Violation causes from the perspectives of managers and workers in Chinese railway systems: An exploratory study

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ABSTRACT

The objective of this study was to understand violation causes by Chinese railway workers, and how safety culture and personal cultural values influence their violations. We conducted a survey to investigate violation causes, perceived violation risk, violation frequency, and personal cultural values of Chinese railway workers and the safety culture of the Chinese railway system. The survey was completed by 150 railway employees (including workers and managers), from two province capital railway stations. We found that managers mainly attribute workers' violations to saving time and energy and increasing ease, whereas they do not realize the incorrectness, impracticality, and risk of safety rules and the influence of adverse conditions and strict supervision on violations. In addition, managers perceived lower risk on all types of violations than railway workers did, especially on exceptional and optimizing violations. They believed that approaches to decreasing optimizing violations primarily involved enhancing enforcement and strengthening supervision. However, these approaches tend to be unreasonable choices for workers. From the perspective of personal cultural values, workers who rate highly in uncertainty avoidance tend to commit more routine violations, situational violations, and optimizing violations than their counterparts. Workers who rate highly in shared emotions tend to commit more routine violations than their counterparts do. No significant correlations were found between violation frequency and perceived risk by Chinese railway workers.

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1. Introduction

With the fast development of high-speed railways in China in the past decade, the public is increasingly concerned about railway safety issues. Because trains move large amounts of people and goods at high speeds, any accidents in the tightly coupled socio-technological railway system can lead to catastrophic results. The Zibo train collision in 2008 lead to 72 deaths and 416 injuries, and the Wenzhou train collision in 2011 resulted in 40 deaths and 172 injuries (Xin, 2009; Yang, 2012). The investigations of the both disasters showed that violations by railway employees played a critical role. This result is not very surprising, if we consider the result from an analysis report from the former Ministry of Railway, when investigating the possible causes to 378 major railway accidents in China from 1950 to 2001. The report claimed that 64.6% were caused by violations by railway employees (Lv and Li, 2002). Violations by railway employees are common outside China. Reports from the UK and Dutch railways showed that

breaches of safety rules are common in the daily work of railway employees (CIRAS, 2007; Elling, 1991).

Due to the repeatedly demonstrated significance of violations in accident causation in railways and other industries, researchers have endeavored to understand their nature and causes. Reason et al. (1990) defined violations, as deliberate deviations from practices deemed necessary to maintain the safe operation of potentially hazardous systems. He further classified violations into routine and exceptional violations. This rough dichotomy was further elaborated (Free, 1994; HFRG, 1995) into four categories of violations, which are widely used in safety literature:

1. *Routine violations*: Such violation behaviors have become normal, unconscious, and automatic. They often occur when skilled workers find shortcuts in work that has strict rules. Although the risks directly associated with such violations are often low, they normalize the deviance from rules and dilute the entire rule system (Weichbrodt, 2015).

2. *Situational violations*: In response when confronted with adverse conditions (e.g. high time pressure and mental stress); workers may break rules to continue their work. They have higher risk than *routine violations* because severe accidents may occur in extreme situations.
3. *Exceptional violations:* Such violations may happen if unusual actions were called for in unusual circumstances. Workers may not fully understand the results of their actions; hence, these violations are extremely risky.
4. *Optimizing violations*: When workers intend to optimize working conditions (e.g. not wearing a helmet) if they feel bored and uncomfortable in work, they may commit *optimizing violations*. Because these violations mostly happen among experienced workers (Kieran and Ruth, 2005), they are considered of a lower risk than *exceptional violations*.

To reduce violations and minimize railway accidents, we need to understand why people break rules. Empirical reports from various industries show that violations often occur because of goal conflicts between individuals' attempting to optimize behavior and organizations' attempting to control and standardize the behavior of the workforce (Hopkins, 2009; Lawton, 1998). Frequently reported reasons for violations include goal conflicts between safety and production (and other system goals) (English and Branaghan, 2012; McGonagle and Kath, 2010; McLain and Jarrell, 2007). Other reasons include poorly designed or stressed working conditions (Chi et al., 2013; Helmreich, 2000), inappropriate rules (Read et al., 2012), and workers' individual characteristics, such as risk-taking and over-confidence (Hudson et al., 1998; Iszatt-White, 2007).

Distinguishing violations from errors is possible because they are described in a social-cultural rather than cognitive context (Battmann and Klumb, 1993; Reason et al., 1990). It is thought that the safety culture of an organization affects violations by individuals (Farrington-Darby et al., 2005; Laurence, 2005; Öz et al., 2013, 2014). One important reason is that safety culture partly determines the attitudes and beliefs of individuals (Farrington-Darby et al., 2005). This is proved in the studies by Öz et al. (2013, 2014), which showed that individuals' high tacit (unvoiced and indirect) perceptions of safety, and management that values safety, are negatively related to violations. Furthermore, good safety culture helps building safety awareness, enhances the understanding of safety rules, and improves compliance with rules (Laurence, 2005).

In addition to the safety culture specific to organizations, more general social-cultural backgrounds govern individuals' behaviors. In his landmark work on cross-cultural differences, Hofstede et al. (1984, 1993) proposed four basic dimensions of personal cultural values: *power distance*, *uncertainty avoidance*, *individualism* (versus *collectivism*), and *masculinity* (versus *femininity*). Li et al. (2009) found that individuals in the culture of individualism (e.g. U.S.A.) commit fewer violations for flight operations, compared with those in the collectivist culture (e.g. China). This is because people in collectivism cultures often share a high level of *social support* with others around them. *Social support* refers to how much help individuals can receive from their colleagues when in need (Hsee and Weber, 1999; Weber and Hsee, 1998). People with high social support have more risk preferences and are also more likely to violate rules (Forward, 2009; Hsee and Weber, 1999). On the other hand, however, collectivism also indicates that people may have more *shared emotions*—feeling proud of fellows' achievements and ashamed of fellows' failures (Bedford and Hwang, 2003; Stipek, 1998). Past research, indicates that individuals from cultures with more shared emotions (e.g. China) feel more proud of outcomes that benefit others and more ashamed if their children violate rules in exams, than those from cultures with less shared emotions (Bedford and Hwang, 2003; Stipek, 1998).

There have been a couple of studies on violation reasons reported by railway workers from western countries (English and Branaghan, 2012; Forward, 2009; Lawton, 1998), but not from China. Because violations are rooted in social-cultural backgrounds, we found an investigation on Chinese railway workers' violation reasons of significant value. In the current study, we conducted a survey in two Chinese railway stations to understand the violation causes of Chinese railway workers, the influence of organizational safety culture and personal cultural values on each type of violation, and the possible relationships between safety culture and personal cultural values. Whereas the majority of similar prior research collected reports from workers only, we also collected reports from their managers. Within an organization, violation issues can look very different, depending on whose point of view one is taking (Lawton, 1998; Weichbrodt and Grote, 2012). It is interesting to know how managers understand workers' violation behaviors. The identification of gaps between the reasons reported by managers and workers may suggest possibilities for intervention. In summary, we planned to answer the following questions in this study:

(1) What are the violation causes of Chinese railway workers? In perceived violation causes, is there any difference between the Chinese railway workers and managers?
(2) How safety culture influences each type of violation?
(3) How personal cultural values influence each type of violation?

2. Methodology

2.1. Respondents

The survey was administrated to 150 railway workers and managers (Age: $M = 36.8$ years, $SD = 7.77$) from Nanchang and Jinan railway stations. Their demographic information is summarized in Table 1. Among the 89 workers, 40 were signalers, and the rest were maintenance workers. Among the 61 managers, 27 were technical supervisors, 17 were department managers, and 17 were administrative managers. Approximately 88% of the railway managers had an educational background of Junior college or above. However, this percentage for the railway workers was only 69%. The mean working years of the respondents was 14.9 ($SD = 8.44$). They worked 44.0 h ($SD = 13.54$) per week on average, indicating a high level of workload in general.

2.2. Survey design

The complete questionnaire is shown in Appendix A. The questionnaire contained two parts: background information and measurement of violations, safety culture, and personal cultural values. Violation frequency was measured by a single item, "how often do you commit above violations" (5-point scales from "never" to "frequently"). Violation risks was measured by three items addressing risks to oneself, to other workers, and to the system (5-point scales from "very low" to "very high"). The questions of violation causes were inspired by the report by HFRG (1995). Thirteen possible causes identified in the report were listed as a multiple-choice question, and there was an "other" option for the respondents to add possible causes that have not been listed (see Appendix A for the complete questionnaire). Whereas workers evaluated their own behaviors, managers were asked to evaluate violations by workers in the departments they are working in.

The questions of safety awareness and safety behavior were adopted from the study by Wang and Liu (2012). The other three dimensions of safety culture, i.e., supervision dimension, working condition dimension, and safety rules, were measured by instru-