

THESIS

RISK PERCEPTION AND CULTURAL DIFFERENCES OF LATINOS ACROSS THE
RESIDENTIAL, COMMERCIAL, AND HEAVY CIVIL CONSTRUCTION SECTORS

Submitted by

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ABSTRACT

RISK PERCEPTION AND CULTURAL DIFFERENCES OF LATINOS ACROSS THE RESIDENTIAL, COMMERCIAL, AND HEAVY CIVIL CONSTRUCTION SECTORS

In the field of construction, Latino workers currently suffer a disproportionate higher rate of injuries and fatalities than non-Latino workers. Socio cultural barriers exist that may contribute to this disproportionately higher rate; but, what effect does the sector of the construction industry employing the Latino worker have on safety incidents? The purpose of this study is to investigate differences in Latino construction worker's perceptions about safety culture and risk across the three construction sectors of residential, commercial, and heavy civil. This study is a continuation of the research collected for a cross-sectional study on Safety Culture and Risk Perception differences between Latino and non-Latino Construction workers. Analysis was conducted on 219 Latino responses to surveys collected in the Denver Metro and Northern Colorado areas. This study found that significant difference was exhibited between Latinos in different sectors of construction on six different questions. Those questions were, work productivity and quality having a higher priority than safety, feeling uncomfortable with work practices being observed and recorded, some safety rules and procedures being difficult to understand, immigrant workers making the worksite unsafe, willing to take more risks than coworkers, and the dangers present on construction sites cannot cause my death or the death of others. The research and results from this study will add to the literature of available knowledge and help achieve the overall goal of reducing the disproportionate safety incidents Latinos suffer in the construction industry.

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Introduction

Statement of the Problem

The construction industry consistently maintains a higher rate of injuries and fatalities compared to other industries (Abudayyeh, Fredericks, Butt, & Shaar, 2006). Of those injuries and fatalities, Latino construction workers suffer a disproportionately higher rate than non-Latino construction workers (Irizarry, 2009). Many socio cultural barriers exist that may be attributed to this disproportionately higher rate; but, what effect does the sector of the construction industry employing the Latino worker have on safety incidents? The number of Latinos in the U.S. has increased steadily to comprise roughly 25% of the present national workforce (Canales et al., 2009). At the same time, Latino construction workers are twice more likely to get injured on the jobsite than non-Latino construction workers (*IMMIGRANT WORKERS AT RISK*, 2005). With the growing number of Latino workers in the construction workforce, it is becoming vital to understand those factors contributing to higher rates of injuries and fatalities among this population.

Numerous studies have examined the disproportionately higher rate of injuries and fatalities suffered by Latino workers in the construction industry (Brunette, 2005; Irizarry, 2009; Menzel & Gutierrez, 2010; Vazquez, 2004). Both qualitative and quantitative research has been conducted (Dong, Fujimoto, Ringen, & Men, 2009; Pransky et al., 2002; Ruttenberg, 2004). Studies have focused on topics such as language barriers between non-Spanish speaking management and inadequate or non-English speaking workers (Canales, et al., 2009; Loosemore & Lee, 2002; Smith, 2004). Language barriers may result in misunderstanding of work safe practices, instructions and precautions and create limitations to effective training. Another barrier studied is the differences in culture and its affect on safety. The Latino culture has significant

differences from white non-Hispanic culture and these differences can present problems to safety on the jobsite. Barriers exist that inhibit Latino construction workers from achieving high levels of safety on the job and consequently suffer disproportionate injury, illness and casualties within construction (Canales, et al., 2009; Pransky et al., 2002). Advancements need to be made in research to evaluate the influences that may exist within a specific construction sector and the effect on safety incidents.

Safety is directly influenced by individual perception and/or attitude towards risk which is impacted by differences in language and culture. Are there differences in barriers exhibited between the construction sectors? For example, are Latino construction workers employed in the residential construction sector more or less risk averse than Latino workers employed in the Heavy Civil construction sector? There are many negative outcomes experienced by Latino workers in the construction industry as a whole. These negative outcomes impact the industry, workers, stakeholders, and the nation's economy. This study adds to previous research working towards a deeper understanding of safety culture, safe work practices and the growing Latino workforce leading to strategies for reducing injuries and fatalities among this at risk population (Brunette, 2005; Dongping, Yang, & Wong, 2006).

Purpose of the Study

The purpose of this study is to investigate differences in Latino construction worker's perceptions about safety culture and risk across the three construction sectors of residential, commercial, and heavy civil in the Denver metro and northern Colorado areas. Latino construction workers may suffer a disproportionate number of safety incidents between different construction sectors. Literature supports the assertion that Latino workers suffer a

disproportional number of safety incidents in the construction industry compared to non-Latino workers; and that language, education and cultural differences may be factors that preclude or degrade safety activities such as instructions for safe work practices, effective safety meetings and training, and/or correct operations of equipment needed to perform their job (Gilkey & Lopez del Puerto, 2011). Differences that impact risk perception and safe work behaviors could be more or less prevalent depending on the construction sector. This research will explore and identify risk perception and safety culture differences of Latinos between three construction sectors and lead toward effective interventions to improve safety climate and culture on construction sites.

This research is a continuation of analysis on the data collected for the study on Safety Culture and Risk Perception Differences between Latino and Non-Latino Construction workers (Gilkey & Lopez del Puerto, 2011). The study supported The National Occupational Research Agenda's Sector strategic goal 8.0 pertaining to the increased understanding of factors that comprise both positive and negative construction safety and health cultures; and, expand the availability and use of effective interventions at the policy, organizational, and individual level to maintain safe work practices 100% of the time in the construction industry. Within this goal there are three intermediate goals. Goal 8.1 is to create a working definition and framework for construction industry safety and health culture and improve the construction industry. Intermediate goal 8.2 is to develop and expand the use of validated measurement methods for evaluating safety culture and safety climate in the construction industry. Intermediate goal 8.3 is to partner with construction stakeholders to develop and disseminate effective intervention measures for improving safety and health culture in the construction industry (NORA, 2008).

Research Hypothesis

The stated null hypothesis is that, no difference exists in risk perception and safety culture measures between Latino construction workers across residential, commercial and heavy civil sectors of construction.

Review of the Literature

Construction – A High Risk Industry

Workplace safety is an important topic in today's society. According to the Bureau of Labor Statistics estimates, in the United States in 2006, there were 5,703 fatal and 3.9 million nonfatal workplace injuries (Wirth & Sigurdsson, 2008). While these numbers encompass the entire working nation there are specific industries that have consistently represented a large proportion to the total. One industry in particular, construction, has consistently contributed a large proportion to this burden of human suffering. When compared with other industries the construction industry is notorious for its poor safety record (Mohamed, 2002). The fatality rate in construction is regularly exceeded only by rates in mining and agriculture (Abudayyeh, et al., 2006) making it among the most dangerous industries in the United States. In the United States, construction workers have the highest absolute number of casualties and third highest rate of fatal occupational injuries and the highest rate of non-fatal occupational injuries (Jorgensen, Sokas, Nickels, Gao, & Gittleman, 2007).

In 2000, the US construction industry employed 8.9 million workers or 7% of total civilian labor in the United States. According to the Bureau of Labor Statistics (BLS), the construction industry accounted for 20% of the workplace fatalities across all industry sectors, and 8.8% of the occupational injuries and illnesses in that year (Abudayyeh, et al., 2006). When considering fatalities, the rate in construction was equal to 12.9 per 100,000 employed in the field. On the other hand, the rates for non-fatal injury and illnesses in the construction industry were at 8.3 per 100 full-time workers (Abudayyeh, et al.). In 2002, the construction industry workforce increased to 9.4 million or 7.03% of total civilian labor and it was regarded as one of the most dangerous industries accounting for 20.3% of all occupational deaths in that year

(Brunette, 2004). The upward trends continued in 2004 where the construction industry accounted for 7.7% of total US civilian labor and suffered 22.2% of the 5764 reported work related deaths. In 2007 the construction industry carried a 71% higher rate than the rest of the industry for non-fatal injuries and illnesses with days away (Waehrer, Dong, Miller, Haile, & Men, 2007).

Over the past 10 years fatal and non-fatal injuries and illness rates in construction have maintained their high levels despite the adoption of a focus on safety procedures and programs (Abudayyeh, et al., 2006). This trend has been attributed to a multitude of different factors that in combination are unique to the construction industry. The initial factor is the physical work environment where construction takes place. A construction work environment is generally more hazardous than other industries due to the use of heavy equipment, dangerous tools, and hazardous materials; all of which increase the potential for serious accidents and injuries (Abudayyeh, et al.). Another factor posing a challenge to reducing and controlling exposure to occupational hazards is the dynamic, temporary, and “ever evolving” nature of the construction industry (Brunette, 2005).

Additional factors include two defining characteristics of the construction industry: decentralization and mobility (Dongping, Yang, & Wong, 2006). The concept of decentralization means that construction workers are separated by work sites and required to consistently make decisions or judgment calls without consultation, supervision or expertise when facing day to day problems. Mobility means that construction workers constantly move among positions, sites, and companies more often than workers in other industries. It is believed that these various factors, result in a continuation of inadequacy in the construction industry (Dongping, et al., 2006).

Construction injuries have a direct impact on the individuals involved in construction as well as on the work itself. Impacts include personal suffering of the injured worker, construction delays and productivity losses, higher insurance premiums, and the possible liability suits for all parties involved in the project. There are also many other indirect impacts such as revenue losses on the part of the owner for late project delivery, less than optimal quality and reduced morale of the work force (Abudayyeh, et al., 2006). It has been estimated that occupational injuries within the construction industry cost over \$10 billion per year (Waehrer, et al., 2007). When the costs of workplace injuries, illness, and fatalities to the economy are also considered, the public health significance of developing effective occupational safety and health interventions is clear (Wirth & Sigurdsson, 2008).

Construction Sectors

The construction industry is segmented by the different types of work required. This segmentation can be done at many different levels. Construction can be divided by the client such as for the private sector or the public sector. It can be divided by the type of project delivery method such as Design-Bid-Build, Design-Build, Construction Manager at Risk, and others. Often the construction industry is divided by type of work such as residential, commercial, or heavy civil. The Occupational Safety and Health Administration of the U.S. Department of Labor defines residential construction as any employer in a working environment whose methods, materials and procedures are essentially the same as those used in building a typical single-family home or townhouse (Administration, 1999). Commercial construction usually is identified with vertical construction such as office buildings and retail centers. Heavy civil construction usually consists of horizontal construction such as roads and bridges.

Growing Latino Population

The utilization of migrant workers in construction is a growing world-wide phenomenon. In the UK construction sector, the reliance on cheap and flexible sources of regularly and irregularly employed migrant workers has consistently been a fundamental feature of the industry (Bust, Gibb, & Pink, 2008). Australia for example, employs the world's second largest foreign-born workforce with approximately 30% of its civilian labor force origination from other countries. The construction industry in Australia accounts for 7% of total civilian labor and includes a majority of the foreign born. The workforce is employed in this industry due to the large number of unskilled, menial and manual jobs (Loosemore & Lee, 2002). The use of migrant workers in construction is prevalent in many other countries additional to the UK and Australia. The construction workforces of European and Middle Eastern countries are experiencing major influxes of foreign immigrants. In Saudi Arabia, 30% of the construction industry is composed of foreign workers. Even more, in Singapore foreign workers constituted 81.2% of the total construction workforce at one time (Loosemore & Lee, 2002).

One of the largest employers of foreign born labor is the United States. Over the past two decades the United States has experienced one of the largest waves of immigration in its history (Brunette, 2004). The US received 900,000 immigrants per year and by 2001 the United States Immigration and Naturalization Service reported there were 34.7 million foreign born persons in the United States (Brunette, 2004). The US Census Bureau reports that more than 10% of persons living in the United States are foreign born and that over half are from Latin America and almost 40% entered the US in the past decade (Pransky, et al., 2002). In the United States the traditional source of Hispanic immigrant labor has been from Mexico. In the past decade, this trend has changed to include increasing numbers of immigrants from Central America and most

recently countries such as Ecuador, Argentina, Colombia, and Peru as well (Canales, et al., 2009).

The terms Hispanics, Latinos, Immigrant workers and minorities are often used interchangeably to refer to this varying ethnic group. For consistency this paper will use the term Latino. Latinos, today, represent the fastest growing ethnic group in the United States. Latinos include not only those who have immigrated to the US but also those whose families have lived for many generations within the current boundaries of the United States (Brunette, 2005). The number of Latinos in the US workforce has steadily increased throughout the 20th and early 21st centuries (Vazquez, 2004). According to the US Census Bureau, there were 22.4 million recorded Latinos living in the United States in 1990. By 2001 that number had increased 58% to 35.3 million Hispanics in the United States representing 13 percent of the total U.S. Population (Brunette, 2004; Vazquez, 2004). Between 1996 and 2006 the US Bureau of Labor Statistics also projected that the Latino labor force increased 36% faster than any other ethnic group due to high net immigration to the US and higher than average fertility rates (Anderson, Hunting, & Welch, 2000). An estimated 19.6 million workers were Latino in the United States in 2006, 56% of whom were foreign born (*Work-Related Injury Deaths Among Hispanics --- United States, 1992-2006*, 2008). According to the 2008 US Census, Latinos accounted for one-half of the United States growth between 2000 and 2006. In comparison, The Latino growth rate for this period was 24.3%; four times the 6.1% growth rate of the entire US population (Dong, Fujimoto, Ringen, & Men, 2009).

Certain states with the largest growth rate of Latinos are North Carolina, South Carolina, Georgia, Alabama, Virginia, Arkansas, and Mississippi. While these states geographically represent the southern east of the United States, Northern states are also experiencing significant

numbers of Latino Workers. In New York for example, Latinos represent 15% of the population (Vazquez, 2004). In more central states such as Iowa, the Latino population had increased by 153% between 1990 and 2000. Latinos represent the fastest growing sector of the U.S. workforce and have been projected by the US Census Bureau to make up 25% of the entire workforce by 2050 (Canales, et al., 2009).

Latinos in Construction

As the U.S. work force continues to become more multicultural, certain industries like construction have been impacted by this trend disproportionately. As the Latino population in the U.S. has grown dramatically in recent years a large proportion of this immigrant labor force has gravitated into the construction industry (O'Connor, Loomis, Runyan, dal Santo, & Schulman, 2005). Due to the ease of entry, relatively high wages, low skill requirements, lax legal documentation, limited English literacy requirements, and the availability of jobs the construction sector attracts a large number of Hispanic workers (Irizarry, 2009). At one time the construction industry employed 17% of all immigrants and was second only to agriculture's 37% as the industry employing the highest proportion of Latinos workers (Brunette, 2005). According to the 2008 Center to Protect Workers Rights report, construction is the workforce sector with the highest percentage of Latino workers (Dong, et al., 2009).

The Bureau of Labor Statistics reported between 1985 and 1995 the proportion of Latino wage-and-salaried construction workers increased from 8.9% to 14.6%. In addition, between 1997 and 1998, the proportion of Latino construction laborers increased by 16%. From 1995 to 1996, Latinos represented 10% of all workers in the construction industry. By 2001 that percentage had climbed to 18% or 1.3 million workers, a 100% increase (Brunette, 2004). Of

those 1.3 million workers; 70% were born outside the United States, 21% were employed as laborers, and one third spoke only Spanish (O'Connor, et al., 2005). The majority, or 75% of these additional laborers were of Mexican origins (Anderson, et al., 2000). While the majority of Latino construction workers have continued to originate from Mexico other countries have begun to show more presence. More recently the composition of the Latino workforce includes 55% Mexicans, 20% Mexican American/Chicanos, 14% Central/South Americans, 3% Puerto Ricans, 3% Cubans, and 5% Latinos of other countries of origin (Brunette, 2005).

The number of Latinos employed in the construction industry rose from 342,000 in 1980 to 2,577,000 in 2005 (Irizarry, 2009). The number of Latino workers in construction has tripled from a decade ago and has reached nearly 3 million in 2006 comprising more than one-fourth of the construction industry (Dong, et al., 2009). Even though Latinos comprise one-fourth of the construction industry this group makes up a disproportionately large share of workers in certain trades. Latinos comprise 49% of drywallers in the industry, 45% of concrete workers, 40% of roofers, 39% of laborers, 37% of painters and 36% of tile setters (Irizarry, 2009). In certain states, Latinos are overtaking their white non-Hispanic coworkers to comprise a greater proportion of the construction workforce. In 2005 Latinos already comprised the majority of the construction workforce in California, New Mexico and Texas (Canales, et al., 2009). This growing trend is also seen in organizations where in one division of a nationwide construction firm, Latinos comprised 45% of the workforce (Vazquez, 2004).

Disproportionate Safety Incidents

The U.S. construction industry has been responsible for a high rate of job growth for Latinos, especially foreign born Latinos, yet along with this job growth came an increased

exposure to construction occupational hazards and disproportionate fatality rates (Menzel & Gutierrez, 2010). The inherent danger of construction and the growing number of Latino workers gives rise for added concern about the increase in occupational injuries suffered by Latinos in the construction industry. The National Research Council found that between 1995 and 2000, 28% of all Latino work-related deaths were in the construction industry, occurring at a rate of 18.3 per 100,000. In comparison the manufacturing sector's fatal work injury rate was 3.1 per 100,000 during the same period (Vazquez, 2004). Latino construction laborers rank in the top three occupations for nonfatal injuries and illnesses requiring days away from work and occur more frequently in construction than in any other industry (Brunette, 2005; Vazquez, 2004). One study researched a residential and commercial construction boom in Southern Nevada between 2005 and 2007. Along with that boom there was an increase in the number of lost workday injuries (Menzel & Gutierrez, 2010). The study focused on what ethnicities experienced the greatest amount of injuries. What was not addressed was if there were significant differences in injury rates between residential or commercial construction. Other studies have found that it is the smaller establishments where fatalities occur more often (Dong, et al., 2009). When examining fall fatalities by construction sector and trade, roofing contactors and residential construction ranked the highest in fatalities, Latinos comprised 12 percent of the total. Commercial construction represented nearly 6 percent of the total and Heavy Civil construction represented 2.4% of fatalities (Dong, et al., 2009).

In 1990 Latinos made up less than 16% of the construction workforce in the U.S. yet incurred 23.5% of fatal injuries. In Texas it was found by the Bureau of Labor Statistics that between 1991 and 1993 Latinos made up 34% of employed construction workers but accounted for 41% of fatalities (Thompson & Siddiqi, 2007). A 2004 report found that Latino construction

workers employed in the South appeared to be emerging as the group with the nation's highest unintentional fatal occupational injury rate, a rate that increased 67% from 1992 to 2001 (Thompson & Siddiqi, 2007). From 1992 to 2005 work related deaths in construction among Latino construction workers tripled from 108 to 321 (Irizarry, 2009). Of total incurred deaths in 2003, 14% were composed of Latino workers. Between 1996 and 2001, 60% of all recorded fatal deaths occurred to workers from Latin American countries (Brunette, 2005). A 2008 report by the CDC stated that between 2004 and 2006, 3,609 Latinos were reported as deceased by cause of workplace injuries. Of those 3,609 reported deaths 34% were employed by the construction industry (Evia, 2011).

In 1999 the Center for Construction Research and Training found that Latinos experience a disproportionately high rate of deaths compared to all construction. Latinos suffered a rate of 19 deaths per 100,000, 36% higher than the 14 per 100,000 for all construction (Ruttenberg, 2004). Although overall death rates in construction have declined in recent years, the gap between Latino and non-Latinos remains prevalent (Irizarry, 2009). According to the Bureau of Labor Statistics in 2003 the fatality rate for Latinos of 4.5 deaths per 100,000 workers was about 13% higher than the overall rate of 4.0 deaths per 100,000 for White and Black workers. Between 2000 and 2005, the workplace death rate for Latinos on construction sites was 12.4 per 100,000 compared to 10.5 per 100,000 non-Latino workers (Evia, 2011). From 1992 through 2005, the death rate for Latino construction workers has consistently remained higher than the rate for non-Latinos workers (Dong, et al., 2009).

Barriers to Latino Safety

Prospective Latino construction workers enter the United States with poor understanding of health and safety, governmental enforcement of safety regulations, and little or no participation in building trades (Brunette, 2004). Many of the key determinants that will affect these workers levels of safety awareness and behaviors may be impacted by various barriers to safety. One of the most obvious barriers is the language barrier between Latino and non-Latino construction workers. To effectively integrate Latino workers into the U.S. construction workforce an understanding of the communication process and the role of language barriers to communication must be developed, along with identifying the consequences of communication failures (Canales, et al., 2009). According to the National Safety Council's 2003 Salary Survey, few Latinos speak English when they enter the U.S. and more than 71% of companies employ workers whose native language is not English or who do not speak English (Vazquez, 2004). Latino Immigrants and Spanish-speaking workers often receive less job safety and health training because they do not speak English well or even at all (Ruttenberg, 2004). One Latino worker in a survey by the CPWR said that people appear to be less willing to explain things to those with limited English, and foremen get frustrated trying to explain to workers how to do a task safely (Ruttenberg, 2004). To further complicate the situation, the construction industry uses very technical terms, and even Latino workers with Basic English skills find it difficult to communicate (Thompson & Siddiqi, 2007).

Another communication barrier similar to language is literacy. In 2010 the Morrison Institute reported that the typical Mexican immigrant has completed less than nine years of education and only about half of the Latinos in the western United States possess a high-school education (Vazquez, 2004). The US Census Bureau conducted a similar study and found that

27.3 percent of adult Latinos have less than a ninth-grade education (Vazquez, 2004). High illiteracy rates combined with an inability to linguistically communicate can compromise the safety of both Latinos and English-speaking construction workers on the jobsite (Vazquez, 2004). For Latinos, learning opportunities such as work briefings, safety meetings, and worker-to-worker observation and discussion that help supplement formal classroom training are not as beneficial or effective when the knowledgeable and experienced construction workers and managers speak English only (Vazquez, 2004).

Carlos Evia (2011) wrote in a paper that there is a digital divide affecting the lower levels of the industry's hierarchy. Of the 2.7 million Latino construction workers; whom two million are foreign born, 42% cannot speak English well, and 42% cannot speak English at all, this demographic is at a major disadvantage when it comes to high technology uses in the workplace (Evia, 2011). It is particularly important to understand the barrier Latinos face concerning an inability to navigate the US healthcare system (Menzel & Gutierrez, 2010). The Latino workers risk of work injury and disability is exacerbated by a lack of knowledge and awareness of available health services, inadequate health care benefits, substandard living conditions, life style factors, and a lack of preventative services (Pransky, et al., 2002). The US Census Bureau reported Latino immigrants tended to be among the most disadvantaged when it comes to economics and education and this may lead them to be more acceptable to high-risk work with limited access to adequate health care for work injuries (Pransky, et al., 2002).

Worker characteristics of the Latino construction worker may also create barriers to safety. Characteristics such as their undocumented status, relative youth and lack of construction experience (Williams Jr, Ochsner, Marshall, Kimmel, & Martino, 2010). A 2008 report by the CPWR found that Latino construction workers are typically young, lack English-speaking

abilities, are not highly educated, and employed in low-skill and high-risk occupations (Dong, et al., 2009). In an article on the *Adequacy of Health and Safety Training Among Young Latino Construction Workers* it stated young workers are particularly vulnerable to workplace hazards because they lack experience and training and therefore are less likely to recognize hazards (O'Connor, et al., 2005). It was also proposed that young workers lack the physical strength to handle some job tasks, the maturity to make proper judgments, and the confidence to speak up to supervisors about hazards (O'Connor, et al., 2005).

Two of the most influential barriers may be the fear of immigration status and strong economic pressures to stay employed (Brunette, 2004). In one case, roughly half of the Latino construction workforce in the United States are illegal immigrants who may not raise issues about unsafe work practices because they are afraid to lose their job or face deportation (Irizarry, 2009). In another case, many Latino workers face the conflict of refusing what they know to be unsafe work and the often desperation to earn money to support themselves and their families (Williams Jr, et al., 2010). These barriers may all lead to unsafe work environments and the problem of Latinos underreporting levels of non-fatal injuries in an attempt to maintain positive relationships with employers (Brunette, 2004).

Cultural Differences between Latinos and non-Latinos

Between 1996 and 2001 the Census of Fatal Occupational Injury reported that the excess rate of fatal injury occurred more prevalently among foreign-born Latino workers, while U.S.-born Latino workers had fatal injury rates similar to the rest of the U.S. workforce (Jorgensen, et al., 2007). This had led many researchers to believe there is another barrier preventing Latino workers from achieving a high level of safety within the construction industry. When Latino

workers immigrate to the U.S. they bring with them varied histories, cultural sensibilities, strong health beliefs, and a different cultural background compared with non-Latino workers (Brunette, 2004). Some Latino culture and values can present challenges and lead to safety problems on the jobsite.

In a report on *Latino Workers in the Construction Industry*, Fernando Vázquez (2004) outlines the unique culture and values exhibited in the Latino community. Latino culture teaches that authoritative figures are to be shown ultimate respect which leads to Latino's rarely disagreeing with supervisors or foreman even when those authoritative figures are in the wrong. This cultural value of respect will also hinder Latinos from asking questions or challenging instructions delivered by supervisors. Latinos also culturally tend to do as they are told, regardless of whether they understand. The response stems from the large locus of control distance characterized in the Latino Culture where workers are accustomed to organizations that exhibit centralization of power and subordinates do as they are told (Canales, et al., 2009). In Latino culture, there is a very weak uncertainty avoidance which causes eagerness to be considered inappropriate. In societies that exhibit weak uncertainty avoidance individuals are not driven by an urge to be busy but rather work hard only when needed (Canales, et al., 2009). This prompts Latinos by nature to accommodate the passage of time to their needs rather than follow the clock or fill their day with a list of things to do. Latinos revere their jobs and resist the idea of "rocking the boat" for fear of employer punishment. Latino culture teaches them to remain silent rather than confront problems. To complicate the issue, illegal immigrants fear the possibility of deportation which reduces the likelihood of reporting safety problems. Latinos place high value on family which often extends beyond primary family members. At the workplace Latinos will often speak with each other and create close relationships but will be reluctant to discuss issues

with non-Latinos or supervisors. Developing trust in the Latino culture requires time to form personal relationships. With the nature of construction and the constant moving around job sites and relocation, Latinos are unlikely to develop those relationships with supervisors therefore never truly establishing trust between one another (Vazquez, 2004).

For Latino men, the idea of machismo has a significant impact on job site safety. Machismo is strong in Latino culture and refers to a standard of behavior exhibited by men. Machismo is the masculine force, which to one degree or another drives all masculine behavior both positive and negative (Arciniega, 2008). In a study by Nancy Menzel and Antonio Gutierrez (2010), participants from focus groups stated that machismo plays a role in the higher injury rates suffered by Latinos because it discourages Latino workers from wearing safety equipment (Menzel & Gutierrez, 2010). With an increasing mixture of different nationalities and ethnic groups who understand behaviors in different ways set by cultural knowledge and conventions it is important for a better understanding of cross-cultural management (Bust, et al., 2008).

Contractors face multiple challenges as well when working to improve the safety for Latino workers. Another dimension adding complexity to this issue is not only the cultural differences between Anglos and Latinos but also between and within the various Latin American countries. The CPWR conducted a survey and collected responses from Latinos with construction experience outside the United States. All responses expressed difficulty in adjusting to construction work within the U.S. and show the differences in cultural understanding across varying backgrounds. A Cuban said that in his home country safety equipment was difficult to get and safety regulations were never of any use. A roofer born in Mexico stated he had never used personal protective equipment and was unaware of the importance of safety. He also stated he used to work with cement in his bare feet which is caustic. A Columbian electrician stated in

Colombia the focus is on production and there are few safety regulations (Ruttenberg, 2004). Mismanaging cultural diversity on a job site has serious consequences and leads to increased stress among workers, confusion, frustration, and conflict. These problems can begin to lower work force moral, productivity, quality and can lead to higher accident rates (Loosemore & Lee, 2002). The need to develop strategies to blend cultures in the workplace will become increasingly important as population trends indicate the number of Latino workers will continue to grow within the construction industry (Canales, et al., 2009).

Risk Perception Differences between Latinos and non-Latinos

Safety management is most often conducted through rules and procedures which define and outline safe work practices and conditions. The way in which workers perceive those safety rules and procedures is a major factor affecting the jobsite safety level (Mohamed, 2002). Many of the intrapersonal conflicts associated with safety arise because of differences in perceptions (Prussia, Brown, & Willis, 2003). It has been shown through previous research that differing and discordant beliefs concerning the workplace can lead to dysfunctional effects (Prussia, et al., 2003). Sociological and anthropological studies have been able to show that the roots of risk perception and acceptance of risk form from social and cultural settings (Slovic, 1987). Due to the cultural differences between Latinos and non-Latinos, and cultures effect on risk perception; bringing these two concepts together is paramount. With that in mind, there have been relatively few studies of Latino construction worker perceptions of risk. In order to improve Latino safety, studying how Latino workers perceive risks differently from those of other ethnic groups will help design interventions (Menzel & Gutierrez, 2010).

In order to work towards designing interventions, Nancy Menzel and Antonio Gutierrez (2010) created a qualitative study involving four focus groups of unionized Latino workers in Southern Nevada. Their study was designed to provide a perspective on how Latino construction workers perceive injury risks in order to design injury prevention interventions (Menzel & Gutierrez, 2010). The following factors were themes discovered within all four focus groups to attribute to affect risk perception:

- Construction trade skill differences
- Language/communication skills
- Traditional Latino values
- Workers compensation
- Health literacy

One of the factors identified during the focus groups to have a strong effect on perceptions of risks was construction trade skill; though it had a stronger affect on workers performing entry level or low skill jobs. Level of job skill also affected perceptions of responsibility for safety and accident prevention. Low skill jobs put the responsibility on the employer, while high skill jobs took the responsibility upon themselves and their co-workers. Another identified factor affecting perceived risk was immigration status, where illegal immigrants appeared to be more acceptable to taking more risk on the job (Menzel & Gutierrez, 2010). Four themes were pulled out from the study to have the greatest impact on perceived risks. The most influential theme was English literacy which affected the Latino workers ability to read and understand safety training and signs. The second theme was how the level of skill required for the work resulted in the level or quality of safety training. Lower skilled work received minimal or poor safety instructions. The third theme was how traditional Latino culture

was extensively mentioned to affect safety with emphasis on the values of machismo and respect for those with authority. The fourth theme tied closely with the first but concerned the Latino workers ability to navigate the health care system. For example the difficulty in completing the necessary forms to receive workers (Menzel & Gutierrez, 2010). Menzel and Gutierrez's research helps prove the point that the perception of risk is an important topic that must be understood and evaluated to improve the safety of Latinos in the construction industry.

Safety Culture in an Organization

To improve safety and reduce the potential for accidents and disasters, industries around the world are showing an increased interest in the concept of safety culture. Safety culture is a sub-component of organizational culture and is believed to affect employees' attitudes, assumptions and behaviors in relation to the organizations performance in health and safety (Cooper, 2000). It is this idea that has led the industry to believe that safety culture can be employed as a tool to help control employee beliefs, attitudes, and behaviors with regard to safety (Fernández-Muñiz, Montes-Peón, & Vázquez-Ordás, 2007). The definition of a progressive safety culture is "A set of values, perceptions, attitudes and patterns of behavior with regard to safety shared by members of the organization; as well as a set of policies, practices and procedures relating to the reduction of employees' exposure to occupational risks, implemented at every level of the organization, and reflecting a high level of concern and commitment to the preventions of accidents and illnesses" (Fernández-Muñiz, et al., 2007).

The creation or strengthening of safety culture is dependent upon the deliberate manipulation of various organizational characteristics believed to impact safety management practices (Cooper, 2000). One organizational characteristic with an observable direct impact on

safety is management's commitment to safety. A manager who is committed and is personally involved in safety activities and working conditions fosters the building of a culture committed to the safety of the employees surrounding that organization (Fernández-Muñiz, et al., 2007). One manager or supervisor's commitment can only go so far, the more safety staff, safety committees, and safety training within a company result in lower accident rates (Glendon & Litherland, 2001). As that safety culture builds employees attitudes toward safety will mature causing employees to pursue safer environments thereby reducing unsafe behavior (Glendon & Litherland, 2001).

Dov Zohar (2010), who is known to be one of the founders in developing the concept of safety culture, stated in a recent paper that over the last 30 years there has been tremendous achievement in validating safety culture as a leading indicator or predictor of safety outcomes across industries and countries. Now with the advances in safety culture it is important to ensure that safety is being measured appropriately. Most common measures of safety performance have relied on tracking negative consequences of site accidents rather than proactive strategies (Mohamed, 2003). Negative measures such as accident rates, lost time and workers compensation are now regarded as unsuccessful measures in providing meaningful measures of safety performance (Mohamed, 2003). To adapt to these realizations, behavioral observation can be utilized to measure whether activities are safe or unsafe (Mohamed, 2003). Firms that accomplish this task and build a safety culture and communicate commitment to well-structured and well-funded safety programs can reduce incident and injury rates effectively (Hallowell & Gambatese, 2009)

Cultures Impact on Construction Safety

Construction companies have found it especially important to improve safety culture to attain superior safety performance (Dongping, et al., 2006). Due to the dynamic and temporary nature of construction projects, safety management will need to adjust their techniques to meet the unique needs of the industry (Hallowell & Gambatese, 2009). Hallowell and Gambatese (2009) in a recent study found that most contractors select safety elements for their projects in a very informal approach relying on intuition or word of mouth. Top management has recognized that this common method is no longer applicable and that the safety culture will play a more important role if higher goals of safety performance are to be achieved (Dongping, et al., 2006).

In 1986, Brown and Holmes used an adaptation of Dov Zohar's initial study to measure safety culture and attempted to validate what was found in a sample of American production workers. What they discovered was differences that they attributed to cultural factors. When this study was repeated by Dedobbeleer and Béland in 1991 the same differences were recognized (Glendon & Litherland, 2001). A workers personal culture had bearing and impact on the factors affecting safety culture. Latino culture must be incorporated into safety culture. Safety culture which has a focus in training and education on health and safety is recognized as a crucial factor in reducing and preventing injuries. The disproportionate injuries and fatalities suffered by the Latino working in the high risk industry of construction can be reduced by developing linguistically and culturally appropriate occupational safety and health resources (Brunette, 2005). Current safety training practices use printed materials, videos, and instructors in classroom training that are developed in Spanish. The problem is that these materials lack the culture-specific issues of the Latino workforce and do not incorporate differences in risk perception that may impact jobsite safety (Irizarry, 2009)

In 2004, Susan Harwood Training Grant program funding over three years showed that 11 out of 22 new construction related grants were targeted towards the Latino worker. These numbers show the importance of safety and health education and training materials being targeted to the Latino construction worker. Menzel and Gutierrez (2010) who conducted the study on *Latino Worker Perceptions of Construction Risks* felt that additional research would be needed to assess whether the risk factors they identified are prevalent in other groups. They also felt future studies should incorporate literacy, education level, immigration status, and country of origin to identify perceived risks by those factors. In a report on *An English/Spanish Safety Climate Scale for Construction Workers* it was stated since safety culture has a major impact on workplace health and safety, and because construction workers face higher rates of injury and fatality and because Latinos are disproportionately affected; further study of the impact of safety culture in the construction industry was warranted (Jorgensen, et al., 2007).

Research Methodology

Research Design

This study is a continuation of the research collected for a cross-sectional study by Dr. David Gilkey and Dr. Carla Lopez del Puerto (2011) on Safety Culture and Risk Perception Differences between Latino and Non-Latino Construction workers. Their study utilized a survey to gather data to analyze safety culture and risk perception differences between Latino and non-Latino construction workers. The purpose of survey research is to generalize from a sample to a population so that inferences could be made about some characteristic, attitude, or behavior of the population (Babbie, 1990). The use of a survey provides immediate feedback and allows a surveyor to collect responses over time while maintaining the consistency of the questions. The survey utilized by Dr. Gilkey and Dr. Lopez del Puerto (2011) was administered on-site at construction projects in the Denver metro and northern Colorado area. The field investigator was selected from the available Graduate Research Assistants (GRA) in the Construction Management program at Colorado State University to assist with this study. The field investigator was familiar with the Construction Management program but was also proficient in Spanish and able to conduct the surveys with both Latino and non-Latino construction workers. This additional study utilized the data that was collected for the Safety Culture and Risk Perception Differences between Latino and Non-Latino Construction Workers study but will refocus the data and analyze risk perception differences of Latinos across the different construction sectors.

The survey was designed with nine questions covering respondent demographics. To obtain the respondent demographics questions were asked such as: age, ethnicity, number of years in construction or number of hours of health and safety training in the past year. Eight of

the nine questions on the first page were multiple-choice and one question was an open ended response. The survey also contained 30 questions covering topics concerning risk perception and safety culture. The 30 questions were all multiple-choice utilizing a rating scale from one to five, one being highly disagree and five being highly agree (Gilkey & Lopez del Puerto, 2011).

Population, Sample, and Participants

Participation in the survey was voluntary and the goal was to survey at least 300 construction workers in the Denver Metro and Northern Colorado areas. The intention was to survey 50 Latino and 50 non-Latino construction workers in each of the three construction sectors: Residential, Commercial and Heavy Civil. Construction sites were recruited primarily through two avenues: convenience sampling and existing company partnerships with the Construction Management Program at CSU. To gain access to construction sites, the field investigator typically identified general contractors in each of the three sectors and contacted via telephone safety directors, project managers, vice presidents, or presidents to gain interest and asked if they would be willing to participate in the study. The field investigator would then send a follow-up email with the survey attached to confirm company participation. The email format was consistent and an example of the correspondence is available in Appendix C.

Participants were recruited through convenience sampling and were either employed by the participating general contractors or by subcontractors. Participants could be from any trade, ethnicity, age, etc.; any interested construction worker was invited to participate. The only workers on the jobsites excluded from taking the survey were those of a foreman or higher level management personnel. Participation in the survey usually occurred immediately, however; when there was a sentiment of apprehension it would take only one brave worker to fill out a

survey before initiating a domino effect where other workers would then follow. The survey was primarily conducted between September 2010 and November 2010. A total of 341 completed surveys were collected. Of those responses 219 were Latino and 122 were non-Latino. Across the different sectors: 124 responses were from the residential sector, 105 were from the commercial sector and 110 were from the heavy civil sector, two responses did not identify what sector they worked. In the residential sector of the 124 responses: 95 were Latino and 29 were non-Latino. In the commercial sector of the 105 responses: 67 were Latino and 38 were non-Latino. In the heavy civil sector of the 110 responses: 56 were Latino and 54 were non-Latino (Gilkey & Lopez del Puerto, 2011).

Data Collection Instruments, Variables, and Materials

The survey instrument that was used for the Safety Culture and Risk Perception Differences between Latino and Non-Latino Construction Workers study was an adapted version of the Safety Culture Survey developed by Safety Performance Solutions, Inc (Geller, 1996). This Safety Culture Survey has been used for more than a decade in numerous workplaces and environments including construction. The instrument was used in the HomeSafe Pilot Study by Phil Bigelow and others 1997-2001.

When site access was granted by a company representative with authority, the field investigator arrived at a predetermined scheduled time, convened the voluntary participants, described the study, circulated informed consent waivers, answered questions, collected signed informed consent, administered the surveys in English and Spanish with participating workers, collected surveys, and provided incentive money. A small number of surveys were administered without prior notification when the field investigator randomly encountered construction workers

throughout their work day. If allowed, the field investigator presented the survey to the workers and administered the surveys in the same process as with the scheduled survey times.

In order to incentivize construction workers to participate in the survey all respondents who completed a survey received \$10 cash. The field investigator would coordinate with the project superintendent before the scheduled survey time to obtain an estimated number of available workers to ensure the appropriate amount of \$10 bills were available to accommodate all workers who elected to participate in the survey. In order to account for the cash transaction a separate respondent verification form was required to be filled out by each respondent when they turned in their survey to receive their incentive (\$10). The respondent verification sheet consisted of a name, signature, company, and date. The form was kept separate from the surveys and there was no risk of survey respondent identities being exposed through participation. The anonymous surveys were completed by construction workers and then collected by the field investigator in a plain manila folder for safe keeping and ultimately stored in a locked file cabinet at CSU. No name was required on the actual survey itself. This anonymous process helped to ensure the quality and accuracy of question responses.

Data Analysis Procedures

Once the surveys had been administered the results were manually transferred into SurveyMonkey®. SurveyMonkey® is one of the world's leading providers of web-based survey solutions and provides an online platform to design, collect, and analyze results from surveys. From SurveyMonkey® the results were exported to Microsoft Excel. The raw data was then sorted and coded in order to import the data into SPSS™ for statistical analysis. Survey questions were coded into eight character terms. For example, the survey question, "Most

employees in my company would not feel comfortable if their work practices were observed and recorded by a coworker” was coded as “wrk_obsr”. This process was done for every survey question. When an open ended question was used, responses were grouped and assigned a coded number. For example, if a survey question asked the respondent to briefly describe an injury, and the respondent wrote in “injured leg” this answer was coded a number such as 3. If any other respondents also answered “injured leg” then the same number from before was assigned to that response. This was carried out sequentially until every response had been assigned an individual coded number.

Evaluation of the data included descriptive statistics, frequencies and comparisons between and within groups. There was an explicit interest in the differences and similarities exhibited between Latino construction workers across the three construction sectors. The data was evaluated for assumption of normal distribution and appropriate parametric evaluation was carried out in SPSS™ version 18 using General Linear Model (GLM), Univariate Analysis of Variance (ANOVA) with Tukey’s post hoc testing. Evaluation was accomplished for each dependent variable with fixed factors of Construction Sector and Latino vs. non-Latino to assess between and within group differences. Results yielded means, standard deviations, p-values and 95 percent confidence intervals.

Results

The final sample population for the study totaled 339 survey respondents in the Denver Metro and Northern Colorado geographical areas. Of that total sample population, 121 respondents were non-Latino while 218 respondents were of Latino ethnicity. It should be noted that while the non-Latino ethnicity encompasses those of Anglo, African American, Puerto Rican or other descents; the majority of non-Latino workers in the Colorado geographical areas were of Anglo ethnicity. The surveys were collected through convenience sampling across three construction sectors. In the residential sector, survey responses collected totaled 124; 29 were non-Latino while 95 were of Latino ethnicity. In the commercial sector, survey responses collected totaled 105; 38 were non-Latino while 67 were of Latino ethnicity. In the heavy civil construction sector, survey responses collected totaled 110; 54 were non-Latino while 56 were of Latino ethnicity.

Latino Demographic Results

This study focused on the 218 Latino responses. The first question of the survey identified the sector within which the respondent worked. The possible responses were Residential, Commercial, or Heavy Civil. The results for the first question of the survey can be seen in Table 1.

Table 1 – I work in

| I work in | N | (%) |
|-------------|----|-------|
| Residential | 95 | 43.4% |
| Commercial | 67 | 30.6% |
| Heavy Civil | 56 | 25.6% |

The second question provided whether the respondent was Latino or non-Latino. The results for Latino non-Latino can be seen in Table 2.

Table 2 – I am Latino

| I am Latino | N | (%) |
|-------------|-----|-------|
| Yes | 218 | 64.3% |
| No | 121 | 35.7% |

The third question provided the age of the respondent. The possible responses were: 1- Younger than 30 years old, 2- Between 31 and 40 years old, 3- Between 41 and 50 years old, and 4- Older than 51 years. The results for the age of the respondents can be seen in Table 3.

Table 3 - Age Distribution of Respondents

| Age | N | (%) |
|-----------------------------|----|-------|
| Younger than 30 years old | 67 | 30.6% |
| Between 31 and 40 years old | 90 | 41.1% |
| Between 41 and 50 old | 25 | 11.4% |
| Older than 51 years old | 14 | 6.4% |

The fourth question on the survey provided the number of years the participant had worked in construction. As seen in Table 4 the possible responses were: 1- Less than 5 years, 2- Between 6 and 10 years, 3- Between 11-15 years, and 4- More than 16 years.

Table 4 – Years working in construction

| Years working construction | N | (%) |
|----------------------------|----|-------|
| Less than 5 years | 41 | 18.7% |
| Between 6 and 10 years | 69 | 31.5% |
| Between 11 and 15 years | 50 | 22.8% |
| More than 16 years | 35 | 16.0% |

The fifth question on the survey provided the highest educational grade level attained by the participant. As seen in Table 5 the possible responses were: 1- 6th grade or less, 2- Some high school, 3- High school graduate, 4- Some college, 5- College graduate, and 6- Technical or Trade school.

Table 5 – Highest educational grade level

| Highest educational grade level | N | (%) |
|---------------------------------|----|-------|
| 6th grade or less | 53 | 24.2% |
| Some high school | 74 | 33.8% |
| High school graduate | 43 | 19.6% |
| Some college | 16 | 7.3% |
| College graduate | 6 | 2.7% |
| Technical or Trade school | - | - |

The sixth question provided the number of hours of health and safety training the participant had incurred in the past year. As seen in Table 6 the possible responses were: 1, 2, 3, 4, and 5+ with each response signifying hours.

Table 6 – Hours of health and safety training

| Hours of health and safety training | N | (%) |
|-------------------------------------|-----|-------|
| 1 | 8 | 3.7% |
| 2 | 17 | 7.8% |
| 3 | 21 | 9.6% |
| 4 | 26 | 11.9% |
| 5+ | 110 | 50.2% |

The seventh question of the survey provided whether or not the participant had ever sustained a work related injury. As seen in Table 7 the possible responses were yes or no.

Table 7 – Sustained a work related injury

| Sustained a work related injury | N | (%) |
|---------------------------------|-----|-------|
| Yes | 25 | 11.4% |
| No | 194 | 88.6% |

Question eight on the demographics page stated if the respondent had sustained a work related injury, to briefly describe the injury. Question nine built on the previous question and followed with if the respondent had sustained a work related injury how many days of work were missed. For question eight there were a total of 25 responses to having sustained a work related injury compared to 194 responses of not sustaining a work related injury. For question nine there were a total of 23 responses to the type of injury. Of those 23 responses, the most frequent

response was hurt back at 3.7%. With both of these questions there was such a low response that the GLM was unable to complete a data analysis for this variable. For this reason detailed results for these two questions are not available.

Sector Demographic Results

There were also various differences in the demographics of the respondents across the three construction sectors. The responses to age across the three sectors are provided in Table 8. The residential sector had 45.8% of its responses between the ages of 31 and 40 years old. The commercial sector appeared slightly younger with its largest proportion, 38.8%, indicating that they were younger than 30 years old. The heavy civil sector was similar to the residential sector and had 42.9% reporting that they were between the ages of 31 and 40 years. The heavy civil sector appeared the oldest sector with higher percentages, >40% of respondents reporting their age between 41 and 51 or older than 51 years. In addition, the p-values between each sector were less than 0.05 representing significant difference in age between each of the three sectors.

Table 8 – Age across sectors

| Age | Residential | | Commercial | | Heavy Civil | |
|-----------------------------|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| Younger than 30 years old | 37 | 38.5% | 26 | 38.8% | 4 | 7.1% |
| Between 31 and 40 years old | 44 | 45.8% | 22 | 32.8% | 24 | 42.9% |
| Between 41 and 50 old | 9 | 9.4% | 3 | 4.5% | 13 | 23.2% |
| Older than 51 years old | 2 | 2.1% | 2 | 3.0% | 10 | 17.9% |

The responses to years working construction across the three sectors are provided in Table 9. The residential sector reported 37.5% of its responses between 6 and 10 years. The commercial sector was similar to residential in that they reported 31.3% had worked in the sector between 6 and 10 years. The heavy civil sector showed significantly more experienced workers with 33.9% responding that they had worked more than 16 years in their construction sector. The

p-values between each sector for this question were also less than 0.05 representing significant difference in years working construction between each of the three sectors.

Table 9 – Years working construction across sectors

| Years Working Construction | Residential | | Commercial | | Heavy Civil | |
|----------------------------|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| Less than 5 years | 23 | 24.0% | 14 | 20.9% | 4 | 7.1% |
| Between 6 and 10 years | 36 | 37.5% | 21 | 31.3% | 12 | 21.4% |
| Between 11 and 15 years | 22 | 22.9% | 12 | 17.9% | 16 | 28.6% |
| More than 16 years | 12 | 12.5% | 4 | 6.0% | 19 | 33.9% |

The responses to highest educational level attained across the three sectors are provided in Table 10. In the residential sector 66.7% of the respondents were not high school graduates. In the commercial sector 46.3% of the respondents were not high school graduates. In the commercial sector 57.2% of the respondents were not high school graduates; but, heavy civil also had the largest proportion of college attendees with 17.8% either attending some college or college graduates. The p-values between each sector regarding highest educational levels were less than 0.05 representing significant difference in levels of education between each of the three sectors.

Table 10 – Highest educational level attained

| Highest educational level | Residential | | Commercial | | Heavy Civil | |
|---------------------------|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| 6th grade or less | 26 | 27.1% | 11 | 16.4% | 16 | 28.6% |
| Some high school | 38 | 39.6% | 20 | 29.9% | 16 | 28.6% |
| High school graduate | 20 | 20.8% | 13 | 19.4% | 10 | 17.9% |
| Some college | 5 | 5.2% | 5 | 7.5% | 6 | 10.7% |
| College graduate | 1 | 1.0% | 1 | 1.5% | 4 | 7.1% |
| Technical or Trade school | - | - | - | - | - | - |

The responses to the amount of hours of health and safety training in the past year across the three sectors are provided in Table 11. For each sector the majority of the respondents had participated in five or more hours of health and safety training in the past year. The residential sector had 49% of its respondents answering 5+ hours. The commercial sector had 52.2% of its

respondents answering 5+ hours. The heavy civil sector had 50.0% of its respondents answering 5+ hours of health and safety training. For this question the p-values between the sectors were not all less than 0.05. Significant differences were seen between residential and commercial with a p-value of 0.001 and between commercial and heavy civil with a p-value of 0.001. There was no significant difference between residential and heavy civil.

Table 11 – Hours of health and safety training in the past year

| Hours of health and safety training in the past year | Residential | | Commercial | | Heavy Civil | |
|--|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| 0 | - | - | - | - | - | - |
| 1 | 6 | 6.3% | 1 | 1.5% | 1 | 1.8% |
| 2 | 15 | 15.6% | 1 | 1.5% | 1 | 1.8% |
| 3 | 8 | 8.3% | 5 | 7.5% | 8 | 14.3% |
| 4 | 9 | 9.4% | 7 | 10.4% | 10 | 17.9% |
| 5+ | 47 | 49.0% | 35 | 52.2% | 28 | 50.0% |

The responses to having ever sustained a work related injury across the three sectors are provided in Table 12. Again, the responses were heavily weighted toward the same answer across all three sectors. In the residential sector 88.5% responded to not having sustained a work related injury. In the commercial sector 86.6% responded to not having sustained a work related injury. In the heavy civil sector 91.1% responded to not having sustained a work related injury. No significant difference was seen across the sectors for this question.

Table 12 – Sustained a work related injury

| Have ever sustained a work related injury | Residential | | Commercial | | Heavy Civil | |
|---|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| Yes | 11 | 11.5% | 9 | 13.4% | 5 | 8.9% |
| No | 85 | 88.5% | 58 | 86.6% | 51 | 91.1% |

Latino Risk Perception Results

The remaining questions on the survey focused on risk perception and cultural differences. The risk perception section of the survey included 30 multiple choice questions. After analysis was performed on the results, significant differences were recognized in six of the

30 questions. The results for the entire 30 questions can be seen in Table 13, which contains each question with the mean scores for each sector and then the p-values for comparisons between the 3 sectors. Again, the mean responses are based on a scale from one to five. One represents a response of highly disagreeing with the question, two represents a response of disagreeing, three represents a response of neither disagreeing nor agreeing, four represents a response of agreement, and a five represents a response of highly agreeing with the question. For the p-values any result less than 0.05 represents significant difference between the responses of either one of the sectors with one other sector, a significant difference between one sector and both other sectors, or significant difference between all three sectors.

Table 13 - Risk Perception Survey Results: Means and P-Values

| Question | Res Mean | Comm Mean | HC Mean | Res - Comm | Comm - HC | HC - Res |
|--|-----------------|------------------|----------------|-------------------|------------------|-----------------|
| The risk level of my job concerns me quite a bit | 4.01 | 3.81 | 3.76 | 0.21 | 0.95 | 0.11 |
| When told about safety hazards, supervisors are appreciative and try to correct them quickly | 4.38 | 4.39 | 4.26 | 0.98 | 0.93 | 0.98 |
| My immediate supervisor is well informed about relevant safety issues | 4.54 | 4.36 | 4.48 | 0.51 | 0.95 | 0.71 |
| It is the responsibility of each employee to seek out opportunities to prevent injury | 4.51 | 4.52 | 4.70 | 0.86 | 0.23 | 0.07 |
| At my company, work productivity and quality usually have a higher priority than work safety | 3.38 | 2.78 | 3.02 | 0.01* | 1.00 | 0.01* |
| The managers in my company really care about safety and try to reduce risk levels as much as possible | 4.49 | 4.09 | 4.37 | 0.11 | 0.07 | 0.97 |
| When I see a potential safety hazard (e.g., oil spill), I am willing to correct it myself if possible | 3.97 | 4.39 | 4.24 | 0.08 | 0.99 | 0.12 |
| Management places most of the blame for an accident on the injured employee | 3.27 | 2.99 | 3.44 | 0.11 | 0.57 | 0.57 |
| “Near misses” are consistently reported and investigated at our company | 3.69 | 3.75 | 3.69 | 0.86 | 0.49 | 0.79 |
| I am willing to warn my coworkers about working unsafely | 4.67 | 4.42 | 4.48 | 0.56 | 0.79 | 0.93 |

| | | | | | | | |
|---|------|------|------|--|-------|------|-------|
| Employees seen behaving unsafely in my company are usually given corrective feedback by their coworkers | 4.06 | 4.15 | 4.30 | | 1.00 | 0.48 | 0.51 |
| Compared to other companies, I think mine is rather risky | 2.66 | 2.42 | 2.54 | | 0.09 | 1.00 | 0.11 |
| Working safely is the Number One priority in my company | 4.37 | 4.22 | 4.33 | | 0.44 | 0.12 | 0.70 |
| I have received adequate job safety training | 4.33 | 4.31 | 4.46 | | 0.83 | 0.34 | 0.11 |
| Many first-aid cases in my company go unreported | 2.87 | 2.78 | 2.76 | | 0.45 | 0.67 | 0.09 |
| Information needed to work safely is made available to all employees | 4.46 | 4.58 | 4.35 | | 1.00 | 0.84 | 0.86 |
| Management here seems genuinely interested in reducing injury rates | 4.23 | 4.42 | 4.37 | | 0.83 | 0.47 | 0.18 |
| Safety audits are conducted regularly in my company to check the use of personal protective equipment | 4.31 | 4.25 | 4.33 | | 0.74 | 0.25 | 0.66 |
| I know how to do my job safely | 4.53 | 4.63 | 4.43 | | 0.62 | 1.00 | 0.61 |
| Most employees in my company would not feel comfortable if their work practices were observed and recorded by a coworker | 3.86 | 3.39 | 4.00 | | 0.01* | 0.82 | 0.07 |
| Team work and collaboration are encouraged to reduce safety hazards | 4.47 | 4.55 | 4.67 | | 1.00 | 0.38 | 0.40 |
| I always follow the safety rules and procedures when doing my job | 4.37 | 4.52 | 4.45 | | 0.95 | 0.74 | 0.89 |
| I have the personal protective equipment that I need to do my job safely | 4.63 | 4.61 | 4.63 | | 0.96 | 0.97 | 0.87 |
| Some safety rules and procedures are difficult to understand | 3.44 | 2.94 | 2.63 | | 0.01* | 0.39 | 0.00* |
| Immigrant workers are more likely to suffer accidents than American workers | 2.95 | 2.79 | 2.55 | | 0.30 | 0.68 | 0.05 |
| Immigrant workers make the worksite unsafe for all workers | 2.46 | 2.06 | 1.94 | | 0.06 | 0.90 | 0.02* |
| Accidents can happen to anyone | 4.70 | 4.76 | 4.61 | | 0.75 | 0.88 | 0.97 |
| I am willing to take more risks than my coworkers | 2.79 | 2.26 | 2.00 | | 0.11 | 0.41 | 0.00* |
| The dangers present on construction sites can not cause my death or the death of others | 3.18 | 2.51 | 2.71 | | 0.03* | 0.94 | 0.00* |
| I have control over the dangers that I encounter on construction sites | 4.14 | 4.06 | 3.88 | | 0.92 | 0.79 | 0.47 |

* Significant = p-values < 0.05

The six questions where the p-value showed significant difference in the sectors were as follows:

1. At my company, work productivity and quality usually have a higher priority than work safety.
2. Most employees in my company would not feel comfortable if their work practices were observed and recorded by a coworker.
3. Some safety rules and procedures are difficult to understand.
4. Immigrant workers make the worksite unsafe for all workers.
5. I am willing to take more risks than my coworkers.
6. The dangers present on construction sites cannot cause my death or the death of others.

The first question that showed significant difference was “At my company, work productivity and quality usually have a higher priority than work safety” (Gilkey and Lopez 2011). The responses across the three sectors can be seen in Table 14. In the residential sector 34.4% of the respondents responded in high agreement to this question. In the commercial sector 22.4% responded in high agreement, while also 26.9% responded to highly disagree with the question. In the heavy civil sector 30.4% responded to highly agree with the question, while also 26.8% responded to highly disagree.

Table 14 – At my company, work productivity and quality usually have a higher priority than work safety

| Work productivity and quality higher priority than work safety | Residential | | Commercial | | Heavy Civil | |
|--|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| 1 - Highly Disagree | 13 | 13.5% | 18 | 26.9% | 15 | 26.8% |
| 2 - Disagree | 14 | 14.6% | 13 | 19.4% | 7 | 12.5% |
| 3 - Neither Agree nor Disagree | 12 | 12.5% | 9 | 13.4% | 7 | 12.5% |
| 4 - Agree | 16 | 16.7% | 10 | 14.9% | 7 | 12.5% |
| 5 - Highly Agree | 33 | 34.4% | 15 | 22.4% | 17 | 30.4% |

Figure 1 has two bar graphs providing the mean responses and the p-values for the three different sectors for this question. The mean response for the residential sector was 3.38 (95% CI: 3.06, 3.70). The mean response for the commercial sector was 2.78 (95% CI: 2.41, 3.14). The

mean response for the heavy civil sector was 3.02 (95% CI: 2.61, 3.43). The responses of this question showed significant difference between the residential and commercial sector and the residential and heavy civil sector. As seen in Figure 1, the p-value between residential and commercial and also heavy civil and residential was 0.01. The p-value between commercial and heavy civil was 1.00 and had no significance.

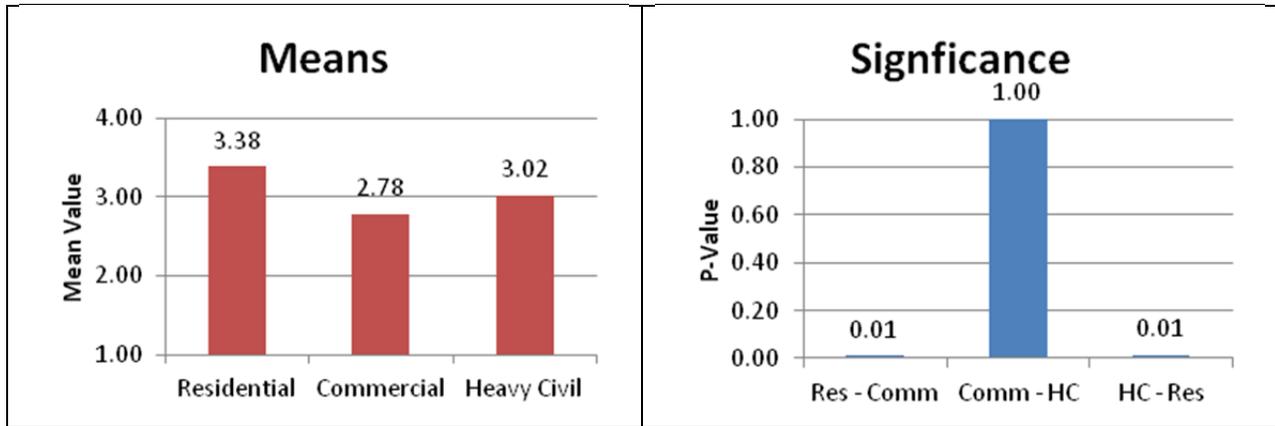


Figure 1 - At my company, work productivity and quality usually have a higher priority than work safety

Significance = p-value < 0.05

The second question that showed significant difference was “Most employees in my company would not feel comfortable if their work practices were observed and recorded by a coworker” (Gilkey & Lopez del Puerto, 2011). The responses across the three sectors can be seen in Table 15. In the residential sector 63.6% of the respondents were either in agreement or high agreement with this question. In the commercial sector 56.7% were either in agreement or high agreement with this question. In the heavy civil sector 67.8% of the respondents were either in agreement or highly agreed with the question.

Table 15 – Most employees in my company would not feel comfortable if their work practices were observed and recorded by a coworker

| Not comfortable work practices observed and recorded | Residential | | Commercial | | Heavy Civil | |
|--|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| 1 - Highly Disagree | 5 | 5.2% | 11 | 16.4% | 3 | 5.4% |
| 2 - Disagree | 5 | 5.2% | 4 | 6.0% | 2 | 3.6% |
| 3 - Neither Agree nor Disagree | 16 | 16.7% | 13 | 19.4% | 4 | 7.1% |
| 4 - Agree | 31 | 32.3% | 21 | 31.3% | 13 | 23.2% |
| 5 - Highly Agree | 30 | 31.3% | 17 | 25.4% | 25 | 44.6% |

Figure 2 provides the mean responses and the p-values for the three different sectors for this question. The mean response for the residential sector was 3.86 (95% CI: 3.58, 4.14). The mean response for the commercial sector was 3.38 (95% CI: 3.07, 3.70). The mean response for the heavy civil sector was 4.00 (95% CI: 3.63, 4.37). Significant difference was only recognized between the residential sector and the commercial sector at a p-value of 0.01. The p-value between the heavy civil and residential sectors was nearly significant at 0.07 while commercial to heavy civil showed no significance at a p-value of 0.82.

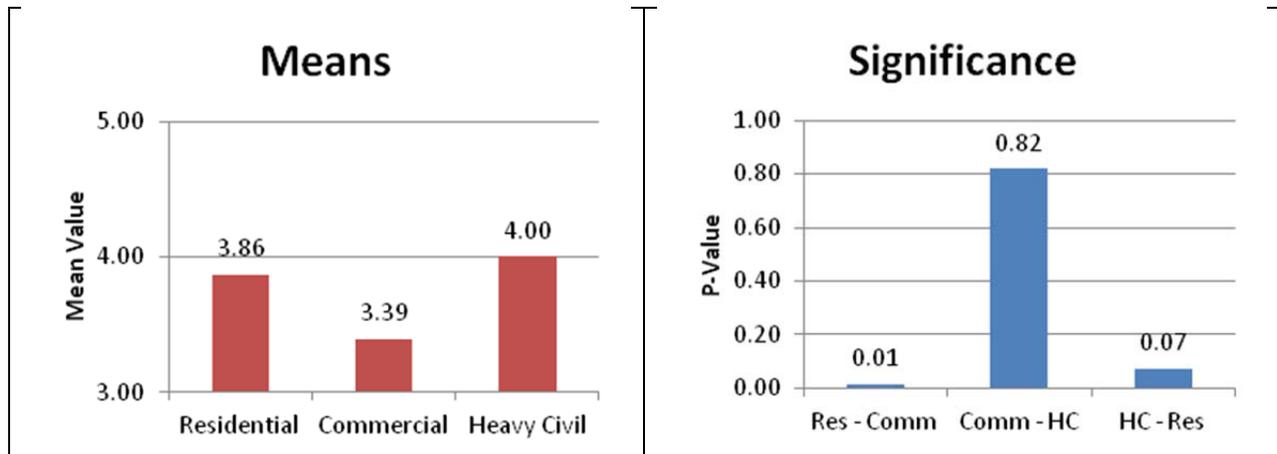


Figure 2 - Most employees in my company would not feel comfortable if their work practices were observed and recorded by a coworker
Significance = p-value < 0.05

The third question that showed significance between the sectors was “Some safety rules and procedures are difficult to understand” (Gilkey & Lopez del Puerto, 2011). The responses across the three sectors can be seen in Table 16. In the residential sector 35.4% of the

respondents highly agreed with the question. In the commercial sector 16.4% of respondents highly agreed with the question. In the heavy civil sector 14.3% of respondents highly agreed with the question.

Table 16 – Some safety rules and procedures are difficult to understand

| Some safety rules and procedures difficult to understand | Residential | | Commercial | | Heavy Civil | |
|--|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| 1 - Highly Disagree | 14 | 14.6% | 16 | 23.9% | 16 | 28.6% |
| 2 - Disagree | 15 | 15.6% | 6 | 9.0% | 4 | 7.1% |
| 3 - Neither Agree nor Disagree | 10 | 10.4% | 18 | 26.9% | 7 | 12.5% |
| 4 - Agree | 14 | 14.6% | 15 | 22.4% | 11 | 19.6% |
| 5 - Highly Agree | 34 | 35.4% | 11 | 16.4% | 8 | 14.3% |

Figure 3 provides the mean responses and the p-values for the three different sectors for this question. The mean response for the residential sector was 3.44 (95% CI: 3.13, 3.75). The mean response for the commercial sector was 2.94 (95% CI: 2.59, 3.30). The mean response for the heavy civil sector was 2.63 (95% CI: 2.22, 3.05). Significant difference was seen between the residential and commercial sector with a p-value of 0.01, and also between the heavy civil and residential sectors with a p-value of 0.001. There was no significance between the commercial and heavy civil sectors which had a p-value of 0.394.

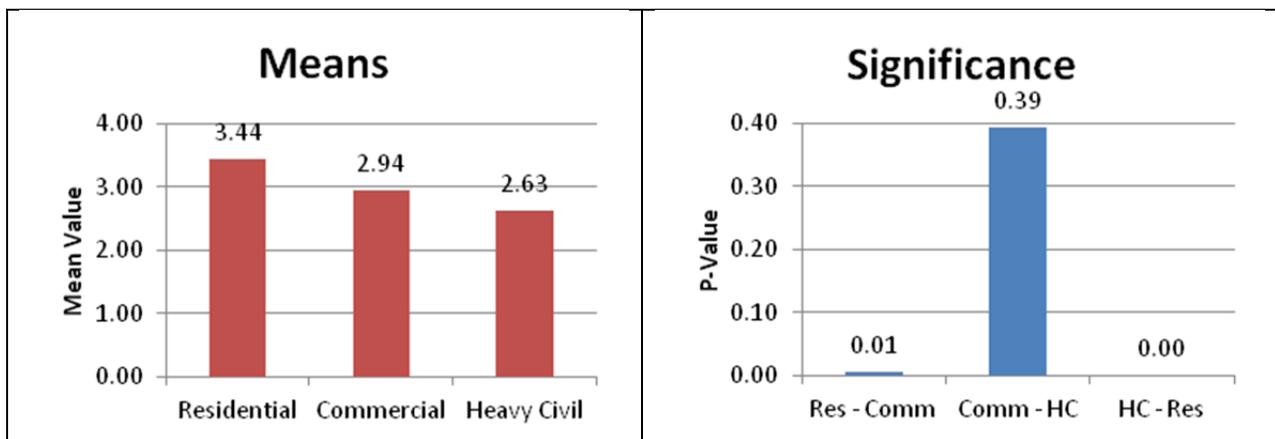


Figure 3 - Some safety rules and procedures are difficult to understand

Significance = p-value < 0.05

The fourth question that showed significance between the sectors was “Immigrant workers make the worksite unsafe for all workers” (Gilkey & Lopez del Puerto, 2011). The responses across the three sectors can be seen in Table 17. In the residential sector 40.6% of the respondents highly disagreed with this question. In the commercial sector 52.2% of the respondents highly disagreed with this question. In the heavy civil sector 57.1% of the respondents highly disagreed with this question.

Table 17 – Immigrant workers make the worksite unsafe for all workers

| Immigrant workers make the worksite unsafe for all workers | Residential | | Commercial | | Heavy Civil | |
|--|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| 1 - Highly Disagree | 39 | 40.6% | 35 | 52.2% | 32 | 57.1% |
| 2 - Disagree | 13 | 13.5% | 11 | 16.4% | 3 | 5.4% |
| 3 - Neither Agree nor Disagree | 9 | 9.4% | 8 | 11.9% | 3 | 5.4% |
| 4 - Agree | 7 | 7.3% | 8 | 11.9% | 7 | 12.5% |
| 5 - Highly Agree | 19 | 19.8% | 5 | 7.5% | 4 | 7.1% |

Figure 4 provides the mean responses and the p-values for the three different sectors for this question. The mean response for the residential sector was 2.46 (95% CI: 2.16, 2.76). The mean response for the commercial sector was 2.06 (95% CI: 1.72, 2.40). The mean response for the heavy civil sector was 1.94 (95% CI: 1.54, 2.34). Significance was seen between the heavy civil and residential sectors at a p-value of 0.02. The p-value between the residential and commercial sectors was nearly significant at 0.06 while commercial to heavy civil showed no significance at a p-value of 0.90.

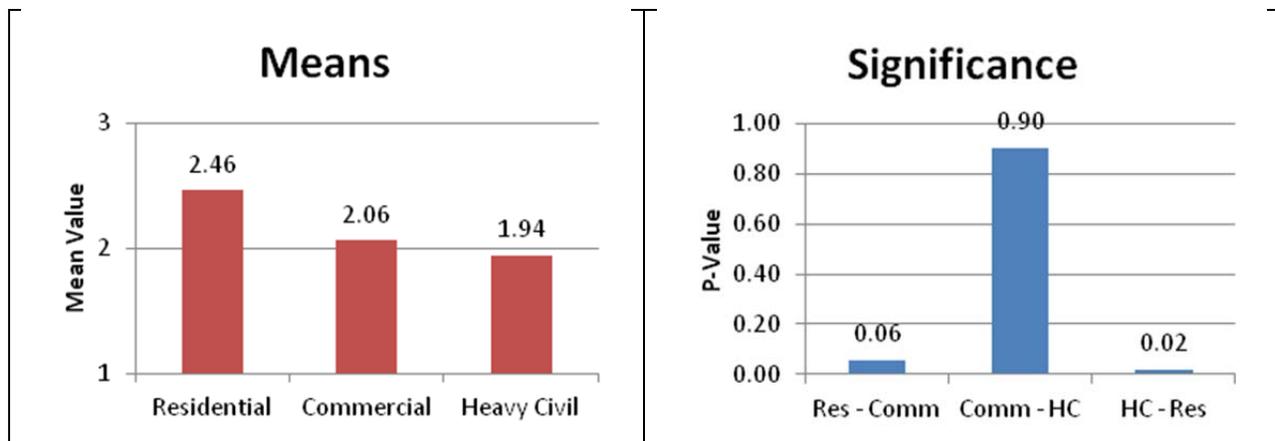


Figure 4 - Immigrant workers make the worksite unsafe for all workers
Significance = p-value < 0.05

The fifth question that showed significant difference between the sectors was “I am willing to take more risks than my coworkers” (Gilkey & Lopez del Puerto, 2011). The responses across the three sectors can be seen in Table 18. In the residential sector 20.8% of the respondents highly agreed with this question. In the commercial sector 10.4% of the respondents highly agreed with this question. In the heavy civil sector 5.4% of the respondents highly agreed with this question.

Table 18 – I am willing to take more risks than my coworkers

| I am willing to take more risks than my coworkers | Residential | | Commercial | | Heavy Civil | |
|---|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| 1 - Highly Disagree | 23 | 24.0% | 22 | 32.8% | 22 | 39.3% |
| 2 - Disagree | 14 | 14.6% | 10 | 14.9% | 8 | 14.3% |
| 3 - Neither Agree nor Disagree | 18 | 18.8% | 9 | 13.4% | 3 | 5.4% |
| 4 - Agree | 8 | 8.3% | 4 | 6.0% | 7 | 12.5% |
| 5 - Highly Agree | 20 | 20.8% | 7 | 10.4% | 3 | 5.4% |

Figure 5 provides the mean responses and the p-values for the three different sectors for this question. The mean response for the residential sector was 2.79 (95% CI: 2.48, 3.10). The mean response for the commercial sector was 2.26 (95% CI: 1.88, 2.65). The mean response for the heavy civil sector was 2.00 (95% CI: 1.58, 2.42). This question showed significance between the heavy civil and residential sectors with a p-value of 0.001. The p-values between the other

two sectors showed no significance. The p-value between residential and commercial was 0.11 and the p-value between commercial and heavy civil was 0.41.

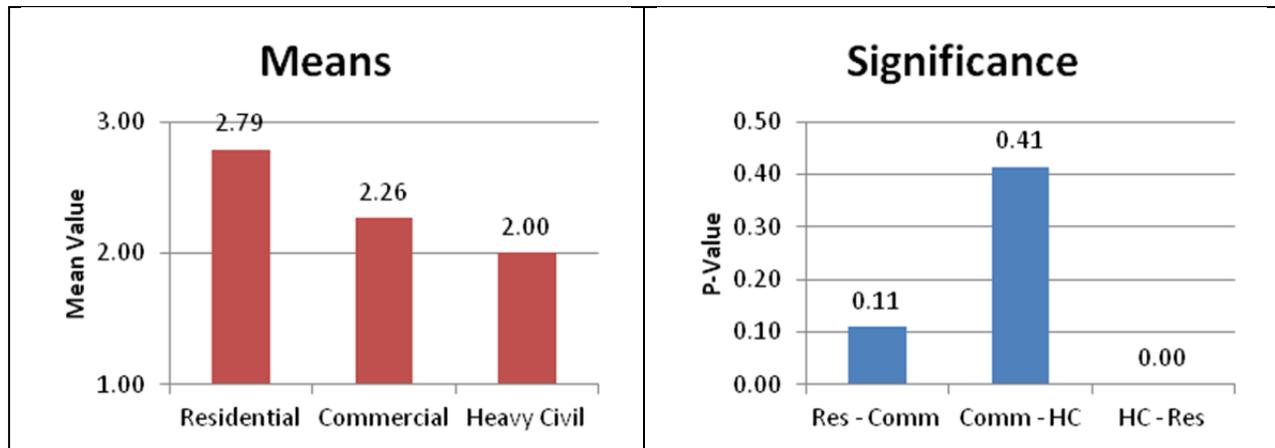


Figure 5 - I am willing to take more risks than my coworkers
Significance = p-value < 0.05

The sixth and final question that showed significant difference between the sector responses was “The dangers present on construction sites cannot cause my death or the death of others” (Gilkey & Lopez del Puerto, 2011). The responses across the three sectors can be seen in Table 19. In the residential sector 36.5% of the respondents highly agreed with this question. In the commercial sector 22.4% of the respondents highly agreed with this question. In the heavy civil sector 23.2% of respondents highly agreed with this question.

Table 19 – The dangers present on construction sites can not cause my death or the death of others

| Dangers present on construction sites can not cause death | Residential | | Commercial | | Heavy Civil | |
|---|-------------|-------|------------|-------|-------------|-------|
| | N | (%) | N | (%) | N | (%) |
| 1 - Highly Disagree | 21 | 21.9% | 26 | 38.8% | 17 | 30.4% |
| 2 - Disagree | 13 | 13.5% | 5 | 7.5% | 8 | 14.3% |
| 3 - Neither Agree nor Disagree | 8 | 8.3% | 2 | 3.0% | - | - |
| 4 - Agree | 6 | 6.3% | 4 | 6.0% | 6 | 10.7% |
| 5 - Highly Agree | 35 | 36.5% | 15 | 22.4% | 13 | 23.2% |

Figure 6 provides the mean responses and the p-values for the three different sectors for this question. The mean response for the residential sector was 3.18 (95% CI: 2.81, 3.55). The mean response for the commercial sector was 2.51 (95% CI: 2.04, 2.98). The mean response for

the heavy civil sector was 2.71 (95% CI: 2.20, 3.22). This question showed significance between both the residential and commercial sector at a p-value of 0.03. Significant difference was also shown between the residential and heavy civil sector at a p-value 0.001. There was no significance seen between the commercial and heavy civil sector which had a p-value of 0.94.

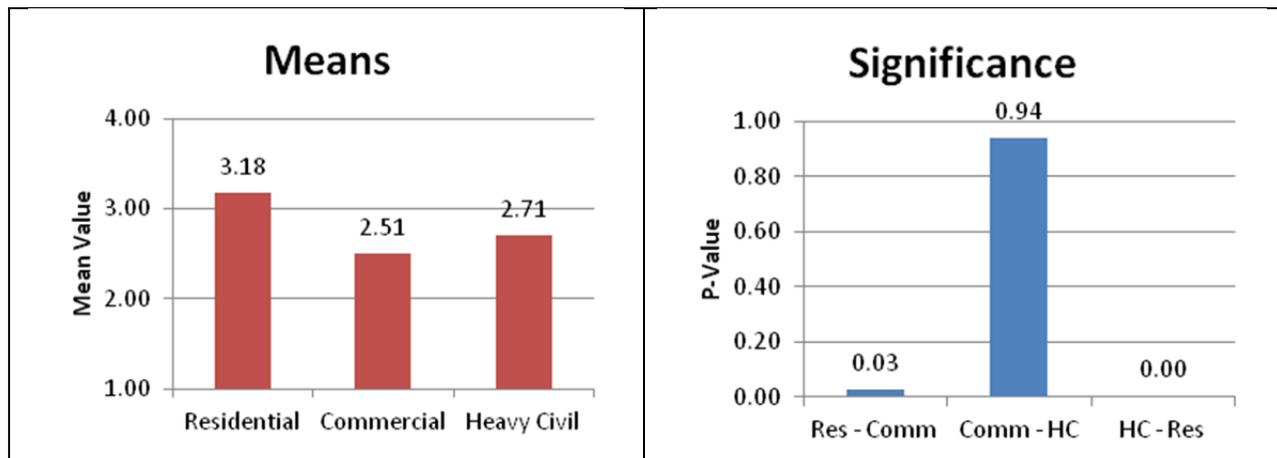


Figure 6 - The dangers present on construction sites cannot cause my death or the death of others

Significance = p-value < 0.05

Discussion

Significance of Results

Analysis of the results of this sample found six questions showed significant difference between the sectors, and suggested a closer examination was merited. It is critical to convey that risk perception across the sectors may potentially be different. The causes of these potential differences are not identified in this study. At best, only alternative explanations may be offered as to why risk perception on these specific questions differed across the three construction sectors of residential, commercial and heavy civil. The means and p-values of the six questions showing significant differences are reiterated in Table 20. These results provide reasoning to reject the stated null hypothesis of this study that no difference exists in risk perception and safety culture measures between Latino construction workers across residential, commercial and heavy civil sectors of construction.

Table 20 – Six Questions Showing Significant difference between the Sectors

| Question | 1.00 Mean | 2.00 Mean | 3.00 Mean | Res - Comm | Comm - HC | HC - Res |
|---|--------------|--------------|--------------|---------------|--------------|-------------|
| At my company, work productivity and quality usually have a higher priority than work safety | 3.38 | 2.78 | 3.02 | 0.01* | 1.00 | 0.01* |
| Most employees in my company would not feel comfortable if their work practices were observed and recorded by a coworker | 3.86 | 3.39 | 4.00 | 0.01* | 0.82 | 0.07 |
| Some safety rules and procedures are difficult to understand | 3.44 | 2.94 | 2.63 | 0.01* | 0.39 | 0.00* |
| Immigrant workers make the worksite unsafe for all workers | 2.46 | 2.06 | 1.94 | 0.06 | 0.90 | 0.02* |
| I am willing to take more risks than my coworkers | 2.79 | 2.26 | 2.00 | 0.11 | 0.41 | 0.00* |
| The dangers present on construction sites can not cause my death or the death of others | 3.18 | 2.51 | 2.71 | 0.03* | 0.94 | 0.00* |

* Significant = p-value < 0.05

Differences can be seen between either one of the sectors with one other sector, between one sector and both other sectors, or between all three sectors. In the first question of the survey that had p-values less than 0.05; significant difference was seen between the residential sector and both the commercial and heavy civil sector. The mean score response for Latinos working in the residential sector showed they were mostly in agreement with the statement that safety was less a priority than productivity and quality in their company.

In the question regarding most employees in my company would not feel comfortable if their work practices were observed; significant difference was seen only between the residential and commercial sector. Interestingly, in this question the mean response for the residential sector lay between the mean responses for commercial and heavy civil. The difference between residential and heavy civil was nearly significant at a p-value of 0.07, but Latino workers in heavy civil felt even more in agreement than residential workers about being uncomfortable being observed and recorded when working. One possibility for this response could be that the heavy civil encounters more regimented recording and quality inspections than the residential sector. This could cause Latinos in the residential sector to experience minimal inspections and be unfamiliar with the pressure heavy civil workers may feel due to more strict quality inspections and tests.

In the question regarding safety rules and procedures being difficult to understand, significant difference was seen again between the residential sector and both the commercial and heavy civil sector. For this question, Latinos working in the residential sector were most in agreement of the three sectors with the statement of safety rules and procedures being difficult to understand. Latino workers in the heavy civil sector were the most in disagreement with the statement. Results from the demographics might help explain this significance. Of the three

sectors, Latino residential construction workers had the lowest response of high school graduates with 66.7% not graduating high school. This high percentage could attribute to low literacy rates and therefore impact the ability to understand safety rules and procedures.

The question regarding immigrant workers making the worksite unsafe for all workers had very interesting results. Significant difference was seen between the residential sector and the heavy civil sector. Significant difference was nearly recognized between the residential sector and the commercial sector at a p-value of 0.06. What is interesting is that the residential sector was most in agreement with the statement that immigrant workers make the worksite unsafe for all workers. This is particular interesting because based on the sector demographics; the residential sector encompassed the greatest proportion of Latino workers. From this viewpoint it could be proposed Latinos feel safer and more risk averse in a more diverse multicultural project site. This is supported by the fact that heavy civil, the sector with the most balanced demographics, was in the highest disagreement with the same statement.

Significant difference was again seen between the residential and heavy civil sector on the question regarding being willing to take more risks than coworkers. Residential Latinos responded they are in most agreement that they are willing to take more risks than their coworkers. Heavy civil was in the most disagreement with this statement. The difficulty of this question is the open interpretation to putting oneself at risk. This question could easily link to the question regarding being observed and recorded while working. Risk was meant to signify putting oneself in heightened danger to accomplish tasks, but it could also have been interpreted as cutting corners in workmanship and risking quality. In both cases Latino residential workers felt more inclined to take more risk, and therefore are more likely to incur injury.

The last question is more a question of negligence or naivety. Significant difference was again recognized between the residential sector and both the commercial and heavy civil sectors. The residential sector was the sector in most agreement with the statement that the dangers present on construction sites can not cause my death or the death of others. Risk averse workers or those with a high risk perception would accept that construction sites are some of the most dangerous workplaces in the industry and greater care should be taken when employed in that industry. The commercial and heavy civil sectors had means in close proximity but both below that of the residential sector. This could show that Latinos employed in the commercial or heavy civil sectors have higher risk perceptions and could work and propagate a better safety culture.

Comparison to Literature

The results of this study support many of the findings in other current literature. One of the most reiterated barriers to Latino safety in current literature was the language barrier (Canales, et al., 2009; Thompson & Siddiqi, 2007; Ruttenberg, 2004). This research supported those findings with the analysis from the question regarding some safety rules and procedures being difficult to understand. Of the total Latino sampled, 12.8% responded to be in high agreement with the previous statement. This research took that finding one step farther and found that Latino workers in the residential sector responded in most agreement of the three sectors in this study to some safety rules and procedures being difficult to understand.

Research conducted also found how worker characteristics of the Latino can also present a barrier to safety (Dong, et al., 2009; O'Connor, et al., 2005; Williams Jr, et al., 2010). Characteristics such as undocumented status, relative youth, lack of construction experience, low-skill employment and high-risk occupations. This study supports these worker

characteristics in that we found Latinos felt the dangers present on construction sites could not cause their death or the death of others and they were willing to take more risks than their coworkers. Worker characteristics of Latinos employed in the residential sector should be paid especially close attention due to the fact it had significant difference from both the commercial and heavy civil sectors on this issue.

The results from the question regarding work productivity and quality having a higher priority than safety also supported current literature. One study found the Latino construction workforce in the United States may not raise issues about unsafe work practices because they are afraid to lose their job or face deportation (Irizarry, 2009). This could be confirmed by the results from the question in our survey. Nearly 30% of the Latino survey respondents were in high agreement with this statement. This agreement with safety being less of a priority could result from the potential undocumented statuses of the survey respondents.

The results from this sample survey were an attempt to encompass a representation of Latino construction workers risk perception and cultural differences across the residential, commercial and heavy civil sectors of construction. As presented in the literature review, risk perception is affected by ones culture (Brunette, 2004; Dongping, et al., 2006; Loosemore & Lee, 2002). The Latino culture often differs from that of U.S. construction culture which has a tremendous impact on risk perception and therefore job site safety. One of the many remaining questions is how that risk perception can be affected by the type of construction sector that the Latino worker is employed.

The Latino demographics of this survey sample resemble those of many other studies reviewed in current literature (Irizarry, 2009; Ruttenberg, 2004). The average respondent in our study was 18 to 40 years old. This age range demographic translates well to other studies and

represents the majority of the working age construction population. Only 18.7% of the Latino respondents answered they had worked less than five years in construction. These numbers suggest the sample was fairly experienced in construction processes. The bulk of the literature found that the more versed in construction processes, the safer the construction workers were on project sites (Abudayyeh, et al., 2006; Brunette, 2005). These two facts in combination provide strong support for the case that this sample was neither extremely unsafe nor extremely safe but more likely somewhere near the middle.

The educational levels of the sample were for the majority at either 6th grade or less or some high school; 58% of the sample responded affirmatively. This supports the findings from the 2010 Morrison Institute report that found the typical Mexican immigrant has completed less than nine years of education and only about half of the Latinos in the western United States possess a high-school education (Vazquez, 2004). On the other hand, over half of the Latinos in this sample had received five or more hours of health and safety training in the past year.

The demographics of the sample population will have significant impact on the results of the survey. Due to the fact convenience sampling was utilized to collect surveys it is vital to properly characterize how this sample could differ from a random sample intended to represent the larger population. In an ideal sample, the proportion of Latinos in each sector would have been random. The sample size was established for pilot study and not intended to represent the industry as a whole. The results showed that the residential sector employs far more Latino workers per total workers than the heavy civil sector. With convenience sampling some workers might have felt uncomfortable answering the survey due to misunderstandings or simply not wanting to participate. It is important to consider how those Latino workers who were not surveyed might behave differently than those workers who were part of the convenience sample.

Future Studies

In each of the questions that displayed significant difference between the sectors, not once was there significant difference seen between the commercial and heavy civil sectors. The residential sector was constantly the sector that showed separation on risk perception from the other industries. Future research should be conducted into the possibilities of differences between the trades in the residential sector. It would also be interesting to further study the effect of a diverse workforce compared to a less diverse work force on a project to identify differences in project safety. Could it be plausible that a more multicultural workforce propagates a better jobsite safety culture?

As the Latino population continues to increase in the construction industry greater care needs to be taken to ascertain safe working environments. Developing good safety culture is a strong way to increase risk perception, promote safe work practices and conditions and prevent jobsite injuries and fatalities. While an increase in safety culture across the board would be advantageous to the industry, research has suggested that certain domains need special attention. The research and results from this study will add to the literature of available knowledge and help achieve the overall goal of reducing the disproportionate safety incidents Latinos suffer in the construction industry.

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Appendix A – Example email correspondence

To whom it may concern,

It was nice speaking with you on the phone this morning, again my name is Kane Bormann, I am the graduate research assistant for Dr. Carla Lopez del Puerto in the School of Construction Management at Colorado State University. I am conducting surveys for a study on Safety Culture and Risk Perception Differences between Latino and non-Latino Construction Workers.

Through this study, we hope to develop methods and materials to improve workplace safety culture, risk perception and safe work practices to reduce risk and injuries. The survey should take 10-15 minutes to administer and there is a \$10 incentive for all workers who participate. Furthermore, the results of this study will be shared with the scientific community and will be used for educational purposes only. All personal and company privacy are assured.

The most advantageous time to administer the survey would be during a weekly safety meeting; or possibly a morning, lunch, or afternoon break. It would be best if I could be present to administer the survey and then distribute incentive money. Your help is greatly appreciated and if you have any questions please don't hesitate to ask.

Respectfully,

Kane Bormann
GRA Colorado State University
XXXX@colostate.edu
(XXX) XXX - XXXX

Appendix B – Safety Culture and Risk Perception Survey

Please complete the following survey and rate each statement on a scale of 1-5, where: **1** = Highly Disagree, **2** = Disagree, **3** = Neither Agree Nor Disagree, **4** = Agree, and **5** = Highly Agree.

Por favor complete la siguiente encuesta y asigne un valor en la escala 1-5 para cada afirmación, donde:

1 = Totalmente en Desacuerdo, **2** = En Desacuerdo, **3** = Ni en acuerdo ni en desacuerdo, **4** = De acuerdo y **5** = Totalmente de Acuerdo.

| <i>Scale/ Escala</i> | | <i>English</i> | <i>Español</i> |
|--------------------------|---|--|--|
| 1 2 3 4 5 | 1 | The risk level of my job concerns me quite a bit | El nivel de riesgo en mi trabajo me preocupa bastante. |
| 1 2 3 4 5 | 2 | When told about safety hazards, supervisors are appreciative and try to correct them quickly. | Cuando se habla acerca de riesgos en la seguridad laboral, los supervisores están muy atentos y tratan de corregirlos rápidamente. |
| 1 2 3 4 5 | 3 | My immediate supervisor is well informed about relevant safety issues. | Mi supervisor inmediato está bien informado sobre aspectos relacionados con la seguridad. |
| 1 2 3 4 5 | 4 | It is the responsibility of each employee to seek out opportunities to prevent injury. | Es responsabilidad de cada empleado buscar la forma de prevenir daños |
| 1 2 3 4 5 | 5 | At my company, work productivity and quality usually have a higher priority than work safety. | En el trabajo, la productividad y la calidad generalmente tienen una mayor prioridad que la seguridad laboral. |
| 1 2 3 4 5 | 6 | The managers in my company really care about safety and try to reduce risk levels as much as possible. | Los gerentes en mi compañía realmente cuidan la seguridad y tratan en lo posible de reducir los niveles de riesgo. |
| 1 2 3 4 5 | 7 | When I see a potential safety hazard (e.g., oil spill), I am willing to correct it myself if possible. | Cuando yo veo un riesgo potencial en la seguridad (por ejemplo aceite derramado), estoy dispuesto a corregir esto por mi mismo si me es posible. |
| 1 2 3 4 5 | 8 | Management places most of the blame for an accident on the injured employee. | Según los agerentes la mayor parte de la culpa en un accidente la tiene el empleado afectado. |
| 1 2 3 4 5 | 9 | "Near misses" are consistently reported and investigated at our company. | Los "casi accidentes" (cuando se salvan por un pelo) son consistentemente reportados e investigados en nuestra compañía. |

| <i>Scale/ Escala</i> | | <i>English</i> | <i>Español</i> |
|--------------------------|----|---|--|
| 1 2 3 4 5 | 10 | I am willing to warn my coworkers about working unsafely. | Estoy dispuesto informar a mis compañeros acerca de los peligros en el trabajo. |
| 1 2 3 4 5 | 11 | Employees seen behaving unsafely in my company are usually given corrective feedback by their coworkers. | Los empleados que se comportan descuidadamente en mi compañía generalmente reciben indicaciones correctivas de sus compañeros de trabajo. |
| 1 2 3 4 5 | 12 | Compared to other companies, I think mine is rather risky. | Comparada con otras compañías, creo que la mía es más riesgosa. |
| 1 2 3 4 5 | 13 | Working safely is the Number One priority in my company. | La seguridad en el trabajo es la prioridad Número Uno en mi compañía |
| 1 2 3 4 5 | 14 | I have received adequate job safety training. | He recibido entrenamiento adecuado en seguridad laboral. |
| 1 2 3 4 5 | 15 | Many first-aid cases in my company go unreported. | Muchos accidentes que requieren primeros auxilios no son reportados en mi compañía. |
| 1 2 3 4 5 | 16 | Information needed to work safely is made available to all employees. | La información necesaria para trabajar de forma segura está disponible a todos los empleados. |
| 1 2 3 4 5 | 17 | Management here seems genuinely interested in reducing injury rates. | Los gerentes aquí parecen estar genuinamente interesados en reducir la tasa de daño en el trabajo |
| 1 2 3 4 5 | 18 | Safety audits are conducted regularly in my company to check the use of personal protective equipment. | Regularmente se lleva a cabo auditorías en seguridad en mi compañía para checar el uso personal del equipo de protección. |
| 1 2 3 4 5 | 19 | I know how to do my job safely. | Yo sé cómo hacer mi trabajo de manera segura |
| 1 2 3 4 5 | 20 | Most employees in my company would not feel comfortable if their work practices were observed and recorded by a coworker. | La mayoría de los empleados en mi compañía no se sentirían cómodos si sus prácticas laborales fueran observadas y registradas por un compañero de trabajo. |
| 1 2 3 4 5 | 21 | Team work and collaboration are encouraged to reduce safety hazards | El trabajo en equipo y la colaboración son fomentados para reducir los riesgos |
| 1 2 3 4 5 | 22 | I always follow the safety rules and procedures when doing my job | Siempre sigo las reglas y procedimientos de seguridad en mi trabajo |
| 1 2 3 4 5 | 23 | I have the personal protective | Tengo todo el equipo de |

| <i>Scale/ Escala</i> | | <i>English</i> | <i>Español</i> |
|--------------------------|----|---|---|
| | | equipment that I need to do my job safely | seguridad personal necesario para realizar mi trabajo de manera segura |
| 1 2 3 4 5 | 24 | Some safety rules and procedures are difficult to understand | Algunos de los procedimientos y reglas de seguridad son difíciles de comprender |
| 1 2 3 4 5 | 25 | Immigrant workers are more likely to suffer accidents than American workers | Los trabajadores inmigrantes tienden a sufrir más accidentes que los trabajadores americanos |
| 1 2 3 4 5 | 26 | Immigrant workers make the worksite unsafe for all workers | Los trabajadores inmigrantes generan un ambiente de trabajo inseguro para todos los compañeros de trabajo |
| 1 2 3 4 5 | 27 | Accidents can happen to anyone | Los accidentes le pueden suceder a cualquier persona |
| 1 2 3 4 5 | 28 | I am willing to take more risks than my coworkers | Estoy dispuesto a tomar mas riesgos que mis compañeros de trabajo |
| 1 2 3 4 5 | 29 | The dangers present on construction sites can not cause my death or the death of others | Los peligros en las obras de construcción no pueden ocasionar mi muerte o la muerte de otras personas |
| 1 2 3 4 5 | 30 | I have control over the dangers that I encounter on construction sites. | Puedo controlar los peligros que me encuentro en las obras de construcción. |

Other Comments: (Is there anything that you wish to tell us about your work experience in construction or about safety health at your company?)/ Otros Comentarios: (Hay algo que quiera añadir sobre su experiencia en la industria de la construcción o seguridad en la compañía?)

(Adapted from the Safety Culture Survey developed by Safety Performance Solutions, Inc.) Reference: Geller, E. S: (1996). *Working Safe*. Radnor, Pennsylvania, Chilton Book Company.