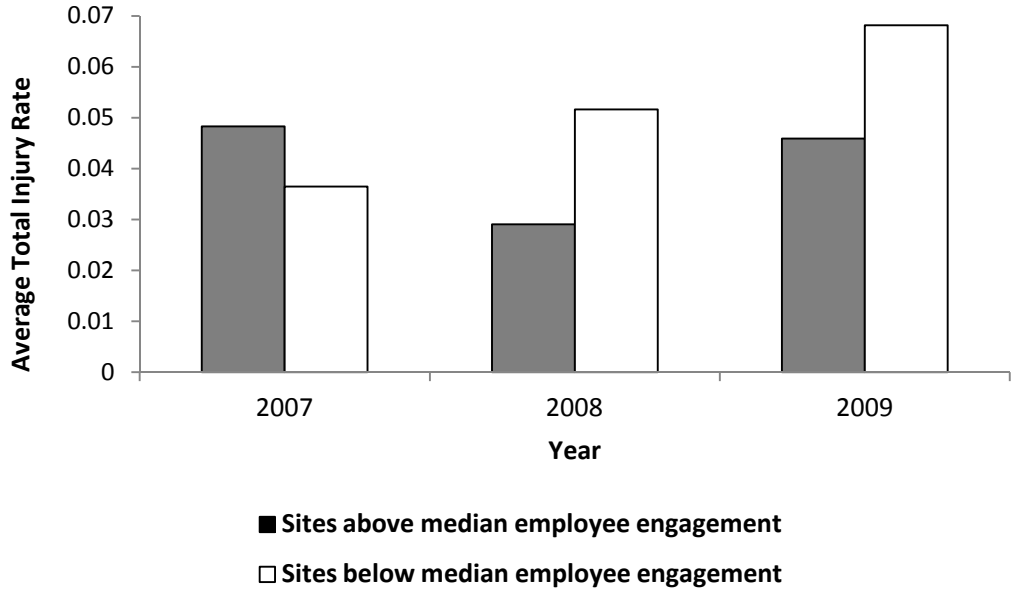

Figure 2. Average total injury rates per year for high scoring employee engagement sites and low scoring employee engagement sites, divided at the median.

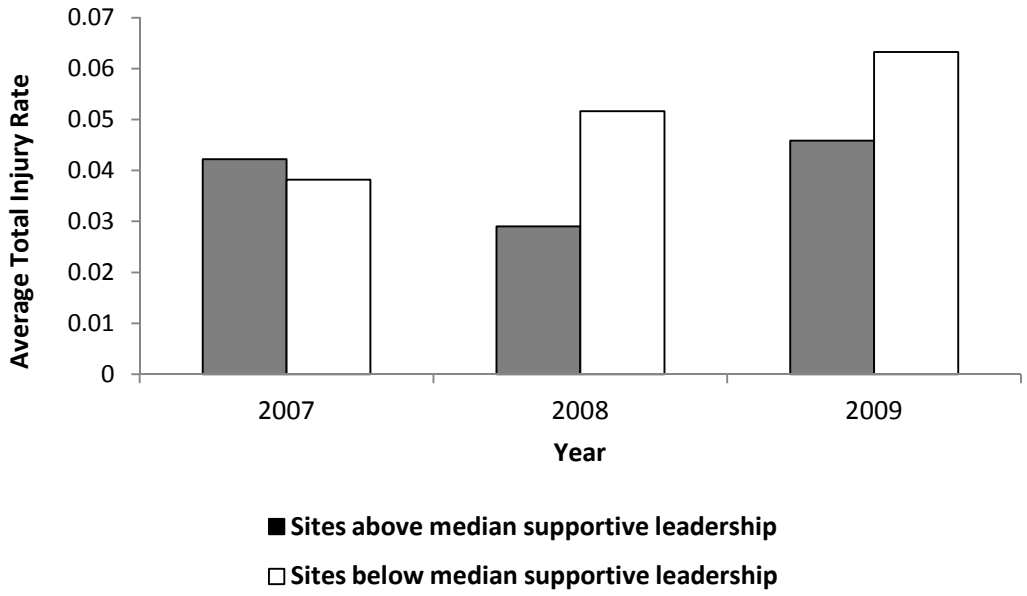

Figure 3. Average total injury rates per year for high scoring supportive leadership sites and low scoring supportive leadership sites, divided at the median.

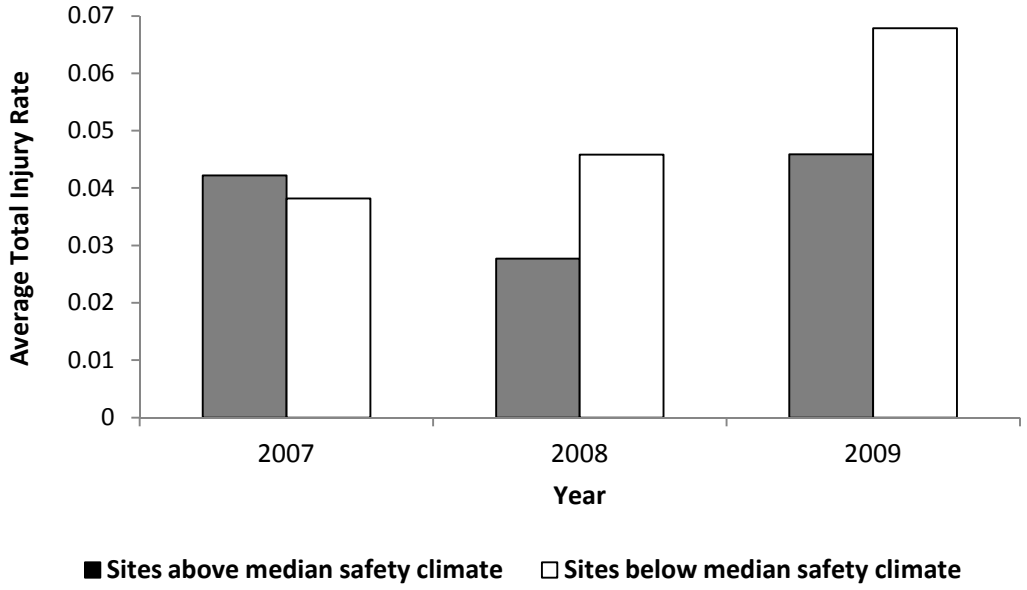

Figure 4. Average total injury rates per year for high scoring safety climate sites and low scoring safety climate sites, divided at the median.

VITA

Lauren Elizabeth Baxter was born in Detroit, Michigan and was raised in Johnson City Tennessee. She attended Towne Acres Elementary School, Liberty Bell Middle School, and Science Hill High School. She graduated with a B.A. degree in Psychology from The University of Tennessee in 2007. She received her M.A. in Experimental/Applied Psychology from The University of Tennessee in 2010 and completed the requirements for her doctorate degree in December 2013.