



Testing the effects of safety climate and disruptive children behavior on school bus drivers performance: A multilevel model



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ABSTRACT

The study was designed to test a multilevel path model whose variables exert opposing effects on school bus drivers' performance. Whereas departmental safety climate was expected to improve driving safety, the opposite was true for in-vehicle disruptive children behavior. The driving safety path in this model consists of increasing risk-taking practices starting with safety shortcuts leading to rule violations and to near-miss events. The study used a sample of 474 school bus drivers in rural areas, driving children to school and school-related activities. Newly developed scales for measuring predictor, mediator and outcome variables were validated with video data taken from inner and outer cameras, which were installed in 29 buses. Results partially supported the model by indicating that group-level safety climate and individual-level children distraction exerted opposite effects on the driving safety path. Furthermore, as hypothesized, children disruption moderated the strength of the safety rule violation–near miss relationship, resulting in greater strength under high disruptiveness. At the same time, the hypothesized interaction between the two predictor variables was not supported. Theoretical and practical implications for studying safety climate in general and distracted driving in particular for professional drivers are discussed.

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1. Introduction

Distracted driving has proven to be a factor affecting driving safety and traffic accidents for both occasional and professional drivers. NHTSA data indicate, for example, that cell phone use was involved in 18% of fatal crashes (NHTSA, 2010) and that distracted driving fatalities increased by 28% over the last decade (Wilson and Stimpson, 2010). Meta-analytic studies indicate that, regardless of the source of distracted driving, its primary outcomes include longer reaction time and visual tunneling whose effect on driving safety is compounded by failure to adopt palliative driving adjustments such as reducing speed or increasing headway (Caird et al., 2008; Horrey and Wickens, 2006). A literature review indicated that distracted driving result from performing any kind of in-vehicle task such as speaking on the phone or with passengers, entering information into navigation systems or searching for songs on music players (Horrey, 2011). In other words, multitasking during

driving requires attention switching and self-regulation leading to driving safety decrements (NSC, 2010; Young and Regan, 2007).

Despite the large societal stakes involved in safe public transportation, bus driver distractions have been little studied. Such paucity of research characterizes also school buses despite the fact that during the last decade they were involved in 5500 crashes, resulting in 137 fatalities in the US alone (NHTSA, 2012; Yang et al., 2009). Salmon et al. (2011) analysis of the sources of bus-driver distraction revealed that the primary sources were in-vehicle technology (cell phone, ticket machine), operational demands (timetables, operating bus doors), and passenger behavior (unruly passengers, enquiries).

Given lack of research, our study started with preliminary interviews with school bus drivers. These interviews revealed that disruptive children behavior during bus rides constitute their primary source of distraction. Consequently, this study was designed to test its (disruptive) effect on driving performance alongside with the (enhancing) effect of safety climate. It is to the description of our conceptual model that we turn next.

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1.1. Organizational safety climate

The original paper on safety climate defined it as “shared employee perceptions about the relative importance of safe conduct in their occupational behavior” (Zohar, 1980; p. 96). This definition identifies safety climate as consensual or shared social cognition regarding the relative importance or priority of driving safely vs. meeting competing demands such as arriving to school on time or cutting costs by taking shorter, though unauthorized bus routes to school. Climate perceptions inform employees about the kinds of role behavior likely to be rewarded or supported in the presence of competing demands. A positive safety climate will increase the frequency of safe driving among employees even when it means failing to meet competing demands such as falling behind schedule. Recent meta-analytic results, covering some two hundred published studies, support the safety climate-behavior relationship, suggesting it is one of the strongest predictors of organizational safety performance (Beus et al., 2010; Christian et al., 2009; Clarke, 2010; Nahrgang et al., 2011).

Despite such robust evidence supporting the safety climate-safety performance relationship, there have been only few studies testing its effect on driving safety. Furthermore, most of the available studies have used generic, rather than driving-specific safety climate scales, followed by a self-report scale asking respondents to report near misses or crashes over the last year, resulting in weak research methodology.

Wills et al. (2005, 2006, 2009) conducted a series of studies, using in-house government employees whose work includes occasional driving activities. Climate level was related to self-reported distraction and traffic violations. Another study in this series reported a relationship between safety climate and self-reported fatigue and near misses experienced during the previous six months (Strahan et al., 2008). Still another study used a brief, 3-item scale taken from a generic safety climate scale after being reworded to suit the driving context (Newman et al., 2008). Safety climate was related to self-reported safety motivation (i.e. investment of effort for driving safely), which was negatively related, in turn, to self-reported accidents in the previous six months. Two other studies tested the climate-accident relationship, using a 4-item safety climate scale (Arboleda et al., 2003; Morrow and Crum, 2004). Climate data were obtained from three delivery truck drivers and dispatchers in each participating company, selected by its fleet safety manager. Climate scores were related to current self-reported fatigue, but not self-reported near misses or accidents during the previous two years.

Two US-based studies that are more recent offer an exception to the above in terms of theoretical and methodological strengths. The first study tested a model in which safety climate mediated the relationship between two generic organizational climate dimensions (i.e. organizational-employee support and leader-employee relations) and objective traffic accident data collected after the safety climate survey (Wallace et al., 2006). The study was conducted with more than 9000 short-haul truck drivers performing local deliveries, using a generic safety climate scale. Safety climate mediated the effect of both generic climate dimensions on post-survey road accidents, measured with objective crash data.

The second study tested the effect of safety climate on long-haul truck drivers, using post-survey records of hard braking and traffic accidents (Huang et al., 2013; Zohar et al., 2014). This study measured safety climate with a new driving-based Trucking Safety Climate (TSC) scale, using a sample of more than 8000 long-haul truck drivers employed in eight large trucking companies. Climate level predicted self-reported driving safety as well as objectively recorded hard braking (i.e. safety near-miss events) and traffic accidents, which have taken place six months after the climate survey. A comparison of effect sizes of the new TSC items with the

generic items inserted into the scale (adopted from Zohar, 1980) indicates that trucking-related items literally doubled predictive validity of both hard braking and traffic accidents outcomes. Given such results, the present study started by developing a new safety climate scale for school-bus drivers (see Method section below).

1.2. Safety climate and driving performance

Given meta-analytic data indicating a robust relationship between safety climate and safety performance (Beus et al., 2010; Christian et al., 2009; Clarke, 2010; Nahrgang et al., 2011), as well as driving-specific studies (Huang et al., 2013; Wallace et al., 2006; Zohar et al., 2014), it can be argued that climate level will be positively related to driving safety. Such argument agrees with organizational climate theory stating that the core meaning of safety climate is the perceived priority and expected rewarding for safe task performance (Zohar, 2010). This line of reasoning leads to the following hypothesis:

Hypothesis 1. Safety climate level will be negatively related to the three driving safety criteria: (a) safety shortcuts; (b) safety rule violations; and (c) near-miss events

As can be noted in the above hypothesis, driving safety criteria form a mediation path resulting in increasing levels of risk taking while driving (Shinar, 2007). A similar path has been supported in recent meta-analyses of the safety climate literature, indicating that safety shortcuts (workarounds) predict rule violations, which predict near miss and actual accidents (Beus et al., 2010; Clarke, 2010; Christian et al., 2009; Nahrgang et al., 2011). Based on this evidence, the following mediation path hypothesis can be formulated:

Hypothesis 2. Driving safety criteria will form a mediation path in which safety shortcuts predict safety rule violations that predict near-miss events

1.3. Distracted driving in school buses

Papers addressing sources of distraction for public bus drivers (Salmon et al., 2011) and the epidemiology of school bus crashes (Yang et al., 2009) mention passenger-related distractions as an understudied source of distracted driving. A computerized search of relevant literature databases has failed to identify any relevant study, except for those using non-professional driver samples for comparing the disruptive effect of cellphone use with passenger conversations (Horrey, 2011). As noted above, the latter studies indicated that both sources of distraction exert similar negative effects on distracted driving, stemming apparently from the fact that both cases result in multitasking, requiring division of limited attention resources (Horrey, 2011). Given such scarcity of research, coupled with societal stakes involved with school bus crashes, we tested the effect of disruptive children behavior on driving performance of school bus drivers.

Choice of unruly children behavior as primary distracting factor was based on driver interviews conducted at the beginning of this project. Responding to an open-ended question regarding major sources of job demands or challenges, most interviewed drivers mentioned disruptive children behavior as a primary source. Such behavior can be expressed by bullying, shaming, throwing objects, playing loud music, or unbuckling and moving to another seat during the ride. When (some) children behave in an unruly manner the driver has to check the rear view mirror and use the speaker more frequently. All of which consumes attentive, motoric, and visual resources, resembling resource investment in a secondary task while driving. Although such distractions may be culture-dependent, i.e. witnessed more frequently in some countries over

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