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AN EXAMINATION OF THE RELATIONSHIP BETWEEN EMPLOYER SAFETY PRACTICES AND INDIVIDUAL RISK TOLERANCE

A Thesis in

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by

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ABSTRACT

The primary purpose of this study was to examine the relationship between employer safety practices and the individual risk tolerance of employees. The safety practices of interest included safety communication, hazard control, and safety training. Each of these variables was measured in terms of their impact on the employee, either in terms of perception or awareness levels. A secondary purpose of this study was to determine the impact of these same practices upon both the incidence of safety-related events and employee job satisfaction.

This study used secondary data that was originally collected using a survey administered to employees of a surface mining company. Several regression models were constructed by alternating each safety practice as an independent variable and either risk tolerance or safety-related events as the dependent variable. Control variables in the form of demographic data and employee job perceptions were held constant within each regression. It was hypothesized that each independent variable would be significantly related to both risk tolerance and safety-related events. These hypotheses were formed partially based upon the concept of social exchange theory, wherein employees have been shown to respond positively if they feel the employer is concerned with their needs and interests. A separate regression was completed in order to examine the relationship between employer safety practices and employee job satisfaction.

The results of this study detected a significant relationship between employee perceptions of safety communication and individual risk tolerance. Safety communication was found to account for 9.7% of the variance in risk tolerance. Employee perceptions of hazard control and employee safety awareness were not found to be significantly related to risk tolerance. In addition, no significant relationships were detected between any of the three independent variables and safety-related events. Lastly, a significant relationship was found between employee perceptions of safety communication, employee perceptions of hazard control, and

employee job satisfaction. Implications and limitations of this study are discussed, along with suggestions for future research.

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Chapter 1

Introduction

1.1 Risk and Risk Tolerance

The term "risk" can be defined as the chance of injury, damage, or loss (Webster's New World Dictionary, p. 1228). It encompasses both the probability and the severity of a loss event taking place. Risk is a somewhat abstract concept often used to denote the level of "safety" associated with an activity.

Employers often strive to minimize risk through the control of unsafe conditions and unsafe acts. The goal in doing so is reduce the potential for workplace injuries and associated costs. The costs of workplace injuries within the United States in terms of both human suffering and economics are considerable.

During calendar year 2007, there were a total of 5,657 occupational fatalities within the United States. There were also over four million OSHA recordable cases with just under one-third of these resulting in days away from work (Bureau of Labor Statistics, 2009). The annual cost of workplace injuries and illnesses in this country is estimated to be in excess of 170 billion dollars (OSHA, 2009). This figure is substantial when compared to the cost of non-occupational diseases. It has been estimated that American workplace injuries and illnesses generate approximately five times the cost of AIDS, three times as much as Alzheimer's disease, and nearly as much as cancer (Leigh et al., 2000).

"Risk tolerance" may be defined as the amount of risk an individual is willing to accept in pursuit of a goal (Hunter, 2002). Risk tolerance is an important concept within the field of occupational safety. Even those employers who devote significant resources toward safety will

not be able to completely eliminate risk within the workplace. As a result, responsibility is often placed upon the individual employee to avoid residual risks. Motivating employees to consistently avoid these risks represents a serious challenge to employers.

This study uses secondary data to expand upon previous research on risk tolerance within the workplace. The previous study by Lehmann et al. (2009) explored the relationship between the amount of safety training received by an employee and their risk tolerance in given scenarios. This study will serve to assess whether employers may be able to impact risk tolerance through other mechanisms.

1.2 Factors Influencing Risk Tolerance

There are a wide variety of factors that influence individual risk tolerance within the workplace. These include personal, situational, and organizational factors (OSHA Region VPP Conference, 2007). Personal factors are individual characteristics over which the employer has little or no control such as past experiences, age, culture, or physical abilities. Situational factors are specific to a given work task and may include such factors as the pace of work, time constraints, or the level of individual control over the task.

Organizational factors are broader than situational factors and can include such issues as the existence or absence of safety programs, leadership behaviors, and peer behaviors. Employers control the work environment and therefore can exert a strong influence upon both situational and organizational factors. One means by which an employer might impact risk tolerance through organizational factors would be the implementation of a safety management system.

1.3 Safety Management Systems

There are numerous approaches to controlling risks within the workplace setting. Traditional approaches such as safety incentives and disciplinary systems have given way to behavior based efforts in recent years. The Occupational Safety and Health Administration (OSHA) has historically emphasized engineering controls and regulatory compliance as key factors in controlling occupational hazards. Throughout much of its existence, OSHA has relied upon an approach based upon the threat of citations and monetary fines in order to motivate employers toward compliance with safety and health standards (Goetsch, 1996).

In recent years, OSHA has encouraged employers to establish a "safety and health management system" as the framework for their safety and health efforts. This system was broadly introduced in the form of voluntary guidelines issued by OSHA in 1989. It has since served as the basis for the various voluntary partnerships available to employers through OSHA. Under these partnerships, OSHA exempts employers from routine compliance inspections if they can demonstrate strong safety and health management systems.

A safety and health management system as defined by OSHA is based upon the implementation of five core elements: management commitment; employee involvement; worksite analysis; hazard prevention and control; and safety and health training (OSHA Fact Sheet, 2008). When effectively implemented, these safety practices have been shown to lower injury and illness rates, reduce related costs, and improve organizational safety culture (Washington State Department of Labor & Industries, 1997). Although different terminology may be used, similar safety practices serve as essential elements of global safety standards such as the British Standards Institutes OHSAS (Occupational Health and Safety Assessment Series) 18001 and ANSI/AIHA (American National Standards Institute/American Industrial Hygiene Association) Z10. Table 1-1 summarizes the major components of the OSHA, OHSAS, and ANSI management systems.

Regardless of the system, key elements of a systematic approach to safety have consistently included the following three rudiments: safety communication, hazard identification and control, and safety training. This study will focus on these three safety practices and their relationship to risk tolerance, safety-related events, and job satisfaction.

Table 1-1: Major Elements of Common Safety Management Systems

OSHA Occupational Safety & Health Management System	**BSI Occupational Health & Safety Management System**	**ANSI/AIHA Occupational Health & Safety Management System**
Management Commitment Employee Involvement Worksite Analysis Hazard Prevention & Control Safety & Health Training	OH&S Policy Planning • Hazard identification, assessment, & control • Legal & other requirements • Objectives & programs Implementation & Operation • Resources, roles, responsibilities, accountability, & authority • Competence, training, & awareness • Communication, participation, & consultation • Documentation • Control of documents • Operational control • Emergency preparedness & response Checking • Performance measurement & monitoring • Evaluation of compliance • Incident investigation • Record control • Internal audit • Management review	Management Leadership Employee Participation Planning Implementation & Operation • OHSMS operational elements • Education, training, & awareness • Communication • Document & record control process Evaluation & Corrective Action Management Review

1.4 Social Exchange Theory

Social exchange theory is based on the premise that the exchange of social and material resources is a fundamental form of human interaction. This theory draws upon intersecting principles from the economic, psychological, and sociological fields. Homans (1958) is credited with the initiation of social exchange theory as a means for better understanding the social behavior of humans in economic undertakings. Blau (1964) contributed significantly to the development of the theory and suggested that the basis of any exchange relationship can be described in terms of either social or economic principles. Exchanges that are social in nature are based on a trust that gestures of goodwill will be reciprocated at some point in the future (Settoon et al., 1996).

Social exchange theory has been applied to the work setting and more specifically to occupational safety in a number of studies. It has been explored both as a broad exchange between an employee and the organization, and as a more focused relationship between supervisors and their subordinates. Regardless of the level of focus, the theory is based upon the concept of reciprocity and suggests that employees will respond in a positive manner if they feel the other party is concerned with their needs and interests (Krause, 2005).

It is logical to assume that employees may respond positively if they perceive that their employer is committed to workplace safety. The employer may demonstrate their commitment to safety in a number of ways such as identifying and eliminating hazards, providing safety training to employees, or establishing lines of communication regarding safety issues. This study is based upon the expectation that employees may respond positively to such safety practices by being less tolerant of personal risk while on the job, and thus less likely to be involved in a safety-related event. It is also expected that employees who perceive their employer is committed to safety will have a higher level of job satisfaction.

1.5 Research Objectives

The previous study found evidence of a relationship between the amount of safety training provided to an employee and that employee's level of risk tolerance (Lehmann et al., 2009). The primary purpose of this study is to expand upon the previous research in order to assess whether employers may be able to impact risk tolerance through other safety practices.

The safety practices of interest within this study include safety communication, hazard control, and safety training. These practices have been measured in terms of their impact upon individual employees. Safety communication and hazard control were both measured based upon employee perceptions, while safety training was measured in terms of job safety awareness.

A secondary purpose of this research is to determine if there is any relationship between the aforementioned safety practices and either safety-related events or employee job satisfaction. The specific objectives of this study are as follows:

1. Determine whether there is a relationship between employee perceptions of safety communication, individual risk tolerance, and safety-related events.
2. Determine whether there is a relationship between employee perceptions of hazard control, individual risk tolerance, and safety-related events.
3. Determine whether there is a relationship between employee safety awareness, individual risk tolerance, and safety-related events.
4. Determine whether there is a relationship between employer safety practices, safety-related events, and employee job satisfaction.

These objectives are pictorially represented in Figures 1 and 2 located on the following pages.

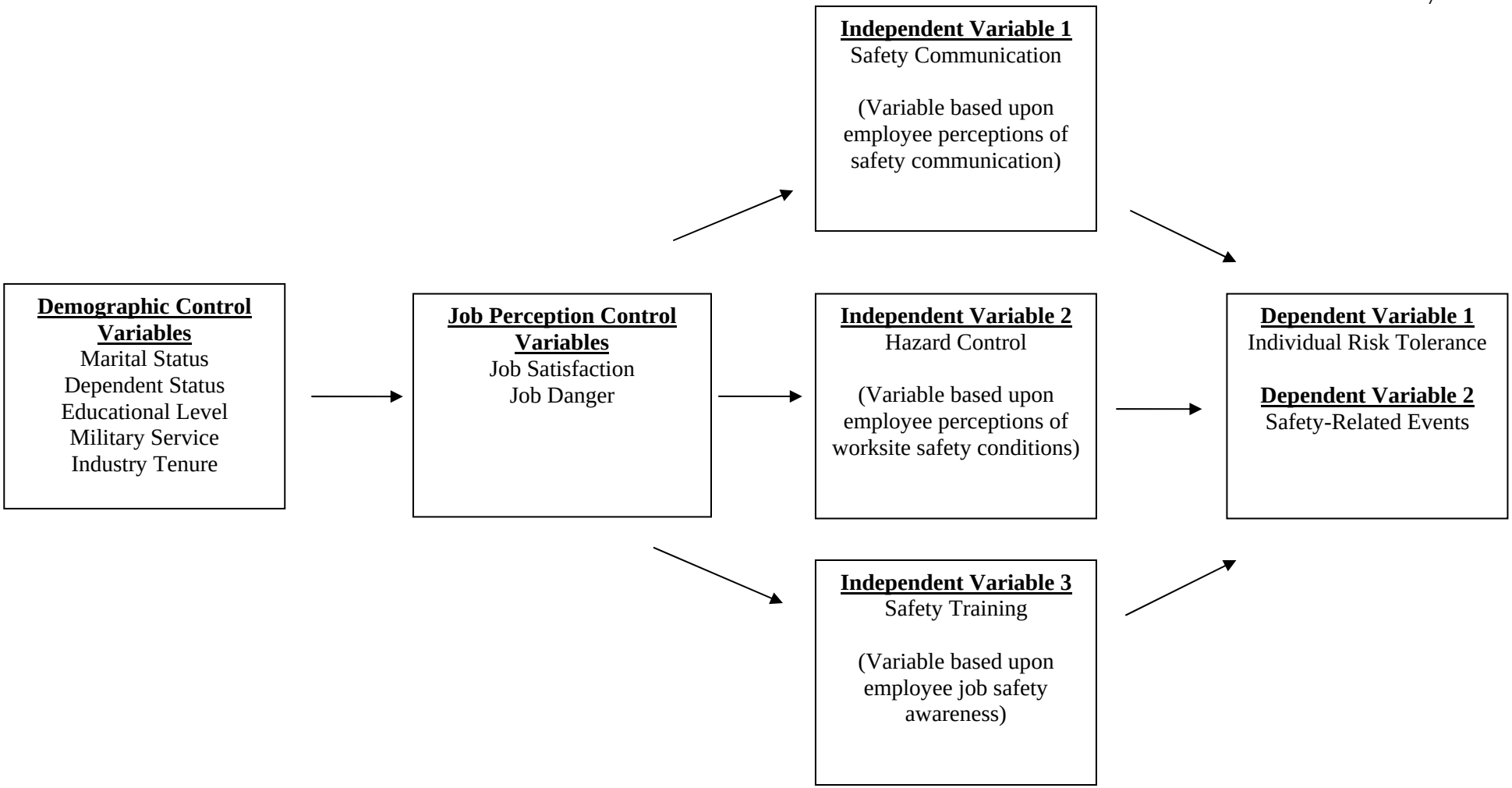


Figure 1. Pictorial Representation of Risk Tolerance and Safety-Related Events Analyses

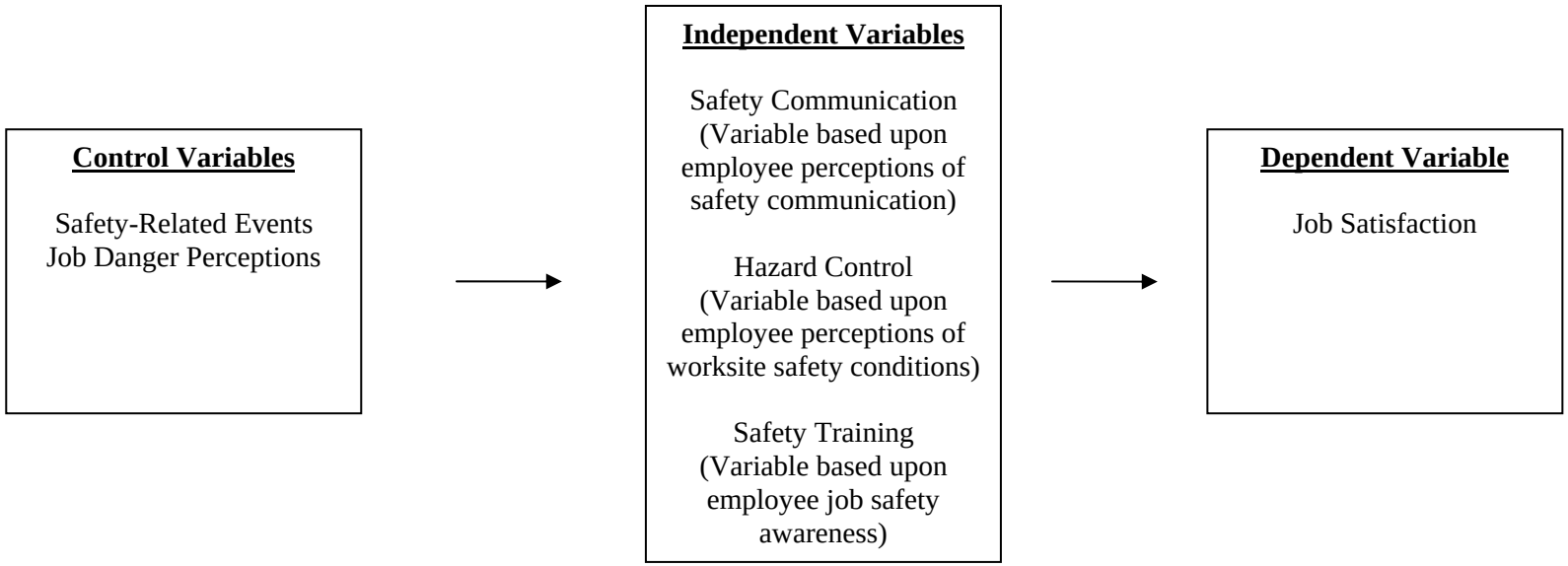


Figure 2. Pictorial Representation of Job Satisfaction Analysis

1.6 Summary

The results of this study will examine the relationship between employer safety practices, individual risk tolerance, and safety-related events. It will also examine the relationship between employer safety practices and employee job satisfaction. The safety practices of interest will include safety communication, hazard control, and safety training. These three variables have been measured in terms of their impact upon individual employees. Employee perceptions will form the basis for assessing both safety communication and hazard control. Employee safety awareness will serve as an indicator of safety training.

1.7 Literature Cited

Blau, P. (1964). *Exchange and power in social life.* New York: Wiley.

Bureau of Labor Statistics. (n.d.). Retrieved June 17, 2009 from http://www.bls.gov/iif/.

Goetsch, D.L. (1996). *Occupational Safety and Health.* Upper Saddle River, New Jersey: Prentice-Hall.

Homans, G. (1958). Social behavior as exchange. *American Journal of Sociology, 63*(6), 597-606.

Hunter, D.R. (2002). *Risk perception and risk tolerance in aircraft pilots.* Federal Aviation Administration Report No. PB2003100818.

Krause, T. (2005). *Leading with Safety*. Hoboken, New Jersey: John Wiley and Sons Inc., pp. 71- 72.

Lehmann, C., Haight, J., Michael, J. (2009). Effects of safety training on risk tolerance: an examination of male workers in the surface mining industry. *Journal of Safety, Health, and Environmental Research, 4*(3). Retrieved September 1, 2009 from http://www.asse.org/academicsjournal/archive/vol6no1/spring09-feature03.pdf.

Leigh, J., Markowitz, S., Fahs, M., Landrigan, P. (2000). *Costs of Occupational Injuries and Illnesses*. Ann Arbor, MI: University of Michigan Press, pp 1-2.

Occupational Safety and Health Administration. (n.d.) Retrieved June 17, 2009 from http://www.osha.gov/dcsp/smallbusinesses/index.html.

Occupational Safety and Health Administration Fact Sheet (March 2008). *Effective Workplace Safety and Health Management Systems.* Retrieved June 23, 2009 from http://www.osha.gov/Publications/safety-health-management-systems.pdf.

Settoon, R., Bennett, N., Liden, R. (1996). Social exchange in organizations: perceived organizational support, leader-member exchange, and employee reciprocity. *Journal of Applied Psychology*, *81*(3), 219-227.

Washington State Department of Labor and Industries (1997). *Benefits of the Voluntary Protection Program.* Retrieved October 22, 2009 from http://www.lni.wa.gov/Safety/Topics/AtoZ/VPP/vppbene.asp.

Webster's New World Dictionary (2nd edition). (1986). New York, NY: Prentice Hall.

Chapter 2

Literature Review

2.1 Social Exchange Theory

Social exchange theory proposes that social behavior is the result of an exchange process. Studies examining exchange relationships within the workplace suggest that employees will respond positively if they feel the employer is concerned with their needs and interests (Krause, 2005). The occupational safety literature includes a number of studies suggesting that social exchange theory may play an important role in understanding safety attitudes and behaviors.

Studies examining exchange relationships between employees and employers often use "organizational citizenship behaviors" as an outcome measure. Organizational citizenship behaviors are discretionary employee behaviors that improve the functioning of the organization, yet go beyond the job duties specifically assigned to the individual (Organ, 1988). Hofmann et al. (2003) completed a study within a military unit which examined the relationship between leader-subordinate exchanges, safety climate, and citizenship behaviors. The results of this study indicated that organizational climate and the quality of leader-subordinate exchanges interacted to predict the frequency of safety citizenship behaviors among employees. Employees were also more likely to consider safety citizenship behaviors as an inherent part of their job expectations when they perceived a positive safety climate and engaged in high quality relations with their immediate supervisor.

Mearns and Reader (2008) collected data from offshore workers in multiple locations in order to determine how they felt about the level of safety support demonstrated by their

organization, supervisor, and coworkers. The findings indicated that employees who perceived high levels of support at both the organizational and supervisory levels were more likely to demonstrate increased safety citizenship behaviors. These behaviors included such positive contributions as monitoring the safety of other employees, correcting potential safety hazards, and informing management of safety issues. The reciprocal relationship uncovered by this study demonstrates that appropriate social behaviors within an organization may lead to unanticipated benefits in the form of employee behaviors that go beyond simple compliance with established standards.

O'Toole (2002) conducted an employee safety perception survey over a 45 month period at a concrete producer within the United States. The results of this study indicated that employee perceptions of the safety management system appeared to influence employee decisions regarding at-risk behaviors. The study found that management commitment to safety generated the strongest positive perception and that this perception was closely associated with a reduction in the company injury rate.

2.2 Risk Tolerance

There is a shortage of research regarding risk tolerance within the workplace setting. Many risk tolerance studies have their roots in traffic psychology. Much of the existing literature is based on financial risk tolerance relative to investment strategies, contributing to the expansion of the field known as behavioral finance.

Several theories have been proposed to explain the amount of risk that an individual may assume for a given activity. Wilde (1994) developed the hypothesis of "risk homeostasis" which suggests that people have a target level of risk that they will accept. This theory proposes that if the risk level changes in some part of one's life, there will be a corresponding rise or fall elsewhere in order to maintain the individual's overall risk equilibrium.

Naatanen and Summala (1974) developed the “zero risk theory” wherein risks will be avoided only when they exceed an individual’s risk threshold. This threshold level is not consistent and can be adjusted by personal experiences. For example, an individual could have their overall threshold level reduced if they have recently experienced a significant risk. The concept of a variable threshold level distinguishes this theory from risk homeostasis.

Fuller (1984) proposed the “threat avoidance model” which suggests that individuals learn to avoid hazards so that no negative consequences are experienced. Risks are determined to be acceptable so long as positive outcomes outweigh negative valences such as accidents or a sense of fear.

Risk tolerance has been linked to a wide variety of personal and environmental factors. Barsky et al. (1997) completed a study of financial risk tolerance in which survey participants responded to hypothetical scenarios. Respondents were asked to choose whether they would leave their current job for another based on varying levels of risk (i.e. whether the new job would generate more or less income). The results of this study found substantial differences in risk tolerance based on demographic variables including age, gender, race, religion, and educational level. Risk tolerance measures were also found to be significantly and positively related to risky behaviors such as smoking, drinking, failing to have insurance, and holding stocks rather than Treasury bills. Al-Ajmi (2008) also conducted a survey to measure financial risk tolerance and found significant differences in this attribute based on the education level, gender, wealth, and nationality of respondents.

Faff et al. (2004) conducted one of the largest scale studies examining the relationship between demographic factors and financial risk tolerance. The research team analyzed a database consisting of over 20,000 responses from individuals who had completed a risk tolerance questionnaire. This questionnaire was used to develop a “risk tolerance score” for each individual. The results of the study showed that individuals were capable of accurately assessing

their own risk tolerance, as self-reported estimates correlated with the score generated by the questionnaire. This study also found positive correlations between risk tolerance and education, income, and wealth. Negative correlations were found between risk tolerance and age, number of dependents, and marital status.

Levels of personal knowledge and work experience have both been related to risk tolerance within the workplace. A study of cardiac physicians completed by Reyna and Lloyd (2006) revealed physicians with greater job knowledge were better at discriminating risk and were more likely to deviate from treatment guidelines. Conversely, less knowledgeable physicians had a lower tolerance for risk. These less experienced professionals were thought to be less confident in their decision making and therefore more inclined, for instance, to admit patients at lower levels of risk. Heemskerk (2003) examined differences in risk tolerance among workers within the hazardous industry of gold mining. The results of this study suggested that employees with a greater tolerance for risk also had longer tenures within the mining industry.

Past research has also shown risk tolerance to be influenced by environmental perceptions. Bellrose and Pilisuk (1991) found that a number of compensatory mechanisms contribute to vocational risk tolerance. This study was based upon a comparison of employees engaged in three separate occupations: firefighting, radiation protection, and office work. Participants were asked to assess the level of risk associated with their own jobs along with jobs from the other two categories. Results indicated that a variety of factors such as familiarity with hazards, levels of social support, public image, and salary levels all contribute to differences in risk tolerance.

2.3 Employee Job Perceptions

A number of studies have been completed to assess the effect of employee job perceptions on safety-related outcomes. The two primary job perceptions of interest within this study were job satisfaction and job danger. Job satisfaction is perhaps the most commonly measured attribute relative to employee perceptions. A review of the research indicates that there is a relationship between an individual's job satisfaction and the potential for workplace injury. Edkins and Pollack (1997) found low morale and negative work attitudes to be correlated with attention deficits and skill-based errors, either of which could increase the potential for workplace injury. Probst and Brubaker (2001) reported that job-security perceptions were strongly related to job satisfaction, which in turn was a key predictor of safety motivation and knowledge. This finding suggests that job satisfaction does have a significant impact upon worker safety behavior.

Job satisfaction is also related to risk perceptions within the workplace. Fleming et al. (1998) found that a low level of job satisfaction is associated with perceptions of workplace risks being greater. McClain (1995) found significant relationships between job satisfaction and perceptions of workplace conditions along with the work itself. These findings suggest that job satisfaction may be linked to employee safety performance and the potential for injury.

Support has also been found for the notion that being involved in a workplace incident creates greater job dissatisfaction. Barling (2003) found that workplace injuries result in a perceived lack of influence and a distrust of management, both of which predicted lower job satisfaction. This raises the possibility of a circular relationship between job satisfaction and workplace injuries wherein suffering an injury further lowers job satisfaction while simultaneously increasing the potential for future injury. Clearly, the literature indicates that adequate attention must be given to job satisfaction when attempting to fully evaluate occupational injury risks.

In regard to employee perceptions of job danger, it has been found that employees who perceive their jobs as being safe tend to be involved in fewer accidents than employees perceiving their jobs as more dangerous (Guastello and Guastello, 1988), (Harrell, 1990), and (Smith et al., 1992). Employees who perceive their workplace as being safe also report lower levels of job stress and exposure to fewer workplace hazards (Guastello, 1992). Both of these factors have been strongly linked to injury and illness rates (Guastello, 1989).

2.4 Safety Communication

Numerous studies have been completed to assess the impact of effective supervisory communication within the workplace setting. Many of these studies focus upon the downward flow of safety information through the organization from upper management to front line employees. Other studies use the term "safety communication" to instead center on the exchange of safety information between an employee and their supervisor. The focus within this section will be on the latter type of research since it closely relates to the safety communication variable used within this study.

Pfeifer et al. (1976) and DeMichiei et al. (1982) each completed early studies on safety communication between supervisors and employees. These studies were completed within mining companies with low incidence rates and revealed that employees are more likely to report unsafe conditions and minor incidents to supervisors if they feel that those same supervisors are open and responsive to such behavior. In a more recent study, Griffin and Neal (2000) found that supportive supervision was positively correlated with workers' self-reported safety motivation and safety compliance. In a large scale study of industrial organizations, Wood et al. (2000) found that a high involvement supervision style was predictive of more positive safety outcomes.

Mattila et al. (1994) conducted a study focusing on the relationship between supervisor characteristics and accident rates at sixteen sites of a construction company. They found that the

most effective supervisors gave their workers feedback more often and spent a greater amount of time communicating with their subordinates. Simard and Marchand (1994) determined that participative supervisory behaviors, including safety communication, promote a closer relationship and greater cooperation with employees. Both of these factors in turn were associated with increased compliance with workplace safety rules.

Michael et al. (2006) investigated how much safety communication and leader-member exchange contribute to safety-related outcomes within the workplace. The constructs used for safety communication and safety-related events within Michael's study were both very similar to the corresponding variables used in this study. Leadership-member exchange (LMX) differs from safety communication in that LMX focuses on the quality of the exchange between supervisor and employee, whereas safety communication provides an indication of how likely an employee is to express concern or share information with their supervisor. The results of Michael's study indicated that the influence of LMX was greater than that of safety communication in predicting safety-related events. No significant relationships were detected between safety communication and the incidence of either safety-related events or OSHA recordable cases. However, Michael theorizes that safety communication might still impact accidents via other variables and suggests this as an area for future research.

Hofmann and Morgenson (1999) used a study of 49 dyads consisting of supervisors and group leaders within a manufacturing facility to develop a structural model linking leader-member exchange (LMX) and perceived organizational support (POS) to safety communication, safety commitment, and accidents. This study found significant relationships between LMX and safety communication, indicating that high-quality exchanges would be correlated with more open communication of safety issues. It also found a significant relationship between safety communication and POS, which signifies that group leaders who engage in more safety communication are perceived as being more committed to safety. Lastly, the study detected a

significant negative relationship between safety communication and accidents. Thus, survey participants who engaged in more safety-related communication were involved in fewer accidents over a defined time period following completion of the survey. Hofmann and Stetzer (1998) also completed an earlier study which investigated the influence of safety communication and safety climate on accident attributions within the utility industry. Their findings indicated that both of these factors significantly influenced causal attributions made by workers about industrial accidents. Workers in groups that openly discussed safety-related issues were more likely to make internal attributions, while workers that did not have opportunities to openly discuss safety issues were less willing to recognize a fellow worker as the cause of an accident.

Bentley and Haslam (2001) conducted a comparison of safety practices used by managers of postal delivery offices with varying incidence rates. The safety practices of interest within this study included safety communication, hazard management, and accident investigation. Their findings indicated that the most apparent difference in approach between low and high accident rate offices was the propensity for supervisors to frequently discuss safety issues with their employees. These findings supported earlier research by Smith (1978), who found that positive contacts and communication between supervisors and staff were important factors in safety performance.

2.5 Hazard Control

The systematic identification and control of hazards is the most common and direct method of improving safety within the workplace. The link between workplace hazards and employee injury or illness is well documented within the occupational safety literature. Although employee perceptions of hazard control efforts within the workplace have been explored in various studies, none of these have specifically focused upon the relationship between such perceptions and individual risk tolerance.

DeJoy et al. (2004) included employee perceptions of hazard control within a study which attempted to identify the factors determining the "safety climate" within an organization. This study analyzed data collected from over 2,000 employees at 21 locations of a large national retail operation. After controlling for demographic variables, the following three factors accounted for 55% of the variance in perceived safety climate: environmental conditions, safety-related policies and programs, and general organizational climate. The "environmental conditions" variable in this study was based upon employee perceptions of the potential hazards within their work areas such as excessive heat, noise, and poor lighting. The results of this study serve to highlight the relative importance of hazard control in forming employee perceptions of safety climate.

Rundmo (1996) completed a study within the offshore oil industry which detected relationships between a number of employee safety perceptions and risk behaviors. These perceptions included employee evaluations of their physical working conditions. The study found that employees who did not feel "safe" within the work environment were more likely to engage in risky behaviors and also were subject to increased job stress.

2.6 Safety Awareness

Safety and health training is commonly provided within the workplace in order to ensure employees are aware of potential hazards and how to effectively protect themselves from those hazards. Within a given workplace, such training will typically cover a wide variety of topics and be delivered periodically over the course of an employee's tenure. Safety and health training can be delivered through a range of different media, from traditional classroom instruction to online courses. It may also be provided on an individual basis or within a group setting. Regardless of the means of provision, the basic mission of safety and health training is to increase the safety awareness of the recipient.

No previous studies were found that specifically examined the relationship between an employee's safety awareness and their tolerance for risk. However, safety awareness has been linked to other beneficial safety outcomes. Helmkamp et al. (2004) developed a specific training initiative for loggers designed to increase their safety awareness. They found that increasing the safety awareness of this population resulted not only in improved attitudes toward safety but also led to an increase in the frequency of self-reported safe behaviors.

2.7 Summary

A review of the literature revealed that social exchange theory is increasingly being used as the basis for occupational safety research. A number of studies have found support for the expectation that employees may respond positively if they perceive their employer is committed to their well-being. These findings provide support for the primary purpose of this study, namely to determine whether there is a relationship between employer safety practices and individual risk tolerance.

There is a limited amount of research pertaining to risk tolerance in the workplace. Risk tolerance has been linked to a wide variety of personal and environmental factors. Demographic variables, personal knowledge, work experience, and social factors have all been cited as potential contributors to one's level of risk tolerance.

Safety communication, hazard control, and safety awareness have been identified as the key independent variables to be tested in this study. No studies were found that specifically explored the relationship of these variables to risk tolerance. However, each of these factors has been related to various positive safety outcomes within the work setting.

2.8 Literature Cited

Al-Ajmi, J. (2008). Risk tolerance of individual investors in an emerging market. *International Research Journal of Finance and Economics, 17,* 15-26.

Barling, J., Kelloway, E., Iverson, R. (2003). High-quality work, job satisfaction and occupational injuries. *Journal of Applied Psychology, 88,* 276-283.

Barsky, R.B., Juster, F.T., Kimball, M.S., Shapiro, M.D. (1997). Preference parameters and behavioral heterogeneity: an experimental approach in the health and retirement study. *The Quarterly Journal of Economics, 112*(2), 537-579.

Bellrose, C.A., Pilisuk, M. (1991). Vocational risk tolerance and perceptions of occupational hazards. *Basic and Applied Social Psychology, 12*(3), 303-323.

Bentley, T.A., Haslam, R.A., (2001). A comparison of safety practices used by managers of high and low accident rate postal delivery offices. *Safety Science, 37*(1), 19-37.

DeJoy, D., Schaffer, B., Wilson, M., Vandenberg, R., Butts, M. (2004). Creating safer workplaces: assessing the determinants and role of safety climate. *Journal of Safety Research, 35,* 81-90.

Edkins, G.D., Pollock, C.M. (1997). The influence of sustained attention on railway accidents, *Accident Analysis and Prevention, 29*(4), 533-539.

Faff, R.W., McKenzie, M.D., Hallahan, T.A. (2004). An empirical investigation of personal financial risk tolerance, *Financial Services Review, 13,* 57-78.

Fleming, M., Flin, R., Mearns, K., Gordon, R. (1998). Offshore workers' perceptions of risk: comparisons with quantitative data. *Risk Analysis, 18,* 103-110.

Fuller, R. (1984). A conceptualization of driving behavior as threat avoidance. *Ergonomics, 27*(11), 1139-1155.

Guastello, S.J., Guastello, D.D. (1988). *The Occupational Hazards Survey: Second edition manual and case report.* Milwaukee, WI: Guastello and Guastello.

Guastello, S.J. (1989). Catastrophe modeling of the accident process: evaluation of an accident reduction program using the occupational hazards survey. *Accident Analysis and Prevention, 21*(1), 61-77.

Guastello, S.J. (1992). Accidents and stress-related health disorders among bus operators: forecasting with catastrophe theory. *Stress and well-being at work*, American Psychological Association, Washington DC, 252-269.

Harrell, W.A. (1990). Perceived risk of occupational injury: Control over pace of work and blue-collar versus white-collar work. *Perceptual and motor skills, 70,* 1351-1359.

Heemskerk, M. (2003). Risk attitudes and mitigation among gold miners and others in the Suriname rainforest. *National Resources Forum, 27*(4), 267-278.

Helmkamp, J.C., Bell, J.L., Lundstrom, W.J., Ramprasad, J., Haque, A. (2004). Assessing safety awareness and knowledge and behavioral change among West Virginia loggers. *Injury Prevention, 10,* 233-238.

Hofmann, D.A., Morgeson, F.P., Gerras, S.J. (2003). Climate as a moderator of the relationship between leader-member exchange and content specific citizenship: safety climate as an exemplar. *Journal of Applied Psychology, 88*(1), 170-178.

Hofmann, D.A., Morgenson, F.P. (1999). Safety-related behavior as a social exchange: the role of perceived organizational support and leader-member exchange. *Journal of Applied Psychology, 84*(2), 286-296.

Hofmann, D.A., Stetzer, A. (1998). The role of safety climate and communication in accident interpretation: implications for learning from negative events. *The Academy of Management Journal, 41*(6), 644-657.

Krause, T. (2005). *Leading with Safety*. Hoboken, New Jersey: John Wiley and Sons Inc., pp. 71- 72.

Mattila, M., Hyttinen, M., Rantanen, E. (1994). Effective supervisory behavior and safety at the building site. *International Journal of Industrial Ergonomics, 13,* 85-93.

McClain, D. (1995). Responses to health and safety risk in the work environment. *Academy of Management Review, 38*(6), 1726-1743.

Mearns K., Reader, T. (2008). Organizational support and safety outcomes: an uninvestigated relationship? *Safety Science,* 46, 388-397.

Michael, J., Guo, Z., Wiedenbeck, J., Ray, C. (2006). Production supervisor impacts on subordinates' safety outcomes: an investigation of leader-member exchange and safety communication. *Journal of Safety Research, 37*(5), 469-477.

Naatanen, R., Summala, H. (1974). A model for the role of motivational factors in drivers' decision making. *Accident Analysis and Prevention,6,* 243-261.

Organ, D.W. (1988). *Organizational Citizenship Behavior: The Good Soldier Syndrome.* Lexington, MA: Lexington Books.

O'Toole, M. (2002). The relationship between employees' perceptions of safety and organizational culture. *Journal of Safety Research, 33*(2), 231-243.

Pfeifer, C., Stefanski, J., Grerther, C. (1976). *Psychological, behavioral, and organizational factors affecting coal miner safety and health.* (Contract HSM 99-72-151): DHEW.

Probst, T.M., Brubaker, T.L. (2001). The effects of job insecurity on employee safety outcomes: cross-sectional and longitudinal explorations. *Journal of Occupational Health Psychology, 6,* 139-159.

Reyna, V.F., Lloyd, F.J. (2006). Physician decision making and cardiac risk: effects of knowledge, risk perception, risk tolerance, and fuzzy processing. *Journal of Experimental Psychology: Applied, 12*(3), 179-195.

Rundmo, T. (1996). Associations between risk perception and safety. *Safety Science, 24*(3), 197-209.

Simard, M., Marchand, A. (1997). Workgroups' propensity to comply with safety rules: the influence of micro-macro organizational factors. *Ergonomics, 40*(2), 127-188.

Smith, M.J., Cohen, H., Cohen, A., Cleveland, R. (1978). Characteristics of successful safety programs. *Journal of Safety Research, 10,* 5-15.

Wilde, G.J.S. (1994). *Target Risk.* Toronto: PDE Publications.

Chapter 3

Methodology

3.1 Company and Employee Information

The data used for this research was originally collected in January 2007 from a heavy construction services and products company located in Pennsylvania. The survey respondents were non-union employees engaged in the surface mining of stone aggregate at five separate locations. A total of 145 employees participated in the survey, with 123 of these individuals submitting complete and useable surveys. Only two of the respondents were females. As in the previous study, both of these data sources were discarded in order to eliminate the need to account for a gender variable.

3.2 Data Collection

Employee data was collected at the beginning of three company-sponsored safety training sessions. The original investigator requested that employees voluntarily complete the safety survey found in Appendix A. Respondents were given the option to answer or decline to answer any question on the survey. The research team collected all completed surveys, secured them, and immediately removed them from company property. The surveys were later transferred to the current researcher for further analysis.

Data associated with a number of variables was collected. No information was obtained that allowed for the identification of any survey respondent. Table 3-1 contains a complete list of all variables and data sources used in this analysis.

Table 3-1: Characteristics of Research Variables

Variable	Data Source	Variable Type	Variable Abbreviation
Risk Tolerance Sum	Survey scale	Interval	Risk Sum
Risk Tolerance (Low Risk Scenario)	Survey scale	Ordinal	Risk 1
Risk Tolerance (Medium Risk Scenario)	Survey scale	Ordinal	Risk 2
Risk Tolerance (High Risk Scenario)	Survey scale	Ordinal	Risk 3
Safety-Related Events Sum	Survey scale	Interval	SRE Sum
Safety Communication Sum	Survey scale	Interval	C Sum
Hazard Control Sum	Survey scale	Interval	HC Sum
Safety Awareness Sum	Survey scale	Interval	SA Sum
Marital Status	Direct response	Nominal	MaritalCoded
Dependent Status	Direct response	Nominal	DepCoded
Educational Level	Direct response	Nominal	EdCoded
Military Service	Direct response	Nominal	MilSvCoded
Industry Tenure	Direct response	Interval	Yr Indus
Job Satisfaction	Survey scale	Ordinal	JS
Job Danger	Survey scale	Ordinal	JD

3.3 Measures

The risk tolerance and safety-related events measures were both used as dependent variables within this study. Safety communication, hazard control, and safety awareness measures were each used as independent variables. Marital status, dependent status, educational level, military service, industry tenure, and job danger measures were all used as control variables. Job satisfaction was used alternately as both a dependent and a control variable.

3.3.1 Dependent Variables

Risk Tolerance. The original research team (Lehmann et al., 2009) developed three hypothetical scenarios in order to measure employee risk tolerance. This approach was based upon similar constructs used by Reyna and Lloyd (2006); Hunter (2002); and Barsky et al.. (1997). The scenarios were developed to reflect situations representing three incremental levels of risk rated as low, medium, and high:

Risk Scenario 1: Low Personal Risk

It is the end of the work shift. On the way out, a worker notices a broken electrical conduit. It is not in his area of the work site. Reporting the problem will make him late getting home. He leaves without reporting what he saw.

This scenario (Risk 1) represents a potential exposure to an unsafe condition in that the broken conduit could pose either a shock or fire hazard. The worker is also committing an unsafe act by choosing not to report the broken conduit. In this scenario, the respondent is not likely to be at risk, but employees coming into the work area for the next shift might be at risk.

Risk Scenario 2: Medium Personal Risk

It is Friday, the end of the work week. The person responsible for doing the pre-shift inspections is rushed for time. Today, he hurries through the pre-shift inspection in just a few minutes. Usually, the inspection takes much longer to complete.

This scenario (Risk 2) represents a situation in which the worker is committing an unsafe act by rushing through the pre-shift inspection. In this case, there is more personal risk for the respondent than in the first scenario primarily because he will be working in the area where the

inspection was being conducted. The respondent could be directly exposed to any hazard overlooked during the inspection over the course of his work shift.

Risk Scenario 3: High Personal Risk

A worker is in the process of changing a screen and he drops a wrench onto the conveyor belt. Instead of locking out the conveyor belt first, he climbs onto the belt, picks up the wrench, and continues working.

This scenario (Risk 3) represents a situation in which the worker is clearly committing an unsafe act which puts him at great personal risk. The conveyor could unexpectedly start due to the failure to lock it out, thus resulting in serious injury to the respondent.

Survey respondents were asked to indicate their level of comfort with each scenario on a four-point Likert scale. The four options available on this scale were “very comfortable”, “comfortable”, “uncomfortable”, or “very uncomfortable”. Higher scores on this scale indicated that the respondent was less tolerant of risk. These responses were summated to yield an overall risk tolerance measure referred to as “Risk Sum”. Data analysis was conducted in order to identify relationships between independent variables and each risk tolerance measure (Risk 1, Risk 2, Risk 3, and Risk Sum).

Safety-Related Events. Safety-related events were measured by asking survey respondents to self-report incidents they had personally experienced over the previous twelve-month period. This variable was constructed based on a safety-related events scale developed by Barling et al. (2002). The items included were crafted to make them relevant to the stone mining industry. Examples of specific items included such events as “slipped on rock dust” and “dropped idler on foot”.

A total of ten items pertaining to safety-related events were included in the survey. All of these items were based upon a six-point response scale. This scale incrementally increased so that respondents could choose from frequencies of “never”, “once”, “2 - 3 times”, “4 - 5 times”, “6 - 7 times”, or “more than 8 times” for each item. Responses to these ten items were summated to form an overall safety-related event score referred to as “SRE Sum”.

Job Satisfaction. Job satisfaction was measured using the Faces Scale developed by Kunin (1955) and later modified by Dunham and Herman (1975). This scale contains eleven line drawings of faces with expressions ranging from unhappy through neutral to happy. The drawings are intended to represent an equal interval scale and are often used as a measure of general job satisfaction (Ashkanasy and Cooper, 2008). Survey respondents were asked to indicate which of the drawings best correlated with how they feel about their job. Responses were used as both a dependent and a control variable within this study.

3.3.2 Independent Variables

Safety Communication. This variable was used to measure employee perceptions of their immediate supervisor’s willingness to discuss and respond to safety issues within the workplace. It was constructed by having survey participants respond to six items using a five-point Likert scale. These six items were drawn from a safety communication scale originally developed by Hofmann and Stetzer (1998). The range of possible responses to each item varied from “strongly disagree” through “neutral” to “strongly agree”.

Each item was used to gather information on the safety communication relationship between employee and supervisor. The items questioned survey participants as to how comfortable they were approaching their supervisor to discuss safety issues, whether their supervisor encourages open discussion of safety issues, and whether their supervisor openly

accepts ideas for improving safety. Two of the six items were reverse coded to help ensure consistency in responses. Higher scores were indicative of a more favorable safety communication relationship between the respondent and their supervisor. All six items were summated to form an overall score for safety communication perceptions (C Sum).

Hazard Control. This variable was based primarily upon employee perceptions of safety conditions within their specific work area. It was used within this study as an indicator of employer efforts to identify and control occupational hazards. The eight items were developed in order to reflect safety issues within the stone mining industry. Seven of the eight items related to worksite conditions such as clear passageways, sufficient lighting, and the presence of warning signs. The remaining item pertained to unsafe acts as it questioned whether respondents ever observed other workers in their area behaving in an unsafe manner.

All eight items were based upon a five-point Likert scale for which responses ranged from “never” to “almost always”. One item was reverse-coded in order to ensure consistency in responses. Higher scores on this scale indicated that the respondent did not frequently observe safety hazards within their work area. All items were summated in order to create an overall hazard control score (HC Sum).

Safety Awareness. This study focused not on the quantity of safety training received by an employee, but rather on the end results of this training. Since safety and health training should result in increased safety awareness, this variable was used to measure the effectiveness of employer training efforts. The variable was constructed by modifying Evan’s et al.. (2003) scale, as adapted by Barling et al.. (2002).

Survey participants were asked to indicate their response to a total of seven items using a five-point Likert scale. These items were designed to measure employee familiarity with job safety risks, safe work procedures, and emergency protocol. Possible responses varied from “strongly disagree” to “strongly agree”. Higher scores correlated with a greater level of safety

awareness by the participant. Responses to each item were summated to produce an overall job safety awareness score (SA Sum).

3.3.3 Control Variables

Marital Status. Respondents were asked to provide their current marital status by indicating either "single" or "married" on the survey form. Responses were dummy coded for use as a control variable.

Dependent Status. Respondents were asked to identify the number of dependents that live with them and the number of dependents that do not live with them. A control variable indicating whether or not the employee had any dependents was created based on this information.

Educational Level. Survey participants were asked to indicate the highest level of formal education that they had completed. Response options were as follows: "less than high school", "high school", "two-year technical associates degree, or trade school", or "bachelors degree or beyond". Responses to this item were coded for use as a control variable.

Military Service. Survey respondents were asked to indicate how many years of military experience they had accumulated. These responses were used to develop a control variable indicating whether or not the employee had any military experience.

Industry Tenure. This item was included in order to determine how many years experience the employee had within the stone mining industry. Responses indicated not only the amount of time with the current employer, but any additional experience within the industry with previous employers.

Job Danger. This item was used to measure employee perceptions of the relative danger of their jobs. Respondents were asked to indicate how dangerous they felt their particular job was using a five-point Likert scale. Responses ranged from "not at all dangerous" to "very dangerous" with "somewhat dangerous" serving as the midpoint on the scale.

3.4 Research Hypotheses

The following hypotheses were developed in order to explore the impact of employer safety practices upon employee risk tolerance, safety-related events, and job satisfaction.

3.4.1 Hypothesis 1

H_1: There is a positive statistical relationship between employee perceptions of safety communication and individual risk tolerance.

This hypothesis was based upon the assumption that employees who have positive communication experiences with their immediate supervisor on safety issues would be less tolerant of risk within the workplace. If an employee feels that they can approach their immediate supervisor with safety concerns and have them resolved, then it follows that they would be more adverse to engaging in risky behaviors or working in an unsafe environment. As previously noted, higher scores for the risk tolerance variable within this study were indicative of a lower tolerance for risk. Therefore, it was expected that higher safety communication ratings would be associated with increased risk tolerance scores.

3.4.2 Hypothesis 2

H_2: There is a negative statistical relationship between employee perceptions of safety communication and safety-related events.

This hypothesis was formed based upon the assumption that employees who report a positive communication relationship with their supervisor should therefore have more opportunities to absorb safety-related information during such interactions. Such employees should theoretically have a better understanding of safe work procedures, company safety policies, and job hazards. The increased knowledge that is a probable byproduct of safety communication is likely to be associated with a lower incidence of safety-related events.

3.4.3 Hypothesis 3

H_3: There is a positive statistical relationship between employee perceptions of hazard control and individual risk tolerance.

This hypothesis was based upon the assumption that employees who recognize that their employer is making an effort to control job hazards would be less tolerant of workplace risk. Employees who see visible evidence of hazard control within their work area (such as good housekeeping or properly guarded equipment) may interpret this as a commitment of resources by the employer. It might be appropriate to assume that these employees feel an obligation to avoid risky situations in order to fulfill a perceived obligation to the employer.

3.4.4 Hypothesis 4

H_4: There is a negative statistical relationship between employee perceptions of hazard control and safety-related events.

This hypothesis was based upon the assumption that respondents accurately assessed the presence of hazards within their work area. If respondents felt that the workplace was generally free from hazards, then it would follow that there were fewer opportunities for injury within the area. However, it should be stressed that the list of potential hazards included on the survey form was not all inclusive. There was also a heavy emphasis on unsafe conditions within this construct, leaving some uncertainty about the prevalence of unsafe acts within the work environment.

3.4.5 Hypothesis 5

H_5: There is a positive statistical relationship between employee safety awareness and individual risk tolerance.

This hypothesis was formed based on an expectation that the more aware an individual is of safety hazards within the workplace, the less inclined they would be to engage in risky

behaviors. Safety and health training typically provides employees with the ability to recognize hazards and an understanding of how to avoid such hazards. Employees who demonstrate a heightened awareness of these issues would potentially be more inclined to avoid risk situations encountered while on the job.

3.4.6 Hypothesis 6

H_6: There is a negative statistical relationship between employee safety awareness and safety-related events.

This hypothesis is somewhat related to Hypothesis 2, which stated that there is a statistical relationship between employee perceptions of safety communication and safety-related events. That hypothesis was based upon the belief that increased safety interactions between employees and their supervisor would lead to greater safety awareness by the employee. As indicated previously, increased knowledge and awareness of safety issues would likely be correlated with a lower potential to be involved in safety-related events.

3.4.7 Hypothesis 7

H_7: There is a positive statistical relationship between employer safety practices and employee job satisfaction.

This hypothesis was formed based on the expectation that employees who have favorable perceptions of their employer's safety efforts would have a higher level of job satisfaction. Employees who have a positive safety communication relationship with their supervisor are more likely to feel involved in safety efforts and more empowered to affect changes related to safety. Both of these outcomes would be expected to be associated with a higher level of job satisfaction. Likewise, employees who perceive fewer hazards within their work environment would likely be less concerned about the potential for injury and thus more satisfied with their jobs.

3.5 Data Analysis

SPSS 14.0 was used to complete all data analysis for this study. A total of five variables (risk tolerance, safety-related events, safety communication, hazard control, and safety awareness) consisting of multiple Likert items were summated for the purposes of analysis. The Cronbach's alpha coefficient was calculated for each of these summated variables in order to ensure reliability.

A correlation matrix was developed for all variables of interest in order to ascertain the strength of any relationships. Descriptive statistics were also produced for all variables used in this study. Lastly, several regression models were developed and tested in order to determine the relationships between selected independent and dependent variables.

3.6 Literature Cited

Ashkanasy, N., Cooper, C. (2008). *Research Companion to Emotions in Organizations.* Northhampton, MA: Edward Elgard Publishing, Inc., 202-203.

Barling, J., Loughlin, C., Kelloway, E.K. (2002). Development and test of a model linking safety-specific transformational leadership and occupational safety. *Journal of Applied Psychology, 87*(3), 488-496.

Barsky, R.B., Juster, F.T., Kimball, M.S., Shapiro, M.D. (1997). Preference parameters and behavioral heterogeneity: an experimental approach in the health and retirement study. *The Quarterly Journal of Economics, 112* (2), 537-579.

DeMichiei, J., Langton, J., Bullock, K., Wiles, T. (1982). *Factors associated with disabling injuries in underground coal mines.* MSHA, USA.

Dunham, R.B., Herman, J.B. (1975). Development of a female faces scale for measuring job satisfaction. *Journal of Applied Psychology, 60.*

Evans, D.D., Michael, J.H., Weidenbeck, J.K., Ray, C.D. (2005). Relationships between organizational climates and safety-related events at four wood products manufacturers. *Forest Products Journal, 55* (6), 23-28.

Griffin, M.A., Neal, A. (2000). Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of Occupational Health Psychology, 5*(3), 347-358.

Hofmann, D.A., Stetzer, A. (1998). The role of safety climate and communication in accident interpretation: implications for learning from negative events. *The Academy of Management Journal, 41*(6), 644-657.

Hunter, D.R. (2002). Risk perception and risk tolerance in aircraft pilots. Federal Aviation Administration Report Number PB2003100818.

Kunin, T. (1955). The construction of a new type of attitude measure. *Personnel Psychology, 8,* 65-77.

Lehmann, C., Haight, J., Michael, J. (2009). Effects of safety training on risk tolerance: an examination of male workers in the surface mining industry. *Journal of Safety, Health, and Environmental Research, 4*(3). Retrieved September 1, 2009 from http://www.asse.org/academicsjournal/archive/vol6no1/spring09-feature03.pdf.

Reyna, V.F., Lloyd, F.J. (2006). Physician decision making and cardiac risk: effects of knowledge, risk perception, risk tolerance, and fuzzy processing. *Journal of Experimental Psychology: Applied, 12*(3), 179-195.

Wood, S., Barling, J., Lasaosa, A., Parker, S. (2000). Organizational safety practices and safety performance. *Unpublished manuscript.*

Chapter 4

Results

4.1 Survey Validation

A copy of the survey form used for this study is included in Appendix A. This form included several sections requiring participants to respond to multiple Likert items. A number of these items were summated in order to create interval data, thus allowing for a higher level of analysis. The following five variables were formed from the summated data: Risk Sum, Safety-Related Events Sum, Safety Communication Sum, Hazard Control Sum, and Safety Awareness Sum.

The Cronbach alpha value was calculated for each summated variable in order to ensure internal consistency. Cronbach alpha scores can vary from 0 to 1, with values of 0.7 or higher indicating an acceptable level of reliability (Isaac and Michael, 1997). Table 4-1 shows all summated variables used within this study had alpha values greater than 0.7, thus permitting each to be treated as a single variable.

Table 4-1: Cronbach alpha values

Summated Variable	Cronbach alpha value
Risk Tolerance (Risk Sum)	.756
Safety-Related Events (SRE Sum)	.749
Safety Communication (C Sum)	.848
Hazard Control (HC Sum)	.771
Safety Awareness (SA Sum)	.830

4.2 Descriptive Analysis

4.2.1 Risk Tolerance

Risk tolerance was used as a dependent variable within this study. The three risk scenarios were examined as both a summated variable (Risk Sum) and on an individual basis (Risk 1, Risk 2, and Risk 3). The summated variable represents interval data, while the individual scenario responses represent ordinal data (Kerlinger and Lee, 1999; Miller, 1991). Table 4-2 shows the descriptive statistics for each risk tolerance variable. These variables have been coded so higher values correlate with a lower level of risk tolerance by the employee.

Table 4-2: Descriptive statistics for risk tolerance variables

Variable	N	Min	Max	Mean	Median	SD
Risk 1	123	1	4	3.57	4	.725
Risk 2	123	1	4	3.33	3	.719
Risk 3	122	1	4	3.39	4	.838
Risk Sum	122	1	4	3.42	3.66	.625

4.2.2 Safety-Related Events

Safety-related events were summated and used as both a dependent and independent variable within this study. Higher values for this variable (SRE Sum) indicate a higher incidence of either personal injury or exposure to a near-miss event by the respondent over the previous twelve-month period. The safety-related events variable yielded the descriptive statistics shown in Table 4-3.

Table 4-3: Descriptive statistics for safety-related events variable

Variable	N	Min	Max	Mean	Median	SD
SRE Sum	115	1	4	1.83	1.70	.594

4.2.3 Job Satisfaction

Job satisfaction was used as both a dependent and a control variable within this study. Higher values for this variable (JS) indicate a higher overall level of personal job satisfaction by the respondent. Table 4-4 shows the descriptive statistics for this variable:

Table 4-4: Descriptive statistics for job satisfaction variable

Variable	N	Min	Max	Mean	Median	SD
JS	118	1	11	7.60	8	2.20

4.2.4 Independent Variables

Safety communication, hazard control, and safety awareness were all summated and used as independent variables within this study. Higher safety communication scores (C Sum) indicate that respondents perceive more open communication on safety issues with their supervisor. Higher hazard control scores (HC Sum) signify that respondents perceive their work environment as being safer. A high safety awareness score (SA Sum) corresponds with increased knowledge of workplace safety issues. Descriptive statistics for these independent variables are shown in Table 4-5.

Table 4-5: Descriptive statistics for independent variables

Variable	N	Min	Max	Mean	Median	SD
C Sum	120	1.17	5	4.01	4.00	.736
HC Sum	113	1.50	5	4.05	4.12	.614
SA Sum	120	3	5	4.38	4.43	.444

4.2.4 Control Variables

Marital status, dependent status, educational level, military service, industry tenure, and job danger were each used as control variables within this study. All of these variables represent nominal data with the exception of industry tenure. Industry tenure data was expressed in years of experience and thus represents interval data. Table 4-6 shows the frequency of responses for each control variable.

Table 4-6: Frequency of responses for control variables

Variable	N	Responses
Marital Status	121	83 Married (69%) 38 Single (31%)
Dependent Status	118	90 w/ dependents (76%) 28 w/o dependents (24%)
Educational Level	119	6 Less than high school (5%) 78 High school degree (66%) 33 Two year degree or trade school (28%) 2 Bachelors degree or beyond (2%)
Military Service	107	21 w/ service (20%) 86 w/o service (80%)
Industry Tenure	117	Average of 14 years
Job Danger	119	3 at Level1 (2%) 8 at Level 2 (7%) 58 at Level 3 (49%) 21 at Level 4 (18%) 29 at Level 5 (24%)

4.3 Correlation Matrix

A correlation matrix for variables of interest was compiled as shown in Table 4-7. This table includes all variables used in this study. Correlation coefficients were calculated in order to determine the strength of the relationship between each variable (Hinkle et al., 1988 and Fink, 1995).

As can be seen, a number of relationships were found to be significant at the 0.01 level. The summated risk tolerance variable (Risk Sum) was highly correlated with each of the individual risk variables (Risk 1, Risk 2, and Risk 3) with all three coefficients in excess of .800. These individual risk variables were also moderately correlated with each other as coefficients ranged from .494 to .570.

The safety communication summated variable (C Sum) was significantly related at the 0.01 level with a number of other variables. This included all four risk tolerance variables (R Sum, Risk 1, Risk 2, and Risk 3) along with both of the other summated variables (Safety Awareness Sum and Hazard Control Sum). In addition, safety communication was significantly related to job satisfaction with an r value of .501.

Job satisfaction was also significantly related to the hazard control and safety awareness variables with respective r values of .458 and .294. Job danger was significantly related to both safety awareness and industry tenure. Both of these correlations were positive, indicating that employees with higher safety awareness and more experience within the industry tended to consider their jobs as more dangerous.

The summated variables for hazard control and safety awareness were significantly related to one another at the 0.01 level. An r value of .394 was calculated for these two variables. This would indicate a fair degree of correlation between the safety awareness of a given employee and the likelihood of that same employee having a favorable perception of safety conditions within their work area.

Several relationships were also significant at the 0.05 level. Safety Awareness Sum was significantly related to Risk Sum and Risk 2 at this level. Job danger was significantly related to Safety-Related Events Sum and marital status at this same level. Other significant relationships found at the 0.05 level included correlations between Safety Communication Sum and education level (r = .190), Hazard Control Sum and military status (r = -.228), and industry tenure and marital status (r = .187).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Risk Sum	x														
2. Risk 1	.826**	x													
3. Risk 2	.818**	.570**	x												
4. Risk 3	.822**	.494**	.480**	x											
5. Safety-Related Events Sum	.090	.126	.079	.004	x										
6. Safety Communication Sum	.430**	.385**	.335**	.360**	.010	x									
7. Hazard Control Sum	.128	.075	.158	.105	-.057	.453**	x								
8. Safety Awareness Sum	.201*	.114	.230*	.163	-.055	.409**	.394**	x							
9. Marital Status	.007	-.089	.098	.010	-.057	.005	-.045	.126	x						
10. Dependent Status	.094	.018	.043	.158	.079	.032	.021	.052	.582**	x					
11. Educational Level	.035	.047	.023	.018	-.049	.190*	.028	-.012	-.129	-.071	x				
12. Military Status	-.146	-.114	-.094	-.150	.064	-.167	-.228*	-.092	.085	.110	-.173	x			
13. Industry Tenure	-.164	-.159	-.066	-.175	.082	-.156	-.023	-.095	.306**	.187*	-.165	.126	x		
14. Job Satisfaction	.086	.092	.073	.055	-.166	.501**	.458**	.294**	.153	.084	.091	-.148	.083	x	
15. Job Danger	-.075	-.136	-.010	-.035	.194*	.137	.113	.260**	.226*	.139	.031	-.088	.298**	.119	x

**.Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 4-7: Variable Correlation Matrix

4.4 Results of Hypotheses Tested

SPSS 14.0 was used to conduct all statistical calculations. Hypotheses 1 through 6 were tested by building a hierarchical regression analysis using three blocks of data. The first block contained all five control variables (marital status, dependent status, educational level, military service, and industry tenure). The second block contained job-related perceptions (job satisfaction and job danger). Both of these blocks were kept consistent within each regression analysis used to test Hypotheses 1 through 6.

The third block was used to alternate each independent variable (safety communication, hazard control, or safety awareness) in order to detect any relationships with the dependent variables. Risk tolerance and safety-related events were both alternately entered as dependent variables. The risk tolerance analysis included separate analyses for the summated risk tolerance variable (Risk Sum) along with each individual risk tolerance variable (Risk 1, Risk 2, and Risk 3). A multivariate analysis was also completed in order to test the effect of entering all three independent variables into the regression simultaneously.

Hypothesis 7 was tested by creating a separate regression using job satisfaction as the dependent variable. Safety-related events and job danger were entered into the first block. Safety communication, hazard control, and safety awareness were then each entered as independent variables into the second block of the regression.

4.4.1 Hypothesis 1 – Relationship between Safety Communication and Risk Tolerance

This hypothesis speculated that there was a positive statistical relationship between employee perceptions of safety communication and individual risk tolerance. It was tested by conducting four separate regression analyses using safety communication as the independent variable and alternating Risk Sum, Risk 1, Risk 2, and Risk 3 as the dependent variables.

Hypothesis 1 was supported as significant relationships were found between safety communication and the four dependent variables. When using Risk Sum as the dependent variable, the input variables combined to account for 21.3% of the variance in employee risk tolerance. The five demographic variables combined to account for 11.1% of this total, while the two job perception variables added 0.5%. Safety communication accounted for 9.7% of the variance in Risk Sum. When using the individual risk scenarios as the dependent variable, safety communication accounted for 10.4% (Risk 1), 6.9% (Risk 2), and 4.2% (Risk 3) of the respective variances.

In order to find the least complex model predicting risk tolerance, all variables were entered into the regression and then the most non-significant contributors were removed on an individual basis. This process continued until only significant independent variables remained. When using Risk Sum, Risk 2, or Risk 3 as the dependent variable, the analysis was reduced to a simple linear regression as safety communication was found to be the only significant contributor. The equations for these three relationships are as follows:

$$\textit{Risk Sum} = 1.948 + .367(\textit{Safety Communication})$$

$$\textit{Risk 2} = 1.997 + .327\ (\textit{Safety Communication})$$

$$\textit{Risk 3} = 1.796 + .400(\textit{Safety Communication})$$

All of these equations indicate that as employee perceptions of safety communication become more positive, there is a corresponding improvement in individual risk tolerance. In other words, employees who have an increasingly positive communication relationship with their supervisor are progressively less tolerant of risk within the workplace. This was found to be true for medium-risk scenarios (Risk 2), high-risk scenarios (Risk 3), and across all three risk scenarios (Risk Sum).

When using Risk 1 as the dependent variable, a significant relationship was found with safety communication when controlling for job danger. The equation for this relationship is as follows:

Risk 1 = 2.519 + .385(Safety Communication) - .140(Job Danger)

Once again, this equation suggests that as employee perceptions of safety communication improve, there is an improvement in employee risk tolerance. More specifically, this equation indicates that employees with more positive communication relationships will be less tolerant of low personal risk. The two covariates within this equation combined to account for 17% of the variance in Risk 1. Safety communication accounted for 15% of the total while job danger accounted for 2%. The SPSS output for each initial regression between safety communication and risk tolerance (including Risk Sum, Risk 1, Risk 2, and Risk 3) has been included in Appendix B.

4.42 Hypothesis 2 – Relationship between Safety Communication and Safety-Related Events

This hypothesis suggested that there was a negative statistical relationship between employee perceptions of safety communication and safety-related events. It was tested by conducting a regression analysis using safety communication as an independent variable and safety-related events as the dependent variable. Two blocks of covariates (control variables and job-related perceptions) were created prior to inserting safety communication as the third block within the regression. This analysis yielded no significant relationships between safety communication and safety-related events, thus Hypothesis 2 was not supported.

4.4.3 Hypothesis 3 – Relationship between Hazard Control and Risk Tolerance

This hypothesis stated that there is a positive statistical relationship between employee perceptions of hazard control and individual risk tolerance. It was tested by using hazard control as an independent variable within the regression equation previously described. Four separate

regressions were completed using Risk Sum, Risk 1, Risk 2, and Risk 3 alternately as the dependent variable. No significant relationships were detected between hazard control and any of the risk tolerance variables.

4.4.4 Hypothesis 4 – Relationship between Hazard Control and Safety-Related Events

Hypothesis 4 stated that there was a negative statistical relationship between employee perceptions of hazard control and safety-related events. It was tested by entering hazard control as the independent variable and safety-related events as the dependent variable in the regression previously described. No support was found for this hypothesis as no significant relationships were detected between hazard control and safety-related events.

4.4.5 Hypothesis 5 – Relationship between Safety Awareness and Risk Tolerance

Hypothesis 5 stated that there was a positive statistical relationship between employee safety awareness and individual risk tolerance. This hypothesis was not supported as the analysis detected no significant relationships between awareness and risk tolerance. This absence of a relationship was consistent regardless of whether Risk Sum, Risk 1, Risk 2, or Risk 3 was used as the dependent variable within the regression equation.

4.4.6 Hypothesis 6 – Relationship between Safety Awareness and Safety-Related Events

Hypothesis 6 stated that there was a negative statistical relationship between employee safety awareness and the incidence of safety-related events over the previous twelve months. It was tested using the regression method previously described, using Safety Awareness Sum as the independent variable and Safety-Related Events Sum as the dependent variable. No support was found for this hypothesis as no significant relationships were detected by the regression.

4.4.7 Hypothesis 7 – Relationship between Employer Safety Practices and Job Satisfaction

The final hypothesis stated that there was a positive statistical relationship between employer safety practices and levels of employee job satisfaction. Hypothesis 7 was partially

supported as a significant relationship was uncovered between employee perceptions of safety communication, employee perceptions of hazard control, and employee job satisfaction. The equation for this relationship is as follows:

Job Satisfaction = -1.114 + 1.147 (Safety Communication) + .994 (Hazard Control)

This equation was established after three other variables (safety awareness, job danger, and safety-related events) were progressively removed as non-significant contributors from the original regression. The equation indicates that as employee perceptions of both safety communication and hazard control improve, the level of employee job satisfaction increases. The SPSS output for this analysis is included in Appendix B.

4.4.8 Multivariate Analysis

In order to fully analyze the relationships among all variables within this study, a separate regression model was created which included all three independent variables. As in previous models, demographic variables were entered into the first block and job perception variables were entered into the second block. Safety communication, hazard control, and safety awareness were all entered into the third block of the regression.

When using risk tolerance as the dependent variable with this regression, safety communication was found to be the only significant contributor ($p < .01$). This finding was true whether using Risk Sum, Risk 1, Risk 2, or Risk 3 as the dependent variable. These results were consistent with those obtained when each employer safety practice was tested individually.

When using safety-related events as the dependent variable within this regression, no significant relationships were uncovered with any of the input variables. This finding was consistent with the results obtained when alternating each employer safety practice separately in order to specifically test Hypotheses 2, 4, and 6.

4.5 Summary

Several summated variables were created for the purposes of analysis within this study. Each of these summations demonstrated adequate internal consistency based on their individual Cronbach's alpha scores. The creation of a correlation matrix for all variables of interest detected several statistically significant correlations at both the 0.01 and 0.05 levels. In order to test the research hypotheses, a number of regression analyses were completed.

Regressions associated with the first six hypotheses used the same control variables based on demographic data and job perceptions. Safety communication, hazard control, and safety awareness were alternated as the independent variable within each of these regressions. Both risk tolerance and safety-related events were used as dependent variables, with risk tolerance being tested under four different conditions (Risk Sum, Risk 1, Risk 2, and Risk 3). A significant linear relationship was found between safety communication and Risk 1 when controlling for job danger. Simple linear relationships were also detected between safety communication and the following dependent variables: Risk Sum, Risk 2, and Risk 3. Neither of the other independent variables (hazard control or safety awareness) was significantly related to risk tolerance. In addition, no significant relationships were detected between any of the three independent variables and the dependent variable of safety-related events. Results consistent with these findings were obtained when all three independent variables were entered simultaneously into the regression equations for both risk tolerance and safety-related events.

A separate regression was completed in order to test the relationship between employer safety practices and employee job satisfaction. A significant relationship was found between employee perceptions of safety communication, employee perceptions of hazard control, and job satisfaction levels.

Table 4-8 on the following page provides a consolidated summary of the results obtained for each hypothesis.

Hypothesis	Expectation	Supported or Not Supported
1	There is a positive statistical relationship between employee perceptions of safety communication and risk tolerance.	Supported
2	There is a negative statistical relationship between employee perceptions of safety communication and safety-related events.	Not supported
3	There is a positive statistical relationship between employee perceptions of hazard control and risk tolerance.	Not supported
4	There is a negative statistical relationship between employee perceptions of hazard control and safety-related events.	Not supported
5	There is a positive statistical relationship between employee safety awareness and risk tolerance.	Not supported
6	There is a negative statistical relationship between employee safety awareness and safety-related events.	Not supported
7	There is a positive statistical relationship between employer safety practices and employee job satisfaction.	Supported

Table 4-8: Summary of Findings for Research Hypotheses

4.6 Literature Cited

Fink, A. (1995). *How to Analyze Survey Data,* Thousand Oaks, CA: SAGE Publications, Inc.

Hinkle, D.E., Wiersma, W., Jurs, S.G. (1988). *Applied Statistics for the Behavioral Sciences,* Boston: Houghton Mifflin Company.

Issac, S., Michael, W.B. (1997). *Handbook in Research and Evaluation: A Collection of Principle, Methods, and Strategies Useful in the Planning, Design, and Evaluation of Studies in Education and the Behavioral Sciences,* San Diego: EDITS Publishers.

Kerlinger, F.N., Lee, H.B. (1999). *Foundations of Behavioral Research,* Wadsworth Publishing, 433-441.

Miller, D.C. (1991). *Handbook of Research Design and Social Measurement.* Newbury Park, CA: Sage Publications.

Chapter 5

Discussion

5.1 Overview

The primary purpose of this study was to investigate whether employer safety practices were related to the individual risk tolerance of employees. A significant positive relationship was detected between employee perceptions of safety communication and individual risk tolerance. This relationship was indicated for the Risk 1, Risk 2, Risk 3, and Risk Sum variables and resulted in the acceptance of Hypothesis 1. No significant relationships were found between individual risk tolerance and either employee perceptions of hazard control or employee safety awareness. Thus, Hypotheses 3 and 5 were both rejected.

These results suggest that establishing a positive safety communication atmosphere between supervisors and subordinates is associated with less tolerance for risk by employees. This finding is consistent with the principles of social exchange theory, which proposes that employees will respond in a positive manner if they feel the employer is concerned with their needs and interests. This study raises the possibility that being less tolerant of risk on the job may be a means by which employees partially fulfill a perceived obligation created by a positive safety communication relationship with their supervisor.

No significant relationships were found between any of the three independent variables of interest and safety-related events. Hypotheses 2, 4, and 6 were all rejected based on these findings. There are many factors that contribute to the incidence of workplace injuries and illnesses. Environmental exposures, equipment condition, work procedures, and process design are just a few of the many variables that may determine whether or not a loss occurs. Many of

these contributing factors have little to do with employee perceptions or awareness levels. While these employee attributes may play a role in the incidence of safety-related events, their impact does not appear to be as significant as other variables not considered within the scope of this study.

A significant relationship was found between employee perceptions of safety communication, employee perceptions of hazard control, and employee job satisfaction. As a result, Hypothesis 7 was accepted. This finding supports previous research which found evidence of a relationship between job satisfaction and organizational performance (Ostroff, 1992) and more specifically, job satisfaction and safety perceptions (Gyekye, 2005). This outcome reinforces the need for employers to consider workplace safety as an important contributor to employee job satisfaction levels.

5.2 Implications

The presence of a significant relationship between safety communication and employee risk tolerance has implications for both employers and safety professionals. This finding further reinforces the importance of ensuring open safety communication between supervisors and employees. The need for safety communication is uniformly stressed by the various safety management systems as both a means of employee involvement and hazard identification. However, it frequently is not given as much emphasis as traditional methods of hazard identification such as workplace inspections, program audits, and task observations.

The results of this study provide an additional incentive for employers to ensure that clear lines of communication are established for the discussion of occupational safety issues. An emphasis should be placed upon developing effective communication relationships between supervisors and employees. Most organizations consider the supervisor to be the primary point of contact for safety feedback. When this is true, the organization should ensure that this policy is

clearly communicated to all employees and encourage employees to use this route of communication as needed.

Adequate resources should also be devoted to ensuring supervisors are capable of evaluating safety issues raised by employees and responding in an effective manner. This might be accomplished by providing supervisors with training interventions designed to not only increase their knowledge of workplace safety, but also develop their communication skills. Effective and open safety communication is more likely to take place when supervisors can effectively evaluate issues raised by employees based on an understanding of the relevant safety and health implications. Just as importantly, supervisors must also be able to make use of effective communication strategies such as active listening, feedback, and conflict resolution.

The absence of a relationship between either hazard control or safety awareness and risk tolerance does not negate the importance of these two factors within the workplace. The elimination of hazards and completion of safety training both have numerous other potential benefits beyond the relationships investigated within this study.

One possible explanation for the presence of a relationship with safety communication would be the fact that unlike either hazard control or safety awareness, it is based upon a personal interaction with the supervisor. Employees who perceive an open safety communication relationship may conclude that their supervisor has a personal interest in their well-being. This in turn may create a sense of obligation by the employee to avoid risk when this can be consciously accomplished. This same sense of obligation may not be as strong with perceptions of hazard control or safety awareness because in many cases they can be viewed as broader organizational responsibilities. The identification and subsequent control of job hazards, along with the completion of safety training, may be expectations that the employee holds for the organization rather than the supervisor.

Another possible reason for the significant relationship between safety communication and risk tolerance is that safety communication may not be viewed by employees as being a compliance-driven practice. Safety communication is commonly accepted as an effective component of organizational safety efforts, but it is not regulated or specified by governmental bodies. On the other hand, many safety standards exist requiring both the control of hazards and the provision of safety training. From an employee perspective, safety communication may be viewed as somewhat discretionary by the employer simply because it is not required by law. Therefore, it may be viewed as stronger evidence of concern by the employer and potentially more likely to result in a reciprocal behavior such as risk avoidance.

5.3 Limitations

Although a positive relationship was found between safety communication and risk tolerance, caution must be used in the interpretation of these results. The methods employed within this study allowed for the identification of contributing factors, but no definite conclusions can be drawn relating to causality. It is therefore unlikely that an isolated focus on enhancing safety communication will result in a definitive improvement in risk tolerance. It must be stressed that safety communication accounted for a relatively small amount of variance in the risk tolerance variable and there are a multitude of other factors that contribute to a given individual's tolerance for risk. Consideration should also be given to the fact that safety communication is only one element of a safety management system. Other elements not considered within this study may be significant contributors and may interact with safety communication to more fully explain the findings.

The findings of this study are limited to the survey participants and their employer. A number of the constructs used on the survey form were specifically designed to incorporate information specific to the surface mining industry. It should also be stressed that the pool of

respondents participating in this study was not diverse in terms of culture or gender as all respondents identified themselves as white males. This could have implications for the analysis completed, since earlier research has indicated differences in risk tolerance levels based on both gender and cultural factors.

The results of this study may also not extend to other industries or workplaces where an emphasis is not placed on safety. The company participating in this study has a number of hazard control mechanisms in place and has consistently experienced injury rates below the industry averages. Other establishments that do not actively try to prevent workplace injuries and illnesses may not replicate the results found in this study.

Another limitation of this study is the reliance on self-reporting to account for safety-related events. This approach may create the possibility of same-source bias, wherein the use of self-reported data for both the outcome and input variables may generate a spurious association between the two. This is due to the fact that the outcome variable can impact the perceptions associated with the input variables.

5.4 Future Research

Future research should be pursued to confirm the findings of this study. Exploring these relationships across larger samples and different industries would allow for more definitive conclusions. Conducting a similar study within a more diverse workplace may also allow for a more thorough evaluation.

Consideration should also be given to taking a broader approach to identifying determinants of employee risk tolerance. This study focused on three common elements of a safety management system: safety communication, hazard control, and safety training. However, there are other system elements that were not explored such as management commitment, employee participation, and safe work procedures. Accounting for employee perceptions of these

factors may allow for a more complete analysis of risk tolerance determinants. The literature also indicates a broad array of personal and situational factors may contribute to an employee's tolerance for risk. Attempting to account for additional non-occupational attributes is likely to produce more robust results.

No significant relationships were found between employer safety practices and safety-related events in this study. Safety-related events may be better evaluated using another source such as company injury reports, workers' compensation data, or the OSHA Form 300. Using these sources would eliminate concerns related to same-source bias.

5.5 Literature Cited

Gyekye, S. (2005). Workers' perceptions of workplace safety and job satisfaction. *International Journal of Occupational Safety and Ergonomics, 11*(3), 291-302.

Ostroff, C. (1992). The relationship between satisfaction, attitudes, and performance: an organizational level analysis. *Journal of Applied Psychology, 77*(6), 963-974.

Appendix A

Safety Survey Form

Safety Survey

All information you provide is COMPLETELY CONFIDENTIAL. NO ONE FROM YOUR COMPANY WILL EVER SEE YOUR RESPONSES.

The surveys will be collected directly from you by the research team and removed from this facility today.

Employee Number _____

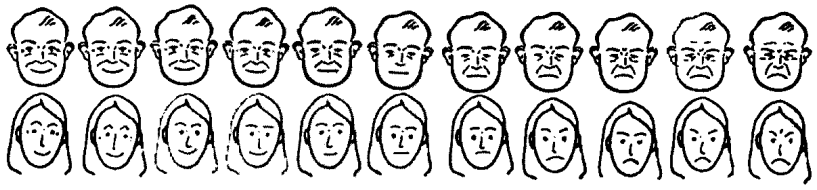
1. Completely fill in the circle that indicates your agreement with each of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am well aware of the safety risks involved in my job	O	O	O	O	O
I know where the first aid kits are located in my workplace	O	O	O	O	O
I do not use equipment that I feel is unsafe	O	O	O	O	O
I inform supervisors of any potential hazards I notice on the job	O	O	O	O	O
I know what procedures to follow if injured on my shift	O	O	O	O	O
I would know what to do if an emergency occurred on my shift (e.g., amputation, laceration, fire, etc)	O	O	O	O	O
I inform my co-workers of any potential hazards I notice on the job	O	O	O	O	O

2. Some jobs in mining operations are more dangerous than others. How dangerous do you feel your particular job is?

Not at all dangerous		Somewhat dangerous		Very dangerous
O	O	O	O	O

3. Please completely fill in the circle below the face that best represents how you feel about your job.



O O O O O O O O O O O

4. Please indicate how many times each of the following events has happened to you during past 12 months on the job.

In the last 12 months I have.....	Never	Once	2-3 times	4-5 times	6-7 times	More than 8 times
➢ overextended myself when lifting or moving things.	O	O	O	O	O	O
➢ tripped over something on the ground.	O	O	O	O	O	O
➢ had an object stuck in my hand (e.g., metal, splinter, staple, etc.) while working.	O	O	O	O	O	O
➢ had clothes get caught in something (e.g., a piece of machinery) while working.	O	O	O	O	O	O
➢ slipped on mud, rock dust, grease, ice, or other objects on the floor.	O	O	O	O	O	O
➢ had contact with dangerous equipment that almost caused an injury (e.g., conveyor, heavy equipment, etc.).	O	O	O	O	O	O
➢ developed joint, tendon, or muscle pain from work activities that use repetitive motions.	O	O	O	O	O	O
➢ dropped heavy object (e.g., idler) on body part (e.g., foot).	O	O	O	O	O	O
➢ received eye injury from foreign matter (e.g., dust, rock chips).	O	O	O	O	O	O
➢ had some other near-miss that almost caused an injury to myself or a co-worker	O	O	O	O	O	O

5. Please indicate to what extent you agree with each of the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel comfortable discussing safety issues with my supervisor.	O	O	O	O	O
I generally try to avoid talking about safety related issues with my supervisor.	O	O	O	O	O
I feel free to discuss safety related issues with my supervisor.	O	O	O	O	O
My supervisor encourages open communication about safety.	O	O	O	O	O
My supervisor openly accepts ideas for improving safety.	O	O	O	O	O
I am reluctant to discuss safety related problems with my supervisor.	O	O	O	O	O

6. Please read each statement carefully then fill in the circle that you feel best describes the safety conditions in <u>your work area</u>.

	Never		Sometimes		Almost Always
Catwalks/passageways and working areas are kept free of tripping hazardous (e.g., rocks)	O	O	O	O	O
Some workers in my area behave in an unsafe manner	O	O	O	O	O
There is enough light in my area to do my job safely	O	O	O	O	O
Equipment in my area is kept in good working condition	O	O	O	O	O
Walkways are open, clean and safe	O	O	O	O	O
First aid and safety equipment are maintained in good working order	O	O	O	O	O
Hazardous materials (e.g., gasoline) and eye wash stations are clearly marked	O	O	O	O	O
Warning signs are posted in visible and relevant locations	O	O	O	O	O

7. How long do you expect to remain with your current <u>employer</u>? (Fill one circle)

Less than one year	About 1 year	2 years	3 years	4 years	More than 5 years
O	O	O	O	O	O

8. How many hours of off-the-job safety-related training have you received in the past 2 years (2005, 2006)? Examples may include safety training received as part of emergency medical technician training, volunteer fire department duties, military / reserve unit training, or other similar activities.

_____ hours

9. Please respond to each of the following situations.

It is the end of the work shift. On the way out a worker notices a broken electrical conduit. It is not in his area of the work site. Reporting the problem will make him late getting home. He leaves without reporting what he saw.

If you did this, how comfortable would you be?

Very Comfortable	Comfortable	Uncomfortable	Very Uncomfortable
O	O	O	O

It is Friday, the end of the work week. The person responsible for doing the pre-shift inspections is rushed for time. Today, he hurries through the pre-shift inspection in just a few minutes. Usually, the inspection takes much longer to complete thoroughly.

If you did this, how comfortable would you be?

Very Comfortable	Comfortable	Uncomfortable	Very Uncomfortable
O	O	O	O

A worker is in the process of changing a screen and he drops a wrench onto the conveyor belt. Instead of locking out the conveyor belt first, he climbs onto the belt, picks up the wrench and continues working.

If you did this, how comfortable would you be?

Very Comfortable	Comfortable	Uncomfortable	Very Uncomfortable
O	O	O	O

9. **Remember that all your responses are confidential and no one at your company will ever see your answers. Please provide us with the following information:**

Gender	**Male**	**Female**			
	O	O			
Race	**White**	**African American**	**Hispanic**	**American Indian**	**Other**
	O	O	O	O	O
Marital Status	**Single**	**Married**			
	O	O			

Number of dependents living with you: _____

Number of dependents that do not live with you: _____

Job Title (Be specific): _____

Please check the highest level of education you have obtained:

_____ **Less than high school**
_____ **High school**
_____ **Two year technical or associates degree, or trade school**
_____ **Bachelors degree or beyond**

Number of years of military service: _____years

Total amount of time you have worked for this company: _____years, _____ months

Total number of years you have worked in construction / mining industry: _____years

Thank you.
We appreciate the time you have taken to answer these questions.

Appendix B

SPSS Output for Significant Relationships

SPSS Output for Regression Analysis

(When Using C Sum as Independent Variable and R Sum as Dependent Variable)

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Yr indus, MilSv Coded, DepCoded, EdCoded, Marital Coded[a]	.	Enter
2	JS, JD[a]	.	Enter
3	CSum[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: RSum

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.333[a]	.111	.061	.60006
2	.341[b]	.116	.046	.60496
3	.462[c]	.213	.141	.57414

a. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD, CSum

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.033	5	.807	2.240	.057[a]
	Residual	32.407	90	.360		
	Total	36.440	95			
2	Regression	4.234	7	.605	1.653	.131[b]
	Residual	32.206	88	.366		
	Total	36.440	95			
3	Regression	7.761	8	.970	2.943	.006[c]
	Residual	28.678	87	.330		
	Total	36.440	95			

a. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD, CSum

d. Dependent Variable: RSum

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.578	.210		17.072	.000
	MaritalCoded	.012	.165	.010	.076	.940
	DepCoded	.191	.173	.136	1.104	.272
	EdCoded	-.019	.112	-.017	-.172	.864
	MilSvCoded	-.237	.163	-.147	-1.452	.150
	Yr indus	-.016	.006	-.279	-2.678	.009
2	(Constant)	3.501	.337		10.396	.000
	MaritalCoded	-.002	.169	-.001	-.011	.991
	DepCoded	.196	.174	.140	1.126	.263
	EdCoded	-.024	.114	-.022	-.212	.833
	MilSvCoded	-.222	.166	-.138	-1.333	.186
	Yr indus	-.015	.006	-.276	-2.534	.013
	JS	.020	.030	.072	.691	.492
	JD	-.019	.065	-.031	-.293	.770
3	(Constant)	2.672	.408		6.550	.000
	MaritalCoded	-.009	.160	-.007	-.059	.953
	DepCoded	.191	.165	.136	1.158	.250
	EdCoded	-.071	.109	-.064	-.646	.520
	MilSvCoded	-.175	.159	-.109	-1.106	.272
	Yr indus	-.010	.006	-.171	-1.584	.117
	JS	-.031	.032	-.108	-.958	.341
	JD	-.054	.063	-.087	-.856	.394
	CSum	.326	.100	.384	3.271	.002

a. Dependent Variable: RSum

Excluded Variables[c]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	JS	.071[a]	.683	.496	.072	.932
	JD	-.028[a]	-.267	.790	-.028	.898
	CSum	.315[a]	3.128	.002	.315	.887
2	CSum	.384[b]	3.271	.002	.331	.658

a. Predictors in the Model: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors in the Model: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Dependent Variable: RSum

SPSS Output for Regression Analysis

(When Using C Sum as Independent Variable and Risk 1 as Dependent Variable)

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Yr indus, MilSv Coded, DepCoded, EdCoded, Marital Coded[a]	.	Enter
2	JS, JD[a]	.	Enter
3	CSum[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: R1

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.292[a]	.085	.035	.709
2	.308[b]	.095	.023	.714
3	.446[c]	.199	.125	.675

a. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD, CSum

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.226	5	.845	1.680	.147[a]
	Residual	45.264	90	.503		
	Total	49.490	95			
2	Regression	4.689	7	.670	1.316	.252[b]
	Residual	44.800	88	.509		
	Total	49.490	95			
3	Regression	9.853	8	1.232	2.703	.010[c]
	Residual	39.636	87	.456		
	Total	49.490	95			

a. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD, CSum

d. Dependent Variable: R1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.731	.248		15.064	.000
	MaritalCoded	-.095	.194	-.062	-.489	.626
	DepCoded	.152	.204	.093	.747	.457
	EdCoded	.030	.133	.023	.225	.822
	MilSvCoded	-.215	.193	-.114	-1.114	.268
	Yr indus	-.015	.007	-.238	-2.254	.027
2	(Constant)	3.790	.397		9.543	.000
	MaritalCoded	-.098	.199	-.064	-.492	.624
	DepCoded	.159	.205	.097	.775	.440
	EdCoded	.034	.135	.026	.252	.802
	MilSvCoded	-.205	.196	-.109	-1.042	.300
	Yr indus	-.014	.007	-.219	-1.987	.050
	JS	.019	.035	.056	.532	.596
	JD	-.063	.077	-.087	-.812	.419
3	(Constant)	2.787	.480		5.812	.000
	MaritalCoded	-.107	.188	-.070	-.569	.571
	DepCoded	.154	.194	.094	.791	.431
	EdCoded	-.022	.129	-.017	-.174	.862
	MilSvCoded	-.148	.187	-.079	-.795	.429
	Yr indus	-.007	.007	-.111	-1.012	.314
	JS	-.043	.038	-.131	-1.148	.254
	JD	-.105	.074	-.145	-1.414	.161
	CSum	.394	.117	.398	3.367	.001

a. Dependent Variable: R1

Excluded Variables[c]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	JS	.053[a]	.502	.617	.053	.932
	JD	-.085[a]	-.795	.429	-.084	.898
	CSum	.309[a]	3.011	.003	.304	.887
2	CSum	.398[b]	3.367	.001	.340	.658

a. Predictors in the Model: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors in the Model: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Dependent Variable: R1

SPSS Output for Regression Analysis

(When Using C Sum as Independent Variable and Risk 2 as Dependent Variable)

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Yr indus, MilSv Coded, DepCoded, EdCoded, Marital Coded[a]	.	Enter
2	JS, JD[a]	.	Enter
3	CSum[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: R2

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.216[a]	.047	-.006	.706
2	.244[b]	.059	-.015	.709
3	.358[c]	.128	.048	.686

a. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD, CSum

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.193	5	.439	.881	.497[a]
	Residual	44.796	90	.498		
	Total	46.990	95			
2	Regression	2.788	7	.398	.793	.595[b]
	Residual	44.202	88	.502		
	Total	46.990	95			
3	Regression	6.018	8	.752	1.597	.137[c]
	Residual	40.972	87	.471		
	Total	46.990	95			

a. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD, CSum

d. Dependent Variable: R2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.406	.246		13.821	.000
	MaritalCoded	.264	.193	.178	1.365	.176
	DepCoded	-.060	.203	-.037	-.294	.770
	EdCoded	-.033	.132	-.026	-.247	.806
	MilSvCoded	-.101	.192	-.055	-.528	.599
	Yr indus	-.011	.007	-.182	-1.684	.096
2	(Constant)	3.390	.395		8.593	.000
	MaritalCoded	.252	.198	.170	1.274	.206
	DepCoded	-.051	.204	-.032	-.249	.804
	EdCoded	-.033	.134	-.027	-.249	.804
	MilSvCoded	-.083	.195	-.045	-.425	.672
	Yr indus	-.010	.007	-.166	-1.477	.143
	JD	-.058	.077	-.083	-.758	.451
	JS	.028	.035	.087	.810	.420
3	(Constant)	2.597	.488		5.326	.000
	MaritalCoded	.244	.191	.165	1.277	.205
	DepCoded	-.055	.198	-.035	-.279	.781
	EdCoded	-.078	.131	-.062	-.595	.553
	MilSvCoded	-.038	.190	-.021	-.203	.840
	Yr indus	-.005	.007	-.078	-.683	.496
	JD	-.091	.075	-.130	-1.213	.228
	JS	-.021	.038	-.065	-.545	.587
	CSum	.312	.119	.323	2.619	.010

a. Dependent Variable: R2

Excluded Variables[c]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	JD	-.079[a]	-.728	.468	-.077	.898
	JS	.084[a]	.783	.436	.083	.932
	CSum	.269[a]	2.536	.013	.260	.887
2	CSum	.323[b]	2.619	.010	.270	.658

a. Predictors in the Model: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors in the Model: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Dependent Variable: R2

SPSS Output for Regression Analysis

(When Using C Sum as Independent Variable and Risk 3 as Dependent Variable)

Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	Yr indus, MilSv Coded, DepCoded, EdCoded, Marital Coded[a]	.	Enter
2	JS, JD[a]	.	Enter
3	CSum[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: R3

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.403[a]	.162	.116	.734
2	.412[b]	.170	.104	.739
3	.461[c]	.212	.140	.724

a. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD, CSum

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.378	5	1.876	3.484	.006[a]
	Residual	48.455	90	.538		
	Total	57.833	95			
2	Regression	9.824	7	1.403	2.573	.018[b]
	Residual	48.009	88	.546		
	Total	57.833	95			
3	Regression	12.274	8	1.534	2.930	.006[c]
	Residual	45.559	87	.524		
	Total	57.833	95			

a. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Predictors: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD, CSum

d. Dependent Variable: R3

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.597	.256		14.036	.000
	MaritalCoded	-.131	.201	-.080	-.653	.515
	DepCoded	.479	.211	.271	2.270	.026
	EdCoded	-.055	.137	-.039	-.401	.689
	MilSvCoded	-.395	.200	-.194	-1.978	.051
	Yr indus	-.020	.007	-.280	-2.772	.007
2	(Constant)	3.322	.411		8.079	.000
	MaritalCoded	-.159	.206	-.097	-.773	.442
	DepCoded	.480	.213	.271	2.256	.027
	EdCoded	-.073	.140	-.053	-.525	.601
	MilSvCoded	-.378	.203	-.186	-1.861	.066
	Yr indus	-.021	.007	-.305	-2.888	.005
	JS	.015	.036	.041	.406	.686
	JD	.063	.080	.081	.792	.431
3	(Constant)	2.631	.514		5.117	.000
	MaritalCoded	-.166	.202	-.101	-.820	.414
	DepCoded	.476	.208	.269	2.284	.025
	EdCoded	-.112	.138	-.080	-.812	.419
	MilSvCoded	-.340	.200	-.167	-1.698	.093
	Yr indus	-.017	.008	-.236	-2.177	.032
	JS	-.028	.040	-.078	-.692	.491
	JD	.034	.079	.044	.432	.667
	CSum	.272	.126	.254	2.163	.033

a. Dependent Variable: R3

Excluded Variables[c]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	JS	.044[a]	.438	.662	.046	.932
	JD	.083[a]	.812	.419	.086	.898
	CSum	.222[a]	2.215	.029	.229	.887
2	CSum	.254[b]	2.163	.033	.226	.658

a. Predictors in the Model: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded

b. Predictors in the Model: (Constant), Yr indus, MilSvCoded, DepCoded, EdCoded, MaritalCoded, JS, JD

c. Dependent Variable: R3

SPSS Output for Regression Analysis

(When Using Employer Safety Practices as Independent Variables and Job Satisfaction as Dependent Variable)

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	JD, SRESum[a]	.	Enter
2	CSum, SASum, HCSum[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: JS

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.288[a]	.083	.065	2.108
2	.571[b]	.326	.292	1.834

a. Predictors: (Constant), JD, SRESum

b. Predictors: (Constant), JD, SRESum, CSum, SASum, HCSum

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	40.583	2	20.291	4.565	.013[a]
	Residual	448.946	101	4.445		
	Total	489.529	103			
2	Regression	159.755	5	31.951	9.495	.000[b]
	Residual	329.773	98	3.365		
	Total	489.529	103			

a. Predictors: (Constant), JD, SRESum

b. Predictors: (Constant), JD, SRESum, CSum, SASum, HCSum

c. Dependent Variable: JS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.756	.912		8.504	.000
	SRESum	-.918	.354	-.252	-2.591	.011
	JD	.422	.208	.198	2.033	.045
2	(Constant)	1.469	2.133		.689	.492
	SRESum	-.735	.314	-.201	-2.337	.021
	JD	.238	.189	.112	1.263	.210
	CSum	1.203	.288	.411	4.179	.000
	SASum	-.201	.472	-.040	-.426	.671
	HCSum	.655	.363	.174	1.805	.074

a. Dependent Variable: JS

Excluded Variables[b]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	CSum	.478[a]	5.633	.000	.491	.968
	SASum	.162[a]	1.634	.105	.161	.910
	HCSum	.353[a]	3.886	.000	.362	.968

a. Predictors in the Model: (Constant), JD, SRESum

b. Dependent Variable: JS

Regression Results for Relationship between Safety Communication and Risk Sum

	Model 1	**Model 2**	**Model 3**
Control Variables	**Std Beta**	**Std Beta**	**Std Beta**
Marital Status	.010	-.001	-.007
Dependent Status	.136	.140	.136
Educational Level	-.017	-.022	-.064
Military Service	-.147	-.138	-.109
Industry Tenure	-.279**	-.276*	-.171
Employee Job Perceptions		**Std Beta**	**Std Beta**
Job Satisfaction		.072	-.108
Job Danger		-.031	-.087
Independent Variable			**Std Beta**
Safety Communication			.384**
Model F	2.240	1.653	2.943**
R^2	.111	.116	.213
R^2 Change		.005	.097

$p < .05$ indicated by *

$p < .01$ indicated by **

Regression Results for Relationship between Safety Communication and Risk 1

	Model 1	**Model 2**	**Model 3**
Control Variables	**Std Beta**	**Std Beta**	**Std Beta**
Marital Status	-.062	-.064	-.070
Dependent Status	.093	.097	.094
Educational Level	.023	.026	-.017
Military Service	-.114	-.109	-.079
Industry Tenure	-.238*	-.219*	-.111
Employee Job Perceptions		**Std Beta**	**Std Beta**
Job Satisfaction		.056	-.131
Job Danger		-.087	-.145
Independent Variable			**Std Beta**
Safety Communication			.398**
Model F	1.680	1.316	2.703**
R^2	.085	.095	.199
R^2 Change		.010	.104

$p < .05$ indicated by *

$p < .01$ indicated by **

Regression Results for Relationship between Safety Communication and Risk 2

	Model 1	**Model 2**	**Model 3**
Control Variables	**Std Beta**	**Std Beta**	**Std Beta**
Marital Status	.178	.170	.165
Dependent Status	-.037	-.032	-.035
Educational Level	-.026	-.027	-.062
Military Service	-.055	-.045	-.021
Industry Tenure	-.182	-.166	-.078
Employee Job Perceptions	**Std Beta**	**Std Beta**	**Std Beta**
Job Satisfaction		.087	-.130
Job Danger		-.083	-.065
Independent Variable			**Std Beta**
Safety Communication			.323**
Model F	.881	.793	1.597
R^2	.047	.059	.128
R^2 Change		.012	.069

$p < .05$ indicated by *

$p < .01$ indicated by **

Regression Results for Relationships between Safety Communication and Risk 3

	Model 1	Model 2	Model 3
Control Variables	**Std Beta**	**Std Beta**	**Std Beta**
Marital Status	-.080	-.097	-.101
Dependent Status	.271*	.271*	.269*
Educational Level	-.039	-.053	-.080
Military Service	-.194	-.186	-.167
Industry Tenure	-.280**	-.305**	-.236*
Employee Job Perceptions		**Std Beta**	**Std Beta**
Job Satisfaction		.041	-.078
Job Danger		.081	.044
Independent Variable			**Std Beta**
Safety Communication			.254*
Model F	3.484**	2.573*	2.930**
R^2	.162	.170	.212
R^2 Change		.008	.042

$p < .05$ indicated by *

$p < .01$ indicated by **

Regression Results for Relationship between Employer Safety Practices and Job Satisfaction

	Model 1	**Model 2**
Control Variables	**Std Beta**	**Std Beta**
Job Danger	.198*	.112
Safety-Related Events	-.252*	-.201*
Independent Variables		**Std Beta**
Safety Communication		.411**
Hazard Control		.174
Safety Awareness		-.040
Model F	4.565*	9.495**
R^2	.083	.326
R^2 Change		.243

$p < .05$ indicated by *

$p < .01$ indicated by **