



Impact of individual resilience and safety climate on safety performance and psychological stress of construction workers: A case study of the Ontario construction industry

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ABSTRACT

Introduction: The construction industry has hit a plateau in terms of safety performance. Safety climate is regarded as a leading indicator of safety performance; however, relatively little safety climate research has been done in the Canadian construction industry. Safety climate may be geographically sensitive, thus it is necessary to examine how the construct of safety climate is defined and used to improve safety performance in different regions. On the other hand, more and more attention has been paid to job related stress in the construction industry. Previous research proposed that individual resilience may be associated with a better safety performance and may help employees manage stress. Unfortunately, few empirical research studies have examined this hypothesis. This paper aims to examine the role of safety climate and individual resilience in safety performance and job stress in the Canadian construction industry. **Method:** The research was based on 837 surveys collected in Ontario between June 2015 and June 2016. Structural equation modeling (SEM) techniques were used to explore the impact of individual resilience and safety climate on physical safety outcomes and on psychological stress among construction workers. **Results:** The results show that safety climate not only affected construction workers' safety performance but also indirectly affected their psychological stress. In addition, it was found that individual resilience had a direct negative impact on psychological stress but had no impact on physical safety outcomes. **Conclusions:** These findings highlight the roles of both organizational and individual factors in individual safety performance and in psychological well-being. **Practical applications:** Construction organizations need to not only monitor employees' safety performance, but also to assess their employees' psychological well-being. Promoting a positive safety climate together with developing training programs focusing on improving employees' psychological health – especially post-trauma psychological health – can improve the safety performance of an organization.

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1. Introduction

The construction industry plays an important role in Ontario's economic growth and employment. Since 2003, the Ontario government invested nearly \$3 billion in the residential sector, which created 60,000 jobs (Ontario, 2014). However, safety remains one of the biggest challenges in construction (Becerik-Gerber & Siddiqui, 2014). Over the 10 year period from 2004 to 2013, the construction sector accounted for 26.6% of all workplace traumatic fatalities in Ontario, the highest percentage of any industry (WSIB, 2013). Meanwhile, the fatality rate in the

Ontario construction has shown little improvement since the 1990s, as shown in Fig. 1.

Between 1965 and 1995, there was a steady decrease in the fatality rate. The decrease was due in part to the enforcement of an increasingly more comprehensive construction safety act that brought about greater safety awareness. After 1995, however, the industry continued to experience approximately 5 fatalities per 100,000 construction workers per year. The plateau phenomenon in safety performance can be observed in other jurisdictions as well, such as New Zealand (Guo, Yiu, & González, 2016) and Australia (Lingard, Cooke, & Blismas, 2010). Similarly, the rate of safety improvement in other countries, such as the United States, has been slowing (Bureau of Labor Statistics (BLS), 2014; Mendeloff & Staetsky, 2014; National Institute for Occupational Safety and Health (NIOSH), 2001).

In addition to the physical safety outcomes, herein safety outcomes refer to unsafe outcomes (e.g., eye injuries and pinch), job related stress

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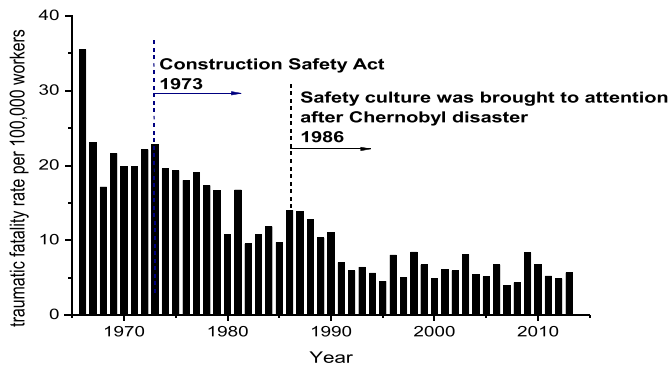


Fig. 1. Traumatic fatality rate in Ontario Construction (1965–2013)^{1,2,3}.

¹ IHSA, (2008)

² AWCBC, (2013)

³ Statistics Canada, (2015a)

in the construction industry is attracting more and more attention. The relatively dangerous work environment, intense job demand, group work style, and interpersonal relationships, etc., increase construction workers' risk for adverse psychological outcomes (Goldenhar, Williams, & Swanson, 2003). Stress, if not properly managed, affects both employees' performance and their health (Cattell, Bowen, & Edwards, 2016). The geographical distribution of 46 papers published between 1989 and 2013 about work related stress in the construction industry (Leung, Chan, & Cooper, 2015) indicated that half of the work on work related stress was from Hong Kong (50%), with the remaining research distributed between Europe (22%), Australia (15%), Africa (11%), and United States (2%). More research on job stress in North America may identify local factors that are associated with psychological stress of workers, and thus may uncover ways to escape the safety plateau.

Safety culture has been shown to improve safety performance. Safety culture is a set of beliefs, norms, attitudes, roles, and social and technical practices focused on minimizing the exposure of employees to dangerous conditions (Pidgeon, 1991; Turner, Pidgeon, Blockley, & Toft, 1989). It is an abstract phenomenon and therefore challenging to measure. One indicator of safety culture is safety climate, which refers to the shared perception of people toward safety in their work environment (Dov Zohar, 1980). Measuring safety climate gives insight into safety culture in its current state (Cox & Cheyne, 2000; Glendon & Stanton, 2000). In addition, individual resilience is associated with higher coping abilities (Wanberg & Banas, 2000); thus, it is believed that individual resilience is associated with lower job stress and better safety performance. The remainder of Section 1 discusses the dimensions of construction safety climate, defines individual resilience, and proposes four hypotheses.

1.1. Safety climate dimensions

Safety climate has been widely recognized as a leading indicator of safety performance, in contrast to lagging indicators, such as lost time injury rates (Flin, Mearns, O'Connor, & Bryden, 2000). Although there is no agreement on the dimensions of safety climate, management commitment to safety is a widely acknowledged organizational level safety climate factor that applies to most industries. For example, perceived management attitudes toward safety was originally proposed as a leading safety climate factor based on surveys from 20 industrial organizations (Zohar, 1980). More recent work used four factors to measure safety climate: management commitment to safety, return to work policies, post-injury administration, and safety training (Huang, Ho, Smith, & Chen, 2006). In addition to management commitment to safety (Cigularov, Lancaster, Chen, Gittleman, & Haile, 2013; Dedobbeleer & Béland, 1991; Gillen, Baltz, Gassel, Kirsch, & Vaccaro, 2002; Guo et al., 2016; Hon, Chan, & Yam, 2014; Tholén, Pousette, & Törner, 2013), a set of dimensions have been proposed for construction, mainly including work pressure focusing on the balance between production and safety

(Cigularov et al., 2013; Glendon & Litherland, 2001; Guo et al., 2016), support from supervisors and/or coworkers (Cigularov et al., 2013; Guo et al., 2016; Kines et al., 2010), and, safety equipment or knowledge needed to have control over safety (Cigularov et al., 2013; Gillen et al., 2002; Glendon & Litherland, 2001; Guo et al., 2016). Categorization of these factors is challenging as two scales with the same name may use different statements to define them and the same statement may be used toward different factors. For instance, statements reflecting safety communications may be included under the scale of management commitment to occupational health and safety (OHS) and employee involvement (Hon et al., 2014), while other researchers may use a separate scale of safety communication (Tholén et al., 2013).

1.2. Safety climate and physical safety outcomes

The relationship between safety climate and physical safety outcomes in construction safety research is evident worldwide. Safety climate was negatively related to near misses and injuries in the Hong Kong construction industry (Fang, Chen, & Wong, 2006; Hon et al., 2014) and positively related to safety behavior in Queensland (Mohamed, 2002). Safety climate was also found to be inversely related to underreporting of workplace injuries and illnesses in the United States (Probst, Brubaker, & Barsotti, 2008). Moreover, safety climate may be affected by a country culture (Ali, 2006), and decisions on safety management may be influenced by cultural norms. From this point of view, aspects of safety climate may vary geographically and there is a clear value in assessing the safety climate in different regions. Here, the authors investigate the Canadian construction safety climate and explore its relationship with physical safety outcomes.

H1. safety climate is negatively related to physical safety outcomes.

1.3. Individual resilience, physical safety outcomes, and psychological stress

Individual resilience (IR) is "the capacity of individuals to cope successfully in the face of significant change, adversity, or risk. This capacity changes over time and is enhanced by protective factors in the individual and environment" (Stewart, Reid, & Mangham, 1997). It is regarded as one type of positive psychological capacity for performance improvement (Luthans, 2002; Youssef & Luthans, 2007). To extend an individual's physical and psychological resources, IR may help individuals deal with stressors that are inherent in the work environment but cannot be changed (e.g., work pressure; Cooper & Cartwright, 1997). Thus, it may improve employees' performance by reducing counter-productive behaviors and help manage their work related stress (Avey, Reichard, Luthans, & Mhatre, 2011). Several studies found evidence to support its positive role. For example, IR was found to be directly related to job satisfaction, work happiness, and organizational commitment (Youssef & Luthans, 2007). It was associated with less work irritation, and weaker intentions to quit given that IR is associated with higher change acceptance (Wanberg & Banas, 2000). IR was also negatively related to depressive symptoms of frontline correctional officers (Liu, Hu, Wang, Sui, & Ma, 2013). It is further believed that positive psychological resource capacities may facilitate safety focused behaviors (Eid, Mearns, Larsson, Laberg, & Johnsen, 2012). However, the authors were unable to find any empirical studies that have examined if IR is associated with better safety performance and lower job stress in the construction industry.

H2. IR is negatively related to physical safety outcomes.

H3. IR is negatively related to psychological stress.

1.4. Injuries and psychological stress

Serious injuries, exposure to actual or threatened death, and other traumatic experiences may result in post-traumatic stress disorder

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