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Trench Safety—Using a Qualitative Approach to Understand Barriers and Develop Strategies to Improve Trenching Practices

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Abstract

Despite efforts to ensure workplace safety and health, injuries and fatalities related to trenching and excavation remain alarmingly high in the construction industry. Because properly installed trenching protective systems can potentially reduce the significant number of trenching fatalities, there is clearly a need to identify the barriers to the use of these systems and to develop strategies to ensure these systems are utilized consistently. The current study reports on the results of focus groups with construction workers and safety management personnel to better understand these barriers and to identify solutions. The results suggest several factors, from poor planning to pressures from experienced workers and supervisors, which present barriers to safe trenching practices. Based on the results, it is recommended that safety trainings incorporate unique messages for new workers, experienced workers and management in an effort to motivate each group to work safely as well as provide them with solutions to overcome the identified barriers.

Keywords

construction industry; safety climate; safety performance; safety training; trench safety

Introduction

Despite efforts in workforce training, Occupational Safety and Health Administration (OSHA) regulations, and effective engineering controls, injuries and fatalities related to trenching and excavation remain alarmingly high in the construction industry. As a whole, the construction industry is considered high risk. Although construction workers comprise about seven percent of the US workforce, they accounted for almost 19% of the 4,340 work-related deaths in 2009 (Bureau of Labor Statistics, [BLS], 2009). Even by construction standards, trenching and excavation work is extremely dangerous. The BLS Census of Fatal Occupational Injuries data-set showed 159 fatalities resulting from trenching and excavation between 2003 and 2005 (Center for Construction Research and Training [CPWR], 2007).

Many of the documented fatalities related to trenching and excavation were likely preventable. The most common cause (71%) of trench related fatalities are cave-ins and side wall collapses (CPWR, 2007). Properly installed trench wall protective systems, such as shielding, sloping and shoring, help protect workers from fatal accidents related to cave-ins and sidewall collapses but these systems do not appear to be used consistently. Because properly installed protective systems can potentially reduce trenching fatalities, there is a need to identify the barriers to their use and to develop strategies to ensure these systems are always utilized. The current study addresses this need by taking a qualitative approach and multiple sources to better understand the current trenching practices and to identify barriers to safety behaviors.

Determinants of Safety Performance

Understanding why workers behave the way they do is not a straightforward topic but there are recognized factors that play a role in workers' behavior. Neal and Griffin's (2004) safety performance framework provides a useful model to understand determinants of safety performance and safety outcomes. This framework suggests that safety knowledge and motivation are directly related to safety performance (*e.g.*, working safely). Safety performance is hypothesized to be directly related to safety outcomes (*e.g.*, working safely is likely to result in fewer injuries). The model also suggests that safety knowledge and motivation are predicted by characteristics of the individual (*e.g.*, safety attitudes) and characteristics of the work environment (*e.g.*, characteristics of the construction industry and safety climate).

Neal and Griffin's (2004) model is utilized for the current study of unsafe trenching practices since the model points to possible factors that could help explain why workers do not engage in proper safety behaviors. Neal and Griffin's suggestion that safety knowledge and motivation directly influence safety performance has been empirically supported (*e.g.*, Christian, Bradley, Wallace, & Burke, 2009). Therefore, possible barriers to safe trenching and excavations include lack of knowledge of proper safe practices or lack of motivation to engage in these behaviors. The model also points to the need to extend beyond knowledge and motivation since both are influenced by factors related to the individual worker as well as the work environment. In the following sections, individual antecedents and then work environment antecedents to safety performance will be addressed in detail.

Individual Antecedents of Safety Performance

As stated above, various characteristics of the individual worker are suggested to influence safety performance (Neal & Griffin, 2004). That is, workers possess various attitudes, experiences, and dispositions, which all influence the extent to which they work safely. Individuals hold beliefs and feelings towards safety, which are referred to as safety attitudes. Personal characteristics are proposed to influence safety performance through safety knowledge and motivation. For example, workers who hold poor safety attitudes are probably not going to go through the effort to learn the proper ways to work safely or be motivated to work in a safe manner, and are therefore, more likely to work unsafely.

Researchers have found some support for the influence of personal characteristics on safety performance. Christian and colleagues (2009) found that safety performance was positively related to both locus of control and safety attitudes and negatively related to propensity for risk taking, although none of these relationships were strong. Another study found that individuals who do not value the importance of safety behaviors, feel pressured not to engage in safe behaviors, or do not feel like they have control over their own safe behaviors are not likely to engage in safe behaviors (Fogarty & Shaw, 2010). The above findings suggest that in addition to lack of knowledge and motivation, individual characteristics of trench workers could provide some explanation for why workers are not engaging in proper trenching-safety behaviors.

Work Environment Antecedents of Safety Performance

Based on Neal and Griffin's (2004) work, one needs to extend beyond individual characteristics when attempting to understand lack of engagement in safety behavior since aspects of the work environment may also play a role in safety performance. When considering workplace safety, it is important to examine the characteristics of the industry (Ringen, Englund, Welch, Weeks, & Seegal, 1995; Ringen, Seegal, & Englund, 1995) as well as organizational factors (Neal & Griffin). Growing recognition of the relationships between industry characteristics, organizational factors and workplace safety is evidenced by its inclusion as a strategic goal in the National Occupational Research Agenda for Construction (National Institute for Occupational Safety and Health [NIOSH], 2008).

There are several characteristics specific to the construction industry that place workers' safety and health at risk (Ringen, Seegal *et al.*, 1995). Health and safety within the construction industry is complex since the work environment is constantly changing (Ringen, Englund *et al.*, 1995). Construction projects usually involve multiple employers (*e.g.*, a general contractor and multiple subcontractors) who are all involved with different tasks (*e.g.*, electrical wiring and roof installation) and responsible for hiring and training their own workers. Because of the complexity of the organization of work, well-coordinated safety programs are difficult to implement. Common practices in the construction industry such as the competitive bidding process and production-based bonuses provide powerful immediate financial incentives for companies to take shortcuts, some of which could lead to unsafe behavior (NIOSH, 2008). Workers also face financial pressure resulting from common characteristics and practices in the construction industry. Construction work tends to be temporary, since the work is project based and arbitrary dismissal is common. This structural insecurity can result in workers prioritizing production over safety as a way to prove that they are valuable employees and thereby increasing their chances to remain on the job and be hired for the next project (Paap, 2006). Additionally, many construction workers operate as self-employed subcontractors, thus removing the responsibility for providing workplace safety from the project management.

All of the above characteristics are important to consider since they can influence safety performance. Due to the constant changing of work sites and lack of coordinated safety programs, workers might not know how to work safely at times. The competitive nature of projects and the pressure to work quickly compared to correctly likely motivates workers to

work unsafely. These pressures can be influenced by macroeconomic conditions and are apt to be aggravated by increased competition in the bidding and hiring processes during economic downturns. Taken altogether, the characteristics of the construction industry need to be examined when attempting to understand trenching-safety behaviors.

Organizational factors are also recognized antecedents to safety performance. One commonly cited organizational factor is safety climate, which is defined as shared perceptions employees hold regarding safety (Neal & Griffin, 2004). These perceptions can be of organizational and management policies, practices, and procedures as well as the priority placed on safety compared to schedules and production (Zohar, 2003). Safety climate is commonly used as a temporary indicator or a “snapshot” of employee perceptions of risk and safety within an organization (Guldenmund, 2000).

The link between safety climate and safety-related outcomes has consistently been found (Hofmann & Stetzer, 1998). Meta-analyses have demonstrated that safety climate is related to safety performance as well as reductions in accidents and injuries (Christian *et al.*, 2009; Clarke, 2006). Studies have also shown that a positive safety climate can be fostered through organizational changes. Zohar’s (2002) leadership intervention is a commonly cited example of how an organization can improve its safety climate. Zohar found that increasing the safety interactions between supervisors and workers led to improvements in safety climate as well as enhanced safety performance and decreased injuries. This intervention illustrates the important role management can play in promoting safety climate as well as workplace safety. Based on the safety climate research, it is suggested that unsafe trenching behaviors could be due to lack of perceived management support for working safely. For example, this work suggests that if workers perceive that properly installing trenching protective systems is not important to management then workers are likely to adopt unsafe behaviors.

The Current Study

Given the above findings on individual characteristics and the work environment, it appears necessary to consider additional elements beyond safety knowledge when attempting to identify barriers to safe behaviors. To gain a better understanding of factors contributing to current trenching practices, five focus groups with participants ranging from inexperienced apprentice carpenters to safety professionals were conducted. A qualitative approach has been adopted by other safety researchers to gain a better understanding of workers’ perceptions of safety. For example, Mullen (2004) identified social and organizational factors contributing to unsafe behaviors by interviewing workers from a variety of occupations. Gittleman *et al.* (2010) utilized a qualitative approach to identify additional safety issues not included in their needs assessment survey and to gain a deeper understanding of construction workers’ perspective of the safety of the work environment. Based on the prior qualitative research, it was decided that to truly understand the challenges to safe trenching practices, individuals involved in trenching needed to be enabled and encouraged to talk about these issues in their own words.

The qualitative data for this study comes from a larger evaluation project designed to examine the effectiveness of the NIOSH Trench Safety Awareness Training. This interactive computer-based training program was developed by NIOSH in 2005 and was designed to

increase awareness of excavation and trenching hazards and safe practices for construction workers, site supervisors and construction management. The themes that emerged from the focus groups were used to gain a better understanding of the current barriers to trenching practices and to provide recommendations regarding modifications that could be made to the current NIOSH Trench Safety Training program.

Methods

A total of forty workers from a Midwest construction trade association were recruited to participate in one of five focus groups. Both union and non-union workers were included in the focus groups. Participants generally were from medium to large contractors. While women were not intentionally excluded from the study the predominance of men in the construction industry resulted in only three women in the sample (two safety management personnel and one safety trainer).

Focus groups are interviews with groups of individuals conducted by a facilitator using a semi-structured question format (Fontana & Frey, 2000). The aim of conducting focus groups is to generate conversation among participants on specific topics of interest to the investigators. This study used focus groups to gain a broad understanding of perspectives and factors related to trench safety practices on specific topics (see goals 1 to 5 below). To meet this goal, individuals from various levels including apprentices, workers, safety trainers, and safety management personnel were divided into five groups. Due to logistical limitations, groups were not stratified by union membership or company size. Groups 1 and 2 included construction workers who had between 1 to 20 years of experience working in trench excavation. Group 3 included carpenters' apprentices who had minimal to no experience in trench excavation but possessed a strong likelihood of performing trench-related activity during their careers. Group 4 consisted of safety trainers and consultants who were typically hired to train management and workers on trench safety practices and OSHA guidelines on trench excavation. Group 5 was composed of safety management personnel working for larger construction companies.

Each group, numbering eight participants, was shown the NIOSH Trenching Safety Awareness Training program and then participated in a guided focus group discussion. It should be noted that the qualitative methods used to analyze focus group data do not lend themselves to the same sort of power analyses used for quantitative research approaches. The concept of saturation is used to determine whether or not an adequate number of focus groups have been conducted (Strauss & Corbin, 1990). Saturation is considered to have occurred when no new topics are generated by the groups. Based upon the researchers' previous experience it was expected that saturation would be reached after conducting 4 to 5 focus groups.

Conversation in each of the groups was started with a general question such as "What are some of the reasons trench safety equipment is not used when it should be?" Follow-up probes to these questions within each focus group discussion followed naturally from the answers received. Additional probes were tailored to draw out any unique perspectives from each group without sacrificing the goals of the analysis. For example, the group responsible

for operations management and decision-making was asked, “What are some of the costs associated with planning and acquiring trench protective equipment?” This item was not asked of the apprentice group. The following goals were addressed:

- Goal 1—Identify attitudes towards the trench safety awareness training program.
- Goal 2—Identify the perceived barriers to acquiring, assembling and implementing trench protective systems.
- Goal 3—Identify optimum sources of information to reach employers and workers and raise awareness about trench safety.
- Goal 4—Identify their current safety and health practices in their work environments.
- Goal 5—Determine their perceptions of current and previous experience with safety training, related to trench safety and/or other work practices.

Data Analysis

Following standard practice, qualitative data analysis of the focus group transcriptions took place in two stages: 1) independent coding, and 2) code consolidation (Ryan & Bernard, 2000). Four researchers independently read the text and assigned labels to specific segments of the text that identified key categories and concepts related to the participants’ knowledge, attitudes and behaviors regarding trench safety. After each researcher completed open coding of the text, the second phase of analysis, code consolidation, began through a series of subsequent meetings to discuss unusual findings, identify divergences in opinion, and develop a consensus on common themes and the quotes related to these themes. Once consensus had been reached the coding schema was applied to the entire text by one of the members of the research team. Data management software (QSR NVIVO 8) was used to produce coding reports which were reviewed and analyzed by two members of the research team to develop a series of conclusions regarding information needs, motivational factors, and obstacles to safe practices reported in this manuscript. The researchers then reviewed the literature to identify possible models that could be used to contextualize the findings that emerged from the data. It was determined by the researchers that Neal and Griffin’s (2004) safety performance model provided a good framework to understand the data.

Results

Three major themes emerged from the analysis of the focus group commentary that contributes to an understanding of possible reasons for unsafe work practices: 1) perceived characteristics of the individual worker, 2) the relationships among experienced and inexperienced workers, and 3) the role of company hierarchy and management responsibilities. The themes of “perceived characteristics of the individual worker” and “the role of company hierarchy” were further broken down into sub-themes which are described at the beginning of each section.

In general, the responses from workers (*i.e.*, experienced workers and apprentices; Groups 1 through 3) and responses from safety professionals (*i.e.*, safety trainers/consultants and

safety management personnel; Groups 4 and 5) were similar. There were instances, particularly regarding the role of company hierarchy, when responses differed between the groups. In these instances the differences are explicitly mentioned below.

Perceived Characteristics of the Individual Worker

Characteristics of the individual worker that contribute to unsafe work practices were mentioned throughout all five of the focus groups. These comments concentrated on individual worker choices when implementing safety measures and could be grouped into three basic categories: 1) youth and inexperience, 2) knowledge of safety practices, and 3) experience.

Youth and Inexperience

Participants throughout the groups consistently brought up young age as a contributing factor to unsafe practices. Many participants believed that young, inexperienced people are generally less concerned about safety and more willing to take risks largely because they are less likely to foresee the potential consequences of a trench collapse or trench-related dangers. One trench worker commented:

“Yeah, I agree with that. You think when you’re young that you’re going to live forever. Because I’m cocky. Because you get a young guy in off the street, and a lot of times he’s not experienced enough to know what could happen to him. Even watching the video, he doesn’t have the experience to know what could happen.”

This attitude of indifference was seen as simply the general orientation of youth toward the world and highlights the need to tailor messages that alter these particular outcome expectancies. These comments further suggested a perception that younger workers with only a few years experience are more likely than older workers to perform risky behaviors.

Knowledge of Safety Practices

Although knowledge of safety practices was viewed as being related to youth or inexperience, many comments were geared more toward simple ignorance of the dangers of trenching in general or to specific regulations and safety practices. As one participant mentioned,

“If I would have knew that (the dangers) back when I first got down in the ditch, I wouldn’t have got in there.”

In another example a participant mentioned that workers he knew were unaware of the fact that there were situations in which a trench box would not provide adequate protection (*e.g.*, when the box is smaller than the height of the excavation). In general, the participants stressed that a major barrier to safe trenching practices is simple ignorance of the dangers and the safety protection systems and that training addressing the lack of safety knowledge would be helpful.

Experience

While many participants mentioned experience contributed to safer work practices, numerous examples were also given throughout all the groups that suggested that experience

was often a hindrance to safety. A common explanation was that older workers developed unsafe practices before many trench safety regulations came into effect. Since these workers rarely encountered or perceived any negative consequences to these behaviors, such as physical injury or corrective action, they seemingly developed a false sense of security. As one participant put it,

“I’ve done this a thousand times. It can’t happen to me.”

In addition, one comment suggested that experienced workers are resistant to change because they see it as questioning their competence.

“Being a young foreman . . . makes it hard on me . . . because they [experienced workers] say they did it for all these years, they don’t want to listen to that. What do you know? You’re young, you’re just getting into it!”

Even though the respondent in this example was the foreman, he still found it difficult to get the more experienced workers he was supervising to follow the safety procedures. In general, the responses surrounding the topic of experienced workers suggested that experienced workers have a tendency to work unsafely since they prefer working their way instead of the safe and correct way.

Relationships between Experienced and Inexperienced Workers

In addition to the perceptions of the role of the individual worker to unsafe work practices, the relationships between the experienced and inexperienced workers were also mentioned as relating to the implementation of mandated safety practices. From the focus groups, it appears that many older, experienced workers seem not to respect current safety regulations and use tactics to prevent inexperienced workers from following these regulations. Inexperienced workers reported feeling pressured to not only conform to the unsafe practices modeled by older workers, but to continue the culture of working unsafely by harassing newer workers who try and do things by the book. The respondents also mentioned that there is an informal hierarchy among trenching workers and new workers have to “earn their acceptance.”

It was commonly agreed among the worker groups that the older workers were key in setting the safety climate. Unfortunately, only one comment was made about an experienced worker *encouraging* safe practices.

“This guy who is kind of a mentor to me will tell me, ‘That’s not the way that I do it, but a lot of things have happened in the last 30 years, and this is the way you probably need to do it if you don’t want to end up with asbestosis or silicosis and a lot of other things.’ Not very many of the old guys will do it. They want you to be a hard ass just like them.”

In contrast, the other comments about experienced workers suggested that the experienced workers seemed to be the ones who encouraged acceptance of the dangers and risk taking. Participants, particularly the younger workers, reported that the experienced workers are often the ones that not only work in an unsafe manner but also have the informal and, at times, the formal authority to influence the way the others work as well.

“I mean, you got a lot of guys who did it before all the safety regulations came around, and they still kind of want to do things their way. A lot of times that’s your foreman or that’s your lead man and you kind of got to go with what he wants . . . you just think in your mind, ‘I’ve got to do it another way.’ But you can’t. If you say something, they view you as a bitcher and you don’t want to be labeled that.”

This example suggests that the experienced workers have significant power in setting the cultural norms for the group. Based on the responses, workers who have been around several years tend to develop a feeling of expertise, which becomes part of their self-image. They perceive that their experience makes them “experts” and do not believe they need to learn new things. Participants also expressed that some of the experienced workers saw learning through trial, error, and injury as just part of the normal work experience; if the experienced workers learned in this manner, they saw no reason why new workers should have a different experience. This suggests some older workers view minor occupational injuries as rite of passage that can serve as an effective lesson in work hazards.

One common description of how experienced workers coerced inexperienced workers was to question their masculinity. In recounting experiences of being pressured by coworkers, terms such as “pup,” “pussy,” or “bitcher” were frequently used to refer to workers who expressed concerns about safety on the job. These comments suggest that the construct of masculinity is commonly used to enforce conformity to group norms and plays an important role in perpetuating the safety climate. Challenging worker masculinity was seen commonly among both experienced workers and supervisors in the workplace:

“So he goes to the foreman and says, ‘Have we got any dust masks?’ He’s like, ‘Nope.’ He said, ‘Well how ‘bout if I can get a dust mask?’ His foreman looked at him and said, ‘Are you going to be a pussy your whole life, or are you going to be a man and get the job done?’ That’s his exact words. His exact words. I mean, old guys, that’s what they do, and you just go around it, or you just join in with them and you do it too.”

Participants mentioned a deeper concern that younger workers not only conform to but, over time, accept and perpetuate this unsafe culture.

Role of Company Hierarchy and Management Responsibilities

In addition to placing the blame for unsafe practices on the individual worker, both workers and safety professionals brought up problems with management. A common theme that ran through these comments was that it all came down to time and money and when there was a choice between meeting a deadline or doing it safely, safety almost always lost.

Participants cited that pressure to complete jobs quickly to meet a deadline is commonplace emanating from several sources. An example of management emphasizing performance over safety was demonstrated by many of the workers expressing fears that failing to meet deadlines could result in the loss of their job. Performance pressure also seems to manifest itself through status differences between workers and foremen, creating expectations that potentially interfere with safer behaviors,

“...everybody’s trying to be buddies with the foreman, or they might feel that pressure to perform, okay, maybe take that cowboy chance, because they feel better in the foreman’s eyes and they look better in the company’s eyes if they’re a productive employee. They get the job done no matter what it takes.”

Participants agreed that getting management to value safety would drastically reduce trench fatalities. While there was agreement on this point, workers and safety professionals differed on what they saw as the main problems with management. Workers focused on the pressure they felt to work quickly versus safely which was often perceived as management’s lack of concern for workers’ well being. In contrast, safety professionals emphasized the organizational structures such as lack of communication between the front office and production teams that contributed to unsafe practices.

Worker Perspective on Management

As mentioned above, the workers tended to blame the company for the unsafe conditions. The workers also pointed out that safety trainings are limited in their effectiveness when up against the pressures of the workplace. Several comments made it clear that it was commonplace for workers to feel pressured to accept an unsafe situation or risk being fired. Of particular frustration to several of the participants was the inconsistency and mixed messages that workers felt they regularly received from the company.

“Well every company you go to, if there’s a big push, if you got this amount of time to get it done and it’s close, you’re doing shit that’s shady. But then once it’s over, then they’ll be assholes about the safety. Then if you don’t get that damn yo-yo on your back, you’re out of here for three days. Next time you’re fired. And that’s everywhere.”

Safety Professionals Perspective on Management

Several unique themes emerged from the safety professionals (*i.e.*, safety trainers/consultants and safety management personnel). The safety professionals did agree with the workers that management’s “time is money” perspective played a major role in shaping unsafe work practices. Safety professionals’ perspectives, however, concentrated on how organization-level structures influenced both safety practices and worker motivation.

Construction sites were seen by safety professionals as constantly changing environments as subcontractors shift quickly among various sites on timetables that may not coordinate with the schedule of the general contractor management. Foremen and safety management often monitor multiple sites throughout the day, making it difficult to keep track of many of the potential hazards faced by subcontractors,

“It happens before our trailer is ever out on the site. The hazards are there and gone before anybody’s had their supervisor at work because the site work’s going on.”

The overall conditions contribute to the poor relationships between contractors and the subcontractors and demonstrate the need for improved communication. One safety trainer argued that better communication was necessary between workers, subcontractors and management to alleviate these problems.

Safety managers with experience at larger companies emphasized that the lack of communication between the front office and the production folks resulted in poor planning on the jobsite. They discussed the difficulties of acquiring trench boxes on short notice either because they were not available or because of the time needed to transport them from one place to another. In other words, if the contractor fails to plan ahead, workers are simply held up waiting for equipment. This dead time increases the pressure to cut corners.

Improved communication, however, only addresses one of the themes brought up by the safety professionals. Participants also alluded to the need for incorporating better safety planning into business practices and for employers to look at safety as a financial investment. It was suggested that safety materials targeting employers incorporate information on OSHA penalties, fines, law suits and productivity losses.

General contractors typically request bids from a number of subcontractors and may not include their safety records as a selection criteria for economic reasons. Both small and large-size employers are faced with many economic choices when planning a project, forcing the safety directors to provide an effective return-on-investment strategy if they intend to leverage a change in the company's culture. In essence, this lack of emphasis on safety from the start of the bidding process creates a culture that perpetuates financial incentive over safety. This attitude trickles down to other levels of management. Contractors may consider this risk as acceptable because, as one consultant stated,

“...you sit there and weigh the odds, am I gonna get caught . . . roll the dice . . . am I gonna get in trouble for this . . . most of the time you win . . . 99% of the time you win.”

This gamble creates unintended motivational consequences among competing subcontractors who actually try to practice safely,

“I mean, you bid against the companies where you don't get the job. You drive by the job and you see an open ditch ten feet deep with nothing in it. You sit there and it's like, 'How did they get away with that; as soon as we do something like that, OSHA's on top of us and things like that.'”

While much discussion touched upon the motivational barriers within the construction culture, several participants talked about the need for more positive approaches to training and changing safety culture. The safety consultant group noted that management commonly criticized workers for inappropriate behavior but rarely praised safe behaviors. By focusing solely on criticizing unsafe behaviors, respondents were concerned that management effectively de-motivates a safe work-place rather than empowering workers to approach safety efficaciously.

Discussion

This study used a qualitative approach to better understand the current trenching practices and to identify possible barriers to safety behaviors in an effort to increase the effectiveness of safety trainings. The findings suggest that although knowledge is a key component to safe practices, other factors such as pressure from coworkers and employers also influence

behaviors. Therefore, to ensure workplace safety, additional factors beyond safety knowledge need to be considered. Identifying and addressing barriers to safe practices at the individual, group and organizational levels is essential in improving safety climate in an organization.

Participants in all of the focus groups tended to attribute risk taking behaviors to an under-appreciation of the dangers of trenching. This is important because workers, who do not perceive their work to be dangerous, are less likely to be motivated to engage in safe practices. Multiple studies have shown that workers who are motivated to work safely tend to work more safely, which has then been linked to fewer accidents and injuries compared to workers who work unsafely (*e.g.*, Christian *et al.*, 2009; Neal & Griffin, 2004). Workers may understand superficially that the work is dangerous but may not understand how dangerous it is, or they may incorrectly believe they can avoid the dangers. Thus, training needs to address risk perceptions in addition to safety knowledge.

The findings also suggest that attitudes related to both inexperience (*e.g.*, I'm invincible) and experience on the job (*e.g.*, I know more than the "safety people") were seen as contributing to a diminished risk perception. Safety trainings should account for the range of factors that contribute to workers engaging in unsafe practices and encourage safety attitudes that influence workers to engage in safe practices (*e.g.*, safety is everyone's responsibility and I could hurt myself and others if I work unsafely). The finding that characteristics of experienced and inexperienced workers can contribute to a diminished risk perception suggests that messages targeting sub-populations of workers (*i.e.*, inexperienced and experienced) may prove more effective than a "one-size-fits-all" model.

Although poor safety attitudes seem to be held by both inexperienced and experienced workers, special attention may need to be given to developing trainings for experienced workers. Experienced workers were perceived as being resistant to change in their safety behaviors since changes were seen as questioning their competence. Safety trainings targeted at experienced workers should focus on replacing unsafe behaviors with safe behaviors and re-training correct practices, but in a manner that reinforces their image as being knowledgeable and competent workers. Tailoring trainings in this manner may increase the likelihood that experienced workers take the trainings seriously and adopt the practices promoted in the trainings.

In addition to perceptions and behaviors at the individual level, group norms and the relationships between experienced and inexperienced workers were also found to be an important factor contributing to unsafe behaviors. Experienced workers were reported as successfully exerting their informal power to influence the behaviors of inexperienced workers. The participants mentioned that experienced workers have created a norm of working unsafely by harassing workers who follow safety guidelines. Because inexperienced workers are socialized to work unsafely, they are placed in vulnerable situations where even if they have the knowledge and motivation to work safely, they often cannot do so due to the pressure they face from the experienced workers.

One common way experienced workers were reported as influencing inexperienced workers was to question their masculinity. Construction is a predominantly male profession and masculinity a core cultural value (Paap, 2006). Younger workers not only feel embarrassed when their masculinity is questioned in front of their peers but they also run the risk of losing their job and future employment if they develop a reputation as not being “man enough” to “get the job done.” When placed in the context of economic security, the association of male identity with risk taking behavior can be seen as a collective response to the pressure workers often feel, from their employer, to value production over safety. The internalization of this value often results in safety norms where workers put the interests of the company above their own safety and coerce fellow workers to do the same. Based on the focus groups, attacking inexperienced workers’ masculinity is effective since inexperienced workers reported engaging in unsafe, yet socially desired, behaviors often against their better judgment as a result of this coercion tactic. As Paap has pointed out, these norms can become internalized so that workers engage in unsafe behaviors when management is not present, or even when management is advocating for safe behavior as seen in the case of the young foreman above who reported older workers that he was supervising, resist his attempts to follow safety procedures. Over time, inexperienced workers not only conform to unsafe group norms but often reproduce them by harassing newer workers.

These findings suggest that the social environment needs to be addressed in safety trainings. Inexperienced workers are vulnerable to the challenges from experienced workers and therefore, need to be trained on how to recognize and address these challenges so they can work safely. Although inexperienced workers have little formal and informal power to control the working conditions, they are not helpless. They should be made aware of the dynamics common to the construction industry and be provided with tools so they can address common situations they are likely to experience. Experienced workers also need to better understand the importance of a positive safety climate and their role in promoting it. One suggestion is that experienced workers be placed in mentoring relationships with inexperienced workers. Leadership research has demonstrated that high quality leader-subordinate relationships are related to workers putting in additional effort to ensure the workplace is safe (Hofmann, Morgeson, & Gerras, 2003), safety communication, and safety commitment (Hofmann & Morgeson, 1999). The role of mentor would help reaffirm experienced workers’ knowledge and expertise. The mentoring role could also be easily framed as a traditional male role making it consistent with the overarching cultural value of masculinity. Based on leadership research and the focus group discussions, if experienced workers (*i.e.*, the informal and/or formal leaders of construction sites) learned to actively promote safety and how to mentor inexperienced workers, the safety of worksites could be improved.

Group norms do not develop in a vacuum and it was widely recognized in all the groups that company management played a central role in influencing the value placed on safety. While it was generally acknowledged by participants that small companies more frequently engaged in unsafe behavior relative to larger ones, it was also noted that pressure to engage in unsafe behavior was commonplace throughout the industry and in companies of all sizes. In some companies, instances of disregard for safety regulations or their inconsistent

application led many respondents in the worker groups to perceive management as being more concerned with production than safety. Encouraging workers to ignore safety regulations in order to finish on or ahead of schedule suggests management is willing to gamble with the safety of their workers and possible OSHA fines when there are financial incentives that accompany meeting a deadline. Likewise, enforcing safety procedures during slow production periods suggests the financial incentive of avoiding potential OSHA fines or workers' compensation claims since there is less financial motivation to finish the job quickly. Either way inconsistent enforcement of safety regulations sends a message to workers that safety is a financial calculation. Over time, it is easy to see how workers could develop a cynical attitude toward company efforts to promote safety and internalize the value of production over protection in an effort to remain employed.

In contrast, the safety professionals perceived lack of communication and planning and poor safety attitude as the main problems with management. This group pointed out that it is not necessarily lack of concern by management but instead lack of communication and planning that forces workers to work unsafely. Industry-wide practices such as competitive bidding were also mentioned as contributing to poor planning and communication. It was emphasized that the economic value of safety needs to be made explicit and that management needs to consistently reward employees for working safely.

The two viewpoints regarding management's contribution to unsafe practices provides insight into elements that need to be included in safety trainings. Similar to the suggestion that trainings need to include ways to deal with the pressure inexperienced workers feel from experienced workers, safety trainings also need to address the reality of working conditions and provide suggestions on how workers can deal with the pressure they will receive from management to work in an unsafe manner. It is suggested that, in addition to training workers, a management intervention involving all levels of management from low-level supervisors to top management is greatly needed since all levels have power and influence over workplace safety. Prior safety climate research has demonstrated the important influence of management demonstrating a commitment to safety on workers' perceptions of the value of safety as well as safety outcomes (Zohar, 2002). If management does not value safety, this is going to trickle down to the workers and influence their safety attitudes and behaviors. To foster positive safety attitudes among the workers, management needs to adopt a more positive view of safety. As mentioned above, Zohar's supervisor intervention is one way to improve safety climate as well increase positive safety behaviors and reduce accidents.

Implications

Hard and Soft Skills—An implication of our findings is the importance of including both hard (*i.e.*, technical knowledge) and soft (*i.e.*, dealing with people) skills into safety trainings. From the focus group discussions and prior research, safety knowledge should continue to be a main element in safety trainings. However, for workers to actually be able to use this safety knowledge, soft skills also need to be taught. One important soft skill identified from the focus group discussions is how to communicate about safety with experienced co-workers and management (*e.g.*, supervisors and top-management). There has

been some research on upward safety communication, which is the freedom workers feel to discuss safety issues with their foremen/supervisor (Hofmann & Morgeson, 1999). Research has demonstrated that construction safety is enhanced with safety communication (Cigularov, Chen, & Rosecrance, 2010). It is important to incorporate safety communication training in future safety trainings. Future research should investigate the best methods to teach safety communication skills to each level of an organization, from workers to top management. Future research could also explore other soft skills that would increase the effectiveness of safety trainings such as behaviors associated with emotional intelligence.

Top-Down and Bottom-Up Approach—Another implication of the findings is the importance of taking both a top-down and bottom-up approach. The focus group data clearly demonstrated that the social environment greatly influences workers' safety behaviors. Training needs to be targeted at workers so they learn how to engage in the proper safety behaviors, learn to value safety, resist social pressure to engage in unsafe acts, and how to communicate safety issues with their coworkers and management. A top-down approach is also needed since management needs to adopt the value of safety and pass this value on to their workers. Most of the communication research has focused on top-down communication (Tucker, Chmiel, Turner, Hershcovis, & Stride, 2008) such as targeting supervisors to communicate the importance of safety to workers in an effort to change the workers' behavior (Zohar, 2002). More research needs to focus on the importance of the influence of experienced workers since the focus group discussions suggest experienced workers greatly influence inexperienced workers behaviors. Additionally, there is a need for unique messages and training strategies to be developed for inexperienced and experienced workers as well as different levels of management.

Limitations

Despite the strengths and contributions of the study, the results and interpretations require a discussion of the possible limitations that should be addressed by future research. First, our research results may not be generalizable due to the relatively small sample size of primarily male workers from mostly medium to large construction contractors. Another possible limitation of the study was company background or union identification were not considered when making the focus group assignments. It is possible that union and non-union workers hold different opinions regarding safe practices. Additionally, workers from small companies could view safety differently than workers from large organizations. Therefore, larger sample sizes with workers from more varied backgrounds should be recruited in order to clarify any differences in opinion between various groups.

Conclusions

Overall, the results suggest that safety trainings need to address real-life situations that construction workers face on a daily basis that impact their ability to work safely. The study demonstrates the need to look beyond safety knowledge to individual, group, and organizational dynamics when developing safety trainings. Specifically, at the individual level future safety trainings should address risk perceptions and safety attitudes, since both appear to contribute to workers engaging in unsafe practices. Safety trainings need to also

address the social environment present on the worksite by highlighting common group dynamics among coworkers (*e.g.*, unsafe social norms, or experienced workers discouraging safe practices) and providing workers with tools to manage these situations. Trainings should account for the various levels in the workforce and include tailored safety messages to different sub-groups such as inexperienced workers, experienced workers, and managers. Safety trainings should also acknowledge and help workers identify and address organizational and industry factors that can contribute to unsafe practices and norms of behavior among individuals and groups of workers. Trainings should provide workers, as individuals and as a group, with tools (*e.g.*, how to respond collectively to an unsafe request from a supervisor) to address real life organizational barriers to safety common in the industry (*e.g.*, pressure from supervisor to work faster at the expense of safety). Overall, these recommendations point to the need for safety professionals to understand their audiences and the barriers to safety prior to the development of training materials. Further research into understanding these barriers and finding effective ways to address them is warranted. In conclusion, the findings suggest that providing workers with effective tools (*i.e.*, “soft skills”) to address individual, group and organizational barriers they are likely to encounter would enhance their ability to implement the safety procedures that are currently taught (*i.e.*, “hard skills”).

References

- Bureau of Labor Statistics [BLS]. Census of fatal occupational injuries. Washington, DC: Department of Labor, Bureau of Labor Statistics Program; 2009. <http://www.bls.gov/news.release/cfoi.nr0.htm>
- Center for Construction Research and Training [CPWR]. The construction chart book. 42007. <http://www.cpwrt.com/rp-chartbook.html>
- Christian M, Bradley J, Wallace C, Burke M. Workplace safety: A meta-analysis of the roles of person and situation factors. *Journal of Applied Psychology*. 2009; 94:1103–1127. [PubMed: 19702360]
- Cigularov KP, Chen PY, Rosecrance J. The effects of error management climate and safety communication on safety: A multi-level study. *Accident Analysis and Prevention*. 2010; 42:1498–1506. [PubMed: 20538106]
- Clarke S. The relationship between safety climate and safety performance: A meta-analytic review. *Journal of Occupational Health Psychology*. 2006; 11:315–327. [PubMed: 17059296]
- Fogarty GJ, Shaw A. Safety climate and the theory of planned behavior: Towards the prediction of unsafe behavior. *Accident Analysis and Prevention*. 2010; 42:1455–1459. [PubMed: 20538101]
- Fontana, A.; Frey, JH. The interview: From structured questions to negotiated text. In: Denzin, NK.; Lincoln, YS., editors. *Handbook of qualitative research*. 2. Thousand Oaks, CA: Sage; 2000. p. 645–672.
- Gittleman JL, Gardner PC, Haile E, Sampson JM, Cigularov KP, Ermann ED, et al. [Case Study] CityCenter and Cosmopolitan construction projects, Las Vegas, Nevada: Lessons learned from the use of multiple sources and mixed methods in a safety needs assessment. *Journal of Safety Research*. 2010; 41:263–281. [PubMed: 20630278]
- Guldenmund F. The nature of safety culture: A review of theory and research. *Safety Science*. 2000; 34:215–257.
- Hofmann DA, Morgeson FP. Safety-related behavior as a social exchange: The role of perceived organizational support and leader-member exchange. *Journal of Applied Psychology*. 1999; 84:268–269.
- Hofmann DA, Morgeson FP, Gerrass SJ. Climate as a moderator of the relationship between leader-member exchange and content specific citizenship: Safety climate as a exemplar. *Journal of Applied Psychology*. 2003; 88:170–178. [PubMed: 12675404]

- Hofmann DA, Stetzer A. The role of safety climate and communication in accident interpretation: Implications for learning from negative events. *Academy of Management Journal*. 1998; 41:644–657.
- Mullen J. Investigating factors that influenced individual safety behavior at work. *Journal of Safety Research*. 2004; 35:275–285. [PubMed: 15288561]
- National Institute for Occupational Safety and Health [NIOSH]. National construction agenda for occupational safety and health research and practice in the US construction sector. NORA Construction Sector Council; 2008. <http://www.cdc.gov/niosh/nora/comment/agendas/construction/>
- Neal, A.; Griffin, MA. Safety climate and safety at work. In: Barling, J.; Frone, MR., editors. *The psychology of workplace safety*. Washington, DC: American Psychological Association; 2004. p. 15-34.
- Paap, K. *Working construction: Why white working-class men put themselves and the labor movement in harm's way*. Ithica, NY: Cornell University Press; 2006.
- Ringen K, Englund A, Welch L, Weeks JL, Seegal JL. Why construction is different. *Occupational Medicine: State of Art Reviews*. 1995; 10:255–259.
- Ringen K, Seegal J, Englund A. Safety and health in the construction industry. *Annual Review of Public Health*. 1995; 16:165–188.
- Ryan, GW.; Bernard, HR. Data management and analysis methods. In: Denzin, NK.; Lincoln, YS., editors. *Handbook of qualitative research*. 2. Thousand Oaks, CA: Sage; 2000. p. 769-802.
- Strauss, A.; Corbin, J. *Basics of qualitative research: Grounded theory, procedures and techniques*. Newbury Park: Sage; 1990.
- Tucker S, Chmiel N, Turner N, Hershcovis MS, Stride CB. Perceived organizational support for safety and employee safety voice: The mediating role of coworker support for safety. *Journal of Occupational Health Psychology*. 2008; 13:319–330. [PubMed: 18837627]
- Zohar D. Modifying supervisory practices to improve subunit safety: A leadership-based intervention model. *Journal of Applied Psychology*. 2002; 87:156–163. [PubMed: 11916209]
- Zohar, D. Safety climate: Conceptual and measurement issues. In: Quick, JC.; Tetrick, LE., editors. *Handbook of occupational health psychology*. Washington, DC: American Psychological Association; 2003.