Safety Science 109 (2018) 165–173

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/safety

Safety climate dimensions and their relationship to construction safety performance: A meta-analytic review

Wael M. Alruqi[a,*], Matthew R. Hallowell[b], Ulises Techera[c]

[a] Department of Civil, Environmental, and Architectural Engineering, University of Colorado at Boulder, 1111 Engineering Dr., Boulder, CO 80309-0428, USA
[b] Department of Civil, Environmental and Architectural Engineering, University of Colorado at Boulder, 1111 Engineering Drive, UCB 428, Boulder, CO 80302, USA
[c] Department of Civil, Environmental, and Architectural Engineering, University of Colorado at Boulder, 1111 Engineering Dr, ECOT 441, Boulder, CO 80309, USA

ABSTRACT

This study investigated the empirical relationship between measures of construction safety climate dimensions and safety performance. A comprehensive review of existing literature of construction safety climate was conducted to: (1) review the questionnaires used to measure safety climate dimensions in the construction industry; (2) identify the salient dimensions of safety climate; and (3) establish a consistent definition of each safety climate dimension. Then, a statistical meta-analysis of the empirical relationship between construction safety climate dimensions and safety performance was performed. 107 studies were reviewed, and 11 studies were included in the meta-analysis. The review indicated that 14 construction safety climate dimensions were commonly used to assess safety climate. Of the 14 dimensions, five— supervisor's safety role ($r = 0.30$, 95% CI = 0.07 to 0.50), management commitment to safety ($r = 0.27$, 95% CI = 0.23 to 0.31), safety rules and procedures ($r = 0.25$, 95% CI = 0.12 to 0.37), individual responsibility to health and safety ($r = 0.23$, 95% CI = 0.17 to 0.31, and training ($r = 0.10$, 95% CI = 0.03 to 0.17)—were identified as commonly used predictors of injury rates. The results can be used by researchers and practitioners in this burgeoning field to standardize the assessment of safety climate and to validate the use of safety climate as a predictor of safety performance.

1. Introduction

Researchers have begun to implement a variety of methods of predicting construction safety performance including safety risk analysis, leading indicators, precursor analysis, and safety climate. Among these, safety climate, defined as "individual perceptions of policies, procedures, and practices relating to safety in the workplace" (Neal and Griffin, 2006, pp. 946–947) is the most widely researched. Recent studies have focused on developing new safety climate measurements (Kines et al., 2011; Mohamed, 2002; Zhang et al., 2015). However, safety climate assessment remains inconsistent across studies (Schwatka et al., 2016). Glendon and Litherland (2001) argued that organizations present different roles and requirements for safety, thus safety climate dimensions might differ by organization. Nevertheless, some dimensions are universally recognized, such as management commitment to safety (Beus et al., 2010; Flin et al., 2000; Schwatka et al., 2016). Thus, the extent to which they consistently predict safety performance is of interest.

Recently, researchers have begun to explore the predictive nature of safety climate. In fact, a positive correlation between safety climate and safety performance has been found by many studies, as indicated by an inverse relationship between positive assessments of safety climate and injury rates (Chen et al., 2013; Goldenhar et al., 2003; Lingard et al., 2011; Hon et al., 2014a; Lingard et al., 2012; McCabe et al., 2016; Panuwatwanich et al., 2016). Unfortunately, these studies do not use a single safety climate survey, which makes evaluating consistency in results difficult. However, a formal statistical meta-analysis can enable comparison and aggregation cross studies and reveal patterns across multiple samples.

No meta-analysis has yet been conducted specifically on safety climate in the construction industry. The construction industry reflects unique and complicated characteristics, and project site conditions that differentiate it from other industries. However, out of all the published meta-analysis and literature review studies, only two reviewed safety culture and climate in the construction industry (Choudhry et al., 2007; Schwatka et al., 2016). For example, Schwatka et al. (2016) qualitatively summarized the literature of safety climate studies between 1980 and 2014. Despite the many construction safety climate studies published recently, a gap exists in safety climate dimension literature from 2014 to present

* Corresponding author.
E-mail addresses: Waal2848@colorado.edu (W.M. Alruqi), matthew.hallowell@colorado.edu (M.R. Hallowell), ulises.techerarocha@colorado.edu (U. Techera).

https://doi.org/10.1016/j.ssci.2018.05.019
Received 10 September 2017; Received in revised form 23 February 2018; Accepted 25 May 2018
0925-7535/ © 2018 Elsevier Ltd. All rights reserved.

The main purpose of this study was to: (1) review questionnaires used to measure construction safety climate dimensions; (2) identify the salient dimensions of safety climate for construction; (3) establish a consistent definition of each safety climate dimension; and (4) quantify the extent to which each safety climate dimensions predicts construction safety performance. To achieve this last objective, a meta-analysis was performed using all peer-reviewed articles published in English from 2000 to 2016.

2. Literature review

The objective of the literature search was to collect and code all safety climate studies that included empirical data published between 2000 and 2016. The search was performed using a wide variety of individual or combined keywords. These key words were "construction," "safety climate," "safety culture," "safety attitude," "safety performance," and "construction safety." These keywords were searched in the following recognized databases and indexing tools: Google Scholar, Web of Science; Engineering Village; PubMed; PsychInfo; and the American Society of Civil Engineering. The following is a summary of the history and salient trends in safety climate in the construction industry.

2.1. Safety climate in the construction industry

In the initial years following the introduction of the safety climate concept (Zohar, 1980), the construction research community showed faint interest with only a few studies published between the years 1980–2000. In the first construction-specific study, Dedobbeleer and Béland (1991) examined the concept of safety climate among construction workers using the Brown and Holmes (1986) three-factor model developed for American manufacturing and production companies. Despite the slow start, the publication rate of construction safety climate studies has accelerated in recent years. In a comprehensive literature review, 107 articles on construction safety climate were published from 2000 to 2016 and approximately 60% were published in the last 5 years. The topics of these studies varied widely, with some focusing on worker perceptions based on work type (Glendon and Litherland, 2001; Cigularov et al., 2010; Hon et al., 2014b) and others developing construction climate surveys (Mohamed, 2002; Kines et al., 2011) or investigating the relationship between safety climate and performance (e.g. Chen et al., 2013; Goldenhar et al., 2003; Lingard et al., 2011; Hon et al., 2014a; Lingard et al., 2012; McCabe et al., 2016; Panuwatwanich et al., 2016). As the volume of research increases in this domain, it is important to strive for consistency, which enables scientific rigor through replication and validation.

2.2. Measuring safety climate

Researchers have measured safety climate through the use of a diverse and inconsistent set of questionnaires. The questionnaires, in general, were designed to reflect the definition of safety climate (Mohamed, 2002). Commonly, the outputs of these surveys are aggregated scores measuring worker perceptions of safety. In an early study by Zohar (1980), eight safety climate dimensions were introduced: (1) "management commitment to safety; (2) safety training; (3) level of work risk; (4) status of safety officer; (5) work pace; (6) safety committee status; (7) effects of safe conduct on promotion; and (8) effects of safe conduct on social status". The final product was a questionnaire with 40 total items related to the eight dimensions. The questionnaire was tested with a sample from industrial organizations and was shown to be a valid tool for quantifying worker perceptions of safety. In total, the following six climate surveys have been adapted and adopted for use in the construction industry:

1. The 10-item questionnaire developed by Dedobbeleer and Béland (1991), which was based on Brown and Holmes' (1986) original 10-dimension survey.
2. The 16-item organizational safety climate questionnaire developed by Zohar and Luria (2005).
3. The 10-item group-level safety climate questionnaire developed by Zohar (2000). Several authors have combined these last two questionnaires to measure both organization and group safety climate (Gao et al., 2016; Lingard et al., 2012; Soraperra et al., 2015).
4. The Climate Survey Tool (CST), developed by the UK Health and Safety Executive (Davies et al., 2001). The CST, originally included 71 items that measured ten safety climate dimensions, such as "organizational commitment and communication, line management commitment, supervisor roles, and workmate influence". The CST is the most popular safety climate questionnaire, and many other researchers have used parts of the CST along with other safety climate tools (Choudhry et al., 2009; Lingard et al., 2011; Lingard et al., 2012).
5. A 10-dimension survey created by Mohamed (2002).
6. The Safety Climate Index Survey (SCI) of the Occupational Safety and Health Council of Hong Kong (OSHC, 2008). The SCI includes 38 questions related to different safety dimensions (Hon et al., 2014b). Various authors across a variety of sectors and work types tested the SCI (He et al., 2016; Hon et al., 2014a; Hon and Liu, 2016).

While several recent studies have focused on construction industry safety climate, these studies are inconsistent regarding climate dimensions and levels of analysis (Table 1).

2.3. Common safety climate dimensions in current literature

As discussed, safety climate is invariably measured through multiple dimensions within one survey, such as management's prioritization of safety, worker safety training and involvement, and safety roles by first-line leaders. Thus, safety climate assessment presents a multi-factor structure (Guldenmund, 2000). The results across dimensions are aggregated to represent the level of safety climate in an organization. In general, there is an agreement on quantitatively measuring the safety perceptions of workers (Wu et al., 2015). However, the core dimensions of safety climate remain contested among researchers, and a commonly accepted set of climate dimensions remains elusive. For example, Guldenmund (2000), Flin et al. (2000), and Schwatka et al. (2016) performed three reviews of safety climate dimensions and they all present a different set of common dimensions. After examining construction safety climate literature from the year 2000 to 2016, 14 common construction safety climate dimensions were found across 107 studies, and Table 2 presents a description for the top 8 safety climate dimensions. Each of these dimensions and their use in safety climate surveys are briefly reviewed below.

Management commitment to safety is the most common dimension found in the literature, present in 63 studies (59%). This dimension is used by several researchers to quantitatively measure how effectively top management prioritizes safety in an organization (Flin et al., 2000) because researchers believe that it is a strong predictor of work-related injuries (Beus et al., 2010). However, the items defining management commitment to safety differ greatly across studies. For example, Mohamed (2002) used seven items to measure management commitment to safety (e.g., "*Management clearly considers safety to be equally as important as production)"* and Tholén et al. (2013) used sixteen.

Supervisory safety response was used by 34 studies (32%). This dimensions measures the behavior of direct supervisors regarding safety procedures implementation. Zohar (2000) argued that supervisors play a major role in organizational safety as the party mainly responsible for executing the policies and procedures of the organization. To measure supervisor influence, Zohar (2000) constructed a 10-item group safety climate survey that measures workers' perceptions of two types of

Download English Version:

https://daneshyari.com/en/article/6974692

Download Persian Version:

https://daneshyari.com/article/6974692

Daneshyari.com