



## Toolbox talks to prevent construction fatalities: Empirical development and evaluation



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### ABSTRACT

Three studies were conducted to develop and evaluate safety toolbox talks about fatal construction incidents. Study 1 surveyed workers ( $n = 28$ ) about existing pre-shift meetings. An evidence-based structure for toolbox talks was developed, and study 2 evaluated our selected line drawing illustration format with workers ( $n = 30$ ). Study 3 evaluated supervisors' talks using: (1) new toolbox guides and (2) long-form investigation reports with workers from eight construction crews.

In study 1, 25% of the sample reported never conducted safety meetings. In study 2, compared to photos, line drawings increased the distance workers' could correctly identify hazards by over 1.5 m. In study 3, the new format was preferred by 82% of supervisors, saved them 15 min preparation/presentation time, and produced favorable impacts with workers.

Brief scripted toolbox talks made it easier for supervisors to share fatal stories and prevention recommendations with their crews. When the format includes scripted text for the supervisors, prompts for discussion and action items, and line drawings worker understanding can be enhanced.

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### 1. Introduction

Construction is a high-risk industry with dynamic occupational hazards. The work is typically performed at dispersed locations, including multiple job sites or multiple locations within a single job site (Bureau of Labor Statistics, 2014). Industry specializations include, but are not limited to, commercial and residential construction, bridge erection, excavation, demolition, and roadway paving. Common hazards vary by trade, project, and project stage, but include falls from heights, mobile machinery, electrical exposures, falling objects, inclement weather, equipment failure, and structural collapse. The mix of contractors, trades, and workers changes as projects progress and employers must continually adapt to recruit, staff, and communicate with workers at each

building stage (Lockyer and Scholarios, 2007). These exposures contribute to elevated occupational fatality rates in construction. Globally it is estimated that 350,000 workers die each year (International Labor Organization, 2014), with 60,000 of these deaths occurring in the construction industry (The National Examination Board in Occupational Safety and Health, 2014). In the US, the current construction industry fatality rate is 9.9 per 100,000 full time workers compared to the average 3.4 rate for all US industries (Bureau of Labor Statistics, 2012). In 2012, the largest proportion (36%) of construction fatalities were due to falls (Bureau of Labor Statistics, 2011).

Controlling hazards and preventing fatal injuries in construction is a multi-faceted challenge. The first priority and best safety control is to completely remove hazards from construction environments. However, when complete hazard removal or control is not possible, training and administrative controls should be applied to promote best safety practices that limit workers' exposures to hazards. In this regard, safety training and communication can set expectations, increase hazard awareness, develop knowledge and skills, and reinforce safe building practices. A traditional communication channel in construction is the safety tailgate or toolbox talk. These brief talks typically address a focused safety

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topic and are delivered by supervisors or safety personnel before work or during breaks.

The current project was designed to develop and evaluate toolbox talk material about fatal construction incidents. This was an outreach research project of the Oregon Fatality Assessment and Control Evaluation (OR-FACE) program (NIOSH Grant U60OH008472), which is one of nine state-based FACE programs funded by the National Institute for Occupational Safety and Health in the United States. The national FACE mission is to “prevent occupational fatalities across the nation by identifying and investigating work situations at high risk for injury and then formulating and disseminating prevention strategies to those who can intervene in the workplace” (Centers for Disease Control and Prevention, 2014a). Research activities of state-based FACE programs include expanded surveillance and assessment of fatal workplace injuries, investigation of selected fatal incidents, and developing and evaluating outreach publications and activities.

Stories and lessons learned from fatal events investigated by FACE programs may provide particularly compelling content for safety toolbox talks. However, traditional FACE investigation reports may not be easily used by supervisors for this purpose (Centers for Disease Control and Prevention, 2014b). These reports are typically 5–10 pages long and provide an in-depth summary of fatality investigations and prevention recommendations. The language in reports is also typically tailored for an audience of safety professionals. While front line supervisors may use investigation reports for toolbox talks, significant reading and preparation time would be required. Briefer toolbox talk guides could save supervisors time and effort and make it easier for them to share fatal stories and lessons learned with their crews. Over the long term, adapting FACE investigation reports into brief toolbox talks could increase the number of construction supervisors who share fatality stories and prevention recommendations with their crews.

### 1.1. Safety communication and the role of toolbox talks

The quality and frequency of safety communication in the workplace, especially between supervisors and their subordinates, is associated with organizational safety practices and employees shared perceptions of safety priorities, or safety climate. In meta-analysis research, including studies in construction (Gillen et al., 2002), safety climate predicts employee safety compliance, participation, and injuries (Clarke, 2006). Applied experiments provide additional compelling evidence of the positive impacts of supervisor safety communication. Zohar and Luria (2003) implemented an intervention at four non-construction worksites where line supervisors set goals and received feedback for three months about (a) the frequency of their safety-related interactions with their subordinates and (b) levels of safe behavior/conditions in the workplace. Line supervisors also discussed their goals and feedback with their own upper-level managers. This cross-level feedback process for leaders increased the frequency of supervisors' safety-related interactions, safe work practices, and group-level safety climate. The same intervention model was tested in the construction industry. Two groups (four foremen and their crews) received the intervention and three groups (three foremen and their crews) served as controls. As expected, control groups that received no intervention showed no changes over time. One of the two intervention groups showed significant increases in the frequency of supervisors' safety-related interactions and safety climate (Kines et al., 2010).

Toolbox talks are a traditional and potentially impactful form of supervisor safety communication in construction. Toolbox talk materials are in demand and provided by notable construction-oriented organizations (Center for Construction Research and Training, 2014). The demand is likely driven by both perceived

utility of the format and government regulations. For example, the Oregon Occupational Safety and Health Administration requires construction employers to hold regular safety meetings or operate a safety committee (Oregon Occupational Safety & Health Administration, 2009). If employers opt for safety meetings, all available employees must attend, and meetings must be held at least once a month and/or at the beginning of any job lasting more than a week. The meetings must include discussions of “safety and health issues [and] accident investigations, causes, and the suggested corrective measures” (p. 113). Therefore, in Oregon and beyond, toolbox talks are an established delivery mechanism for communicating fatality prevention information to many thousands of workers.

Although safety toolbox talks are a common and valued form of safety communication in construction, research evaluating current practices or toolbox talk related interventions are surprisingly scarce. To identify relevant assessment or experimental studies in this area we searched Medline, PsychInfo, Scopus, and Thomson Reuters Web of Science using the search terms: “preplanning meeting\*” OR “toolbox talk\*” OR “safety meeting\*” OR “op\* meeting” OR “daily meeting” OR “preshift huddle” OR “toolbox guides” OR “safety communication” AND (occupational or work\* or industrial) AND the proximal words – using limiters adj2, pre/2, near/1 – (safety or health or injur\$ or accident\$ or mortality or incident\*). These searches returned hits ranging from 25 to 39 articles across the different databases. A review of abstracts and selected full papers identified nine studies/papers related to the perceived importance, effectiveness, and current quality of toolbox talks (seven studies were construction industry focused), and five articles/sources related to the need for materials and value of real case studies in talks. Among these papers, we identified just one experimental field study evaluating a toolbox talk intervention. Our review of findings from our literature search is provided in the paragraphs below.

Evidence does indicate that toolbox talks are perceived to be important and may be a component of effective safety programs in construction. In California, construction industry stakeholders identified improving toolbox trainings as their highest priority intervention area from among several other options (Harrington et al., 2009). Esmaeili and Hallowell (2012) reviewed seven research studies on components of effective safety programs and identified “project specific training and safety meetings” to be one of 12 consensus effective strategies. In a study of interview data from 28 construction sites, Hinze and colleagues (2013) found that reported “participation of all contractors in safety meetings” was one of 14 differentiating practices associated with reduced recordable injury rates (correlation =  $-.27$ ,  $p = .05$ ).

Research on current practices suggests that there are opportunities for improving the frequency and quality of safety meetings, including toolbox talks. In a study of safety climate perceptions among Latino residential construction workers (Arcury et al., 2012) only 25% agreed or strongly agreed that workers attend regular safety meetings. Interview and observational research suggests that some types of safety meetings may be mostly management driven and produce little engagement with subcontractors or workers (Mäki and Koskenvesa, 2012). For example, an analysis of scripts from construction site orientation meetings revealed that workers spent 0–2% of the time talking. Similar formal analyses of engagement in weekly safety meetings was not reported, but researchers noted that these meetings tended to be less formal and provide opportunities for some discussion and two-way feedback. Other researchers have recommended safety toolbox talks as a flexible method for safety communication and generating discussion, especially among small contractors (Hung et al., 2011), or as a means for supporting the dissemination and roll out of new engineering or equipment interventions

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