Safety in Work Vehicles: A Multilevel Study Linking Safety Values and Individual Predictors to Work-Related Driving Crashes

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Although work-related driving is associated with high accident rates, limited research has investigated the factors influencing driving crashes in the work setting. This study explored multilevel influences on self-reported crashes in the workplace by surveying a sample of work-related drivers (n = 380), their workgroup supervisors (n = 88), and fleet managers (n = 47). At the driver level of analysis, safety motivation predicted self-reported crashes. In turn, drivers’ perceptions of their fleet managers’ safety values (but not drivers’ perceptions of their supervisors’ safety values), their own attitudes, and their own efficacy beliefs predicted motivation to drive safely. Furthermore, the influence of supervisors and fleet managers interacted such that drivers were more motivated to drive safely if they perceived both their supervisor and fleet manager to value safety. This study also explored the cross-level relationships between supervisors’ and fleet managers’ perceptions of organizational safety values and drivers’ perceptions of managerial safety values and found a relationship between fleet managers’ perceptions of organizational safety values and drivers’ perceptions of fleet managers’ safety values. These results illustrate that perceptions of workplace safety values are transmitted across levels of the organization.

Keywords: safety climate, fleet safety, attitudes, self-efficacy, work-related driving

Road crashes are now the most common cause of work-related injury, death, and absence in a number of countries. In the United States, work-related drivers accounted for the highest number of fatal work injuries of any occupation. Approximately 7 out of 10 of the fatally injured work-related drivers were killed on public roadways or surrounding areas (Bureau of Labor Statistics, 2004). In the United Kingdom, research has found work-related drivers have above-average crash frequencies compared to non-work-related drivers in personal vehicles (Downs, Keigan, Maycock, & Grayson, 1999; Lynn & Lockwood, 1998). Similar statistics have also been found within the Australian context (Murray, Newnam, Watson, Schonfeld, & Davey, 2003).

The above figures suggest road safety should be an important concern for all organizations where employees are engaged in work-related driving. However, surprisingly little research has investigated the predictors of driving crashes in an organizational setting. Given that past research has found differences in the on-road behavior of work-related drivers when driving a work and personal vehicle (Newnam, Watson, & Murray, 2002), there is a need to explore the influences on driving crashes in an organizational setting.

Safety Framework

Work-related drivers have been defined as those who drive at least once per week for work-related purposes (Murray et al., 2003). To develop a better theoretical understanding of work-related driving, we integrated this issue into the broader context of safety outcomes at work. From this perspective, safe driving at work is a form of motivated behavior that is influenced by a range of workplace and individual factors. Based on research in the areas of safety climate (e.g., Griffin & Neal, 2000; Probst & Brubaker, 2001; Zohar, 2000), Figure 1 shows the main constructs that we expected to influence motivation to drive safely and, subsequently, self-reported driving crashes. We review the evidence for including each of the constructs shown in our model below.

At the individual level, drivers’ perceptions of the safety values held by their supervisor and their fleet manager, along with drivers’ own driving self-efficacy and safety attitudes, were identified as proximal predictors of driver safety motivation. At the workgroup level, we investigated the safety values reported by supervisors and fleet managers themselves as predictors of drivers’ perceptions of supervisor and fleet manager safety values. In this way, we were able to investigate the cross-level link from management values to driver values. In this study, we used self-
reported crashes as the criterion variable. As discussed below, direct measures of driving behavior are difficult to obtain, so we relied on the more indirect measure of crashes.

A unique aspect of this study is the opportunity to explore the correlates of drivers’ safety values at work. The management of safety in the work-related driving setting has some characteristics that distinguish it from the management of other organizational safety activities. Most important, driving activities often fall outside typical line management responsibilities and are supervised by a person who is not part of the same management structure associated with other work roles. In the organization in the current study, a separate fleet manager was responsible for the use of motor vehicles by employees. The role of fleet manager is common to many organizations that require employees to drive and is similar to the role of logistic supervisor or dispatcher (e.g., Rothe, 1991). Fleet managers have regular contact with drivers through duties such as organizing fleet vehicles, distributing car keys, and ensuring accurate completion of log books. Although they do not have supervisory authority over work-related drivers, they may influence drivers’ perceptions of safety within the driving context. Specifically, as fleet managers have initial contact with individuals before and after they use a work vehicle (e.g., distributing keys), they have the ability to alert drivers to safety issues, organizational requirements, and safety standards. Thus, although supervisors in the driving context are believed to be responsible for providing reinforcement through processes such as praise, performance appraisal, and reward power, the role of the fleet manager also needs to be taken into account. Differentiating the effects of fleet managers and supervisors on drivers’ safety perceptions is important for understanding how to manage safe driving in the workplace.

Safety Motivation

Safety motivation refers to an individual’s willingness to put in effort to act safely and the importance an individual places on safe behaviors (Neal & Griffin, 2006). Campbell, McCloy, Oppler, and Sager (1993) identified motivation as a critical determinant of safety outcomes on the grounds that behavior depends on the motivational properties of the situation and determines the direction, amplitude, and duration of volitional behavior. Consistent with this proposition, safety motivation has been shown to influence a range of safety behaviors at work (Griffin & Neal, 2000; Neal, Griffin, & Hart, 2000; Probst & Brubaker, 2001). However, the role of motivation in predicting driving crashes in work-related driving settings has not been investigated.

Past research has found that motivation mediates the link between organizational climate and task behavior (Brown & Leigh, 1996) and that safety motivation has a lagged effect on safety compliance for up to 6 months (Probst & Brubaker, 2001), with more recent research suggesting a lag up to 2 years (Neal & Griffin, 2006). Therefore, in this study, where self-reported crashes are the criterion measure, we proposed that motivation to...
drive safely would be related to self-reported crashes in a work vehicle.

**Hypothesis 1:** Drivers’ safety motivation will be negatively related to self-reported crashes.

**Safety Values in the Workplace**

Workplace perceptions are an important influence on motivated work behaviors, including safety behavior. Much of the research concerning safety-related perceptions of the workplace has focused on perceptions of the organizational climate in work groups (Griffin & Neal, 2000; Hofmann & Stetzer, 1996). **Safety climate** has been described as an individual’s perceptions of the value and importance associated with safety within an organization (Griffin & Neal, 2000; Zohar, 1980). Past research has found support for the relationship between safety climate and outcome measures such as accident rates (Zohar, 1980), self-reported accident involvement (Mearns, Flin, Gordon, & Fleming, 1998), self-reported safety behaviors (e.g., Hofmann & Stetzer, 1996; Neal et al., 2000), and frequency of compensation claims (O’Toole, 2002).

More recently, employees’ perception of value placed on safety within the workgroup has been the focus of safety climate research (e.g., Neal & Griffin, 2006; Zohar, 2000). However, measuring the construct of management safety values within workgroups is somewhat problematic in relation to work-related driving. As noted above, an important difference between work-related driving and other safety activities is the organizational system of rewards and control in which safe driving is managed. The line responsibility for safety in the work vehicle is not the same as the line responsibility for other safety activities in organizations such as hospitals (e.g., Griffin & Neal, 2000) and manufacturing plants (e.g., Zohar & Luria, 2005) because there are two sources of line management with responsibility for safe driving, namely, supervisors and fleet managers.

Drivers’ perceptions of the safety values held by supervisors and fleet managers might be related to safety motivation concerning work-related driving in three ways. First, perceptions of supervisors’ values might be related to motivation independently of perceived fleet managers’ values. Second, perceptions of fleet managers’ values might be related to motivation, independently of perceived supervisors’ values. Third, perceptions of supervisors’ and fleet managers’ values might interact to jointly relate to driving motivation. There are theoretical reasons for proposing hypotheses about each of these possibilities, which we outline below.

With regard to supervisors, supervisory safety practices have been found to have positive effects on increasing safety perceptions and reducing workplace accidents (Zohar, 2002; Zohar & Luria, 2004). Furthermore, the climate created by supervisors has been found to exert a strong impact on individual motivation (Brown & Leigh, 1996), with recent research suggesting positive effects on motivation with lags of up to 2 years (Neal & Griffin, 2006). Considering this research, we expected that supervisors, who have a clear line responsibility for employee general safety, might have an influence on drivers’ safety motivation. As such, we predicted the following:

**Hypothesis 2:** Drivers’ perceptions of supervisors’ safety values will be positively related to drivers’ safety motivation, and this relationship will be independent of drivers’ perceptions of fleet managers’ safety values.

Because work-related driving safety is not well integrated within most occupational health and safety systems, it is possible that the responsibility for managing the safety of drivers becomes partly the responsibility of the fleet manager. In support of this possibility, research has found that fleet managers have the ability to enhance the safety performance of their fleet through particular fleet safety initiatives (Newnam & Tay, 2007; Newnam, Tay, & Mason, 2006). Although fleet managers do not have supervisory authority over drivers, they might influence driving safety by communicating the importance of safety. In support, past research has identified open communication channels between leaders and their subordinates as an important influence on safety performance (e.g., Griffin & Neal, 2000; Hofmann & Morgeson, 1999; Hofmann & Stetzer, 1996; S. K. Parker, Axtell, & Turner, 2001). As fleet managers have regular contact with drivers, particularly before and after drivers use a work vehicle, they have the ability to inform drivers of safety issues. Therefore, we predicted the following:

**Hypothesis 3:** Drivers’ perceptions of fleet managers’ safety values will be positively related to drivers’ safety motivation, and this relationship will be independent of drivers’ perceptions of supervisors’ safety values.

Perceptions of fleet managers’ and supervisors’ values might also combine to influence driver safety motivation beyond simple main effects. Past research has explored the role of social–organizational factors in influencing safety performance (e.g., Hofmann & Morgeson, 1999; Zohar, 2000). Research has suggested that an organization’s values and norms can influence the relationship between supervisors and their subordinates (Dienesch & Liden, 1986). More recent research has supported this assumption with findings suggesting that the organizational climate establishes the context in which leadership behaviors are important (Hofmann, Morgeson, & Gerras, 2003). This research suggests that leaders and the climate that they help to create can have an influence on the safety outcomes of subordinates.

In this context, it is possible that supervisors, given their ability to provide reinforcement through praise, performance appraisal, and reward power, may play a role in creating an environment in which drivers perceive a strong safety climate. In addition to the safety climate’s influence on drivers, it is possible that the climate created by supervisors will also shape any impact the fleet manager may have on safety outcomes. For example, whereas fleet managers are in a position to establish ground rules and promote practices for the safe management of fleet vehicles, supervisors are more likely to create the policies that enforce the safety management of drivers and shape the climate, which emphasizes certain role behaviors as being important. In support, research regarding safety climate suggests that the influence of more senior leaders within an organization is mediated by group leaders (Zohar & Luria, 2005). Therefore, the combined influence of supervisors and fleet managers is likely to have a stronger effect on drivers’ safety motivation, as the climate that supervisors shape will have an effect on drivers’ perceptions of the value given to safety by their fleet manager. Thus, we hypothesized the following:
Hypothesis 4: If drivers perceive their supervisors to value safety, the relationship between drivers’ perceptions of their fleet managers’ safety values and drivers’ motivation will be stronger.

Cross-Level Influences in the Driving Context

In addition to exploring the independent and combined contributions of drivers’ perceptions of supervisors’ and fleet managers’ safety values on drivers’ safety motivation, we extended the framework to incorporate supervisors’ and fleet managers’ own perceptions of organizational safety values. More specifically, this study investigated the cross-level relationships between supervisors’ and fleet managers’ perceptions of organizational safety values and drivers’ perceptions of supervisors’ and fleet managers’ safety values, within both supervisor and fleet manager workgroups.

We deliberately chose to assess supervisors’ and fleet managers’ perceptions of organizational safety values rather than supervisors’ and fleet managers’ own safety values, because our aim was to understand how workplace safety perceptions are transmitted across levels of the organization. We were interested in studying the impact of organizational safety values on the perceptions of supervisors and fleet managers. Although their own safety values may have an impact on their own role definitions (Hofmann et al., 2003) and organizational determinants of safety (Maierhofer, Griffin, & Sheehan, 2000) and organizational determinants of safety (Barling & Zacharatos, 1999), we believe that perceptions of organizational safety values should have the most direct impact on drivers’ perception of fleet managers’ and supervisors’ safety values.

No research to date has established the cross-level relationship between group-level predictors and individual-level safety performance constructs in the driving context. However, past research in other organizational contexts has demonstrated that managers influence subordinates’ safety behaviors (e.g., Maierhofer, Griffin, & Sheehan, 2000) and organizational determinants of safety (Barling & Zacharatos, 1999). Processes operating at the group level have been found to influence employees’ safety perceptions, which in turn predict force definitions (Hofmann et al., 2003) and behavior-outcome expectancies (Zohar, 2000). As such, we predicted the following:

Hypothesis 5: Supervisors’ perceptions of the organizational safety climate will be positively related to drivers’ perceptions of supervisors’ safety values.

Hypothesis 6: Fleet managers’ perceptions of the organizational safety climate will be positively related to drivers’ perceptions of fleet managers’ safety values.

Individual Differences

In addition to safety values in the workplace, individual differences are also likely to play an important role in safety in the organizational context (Hofmann, Jacobs, & Landy, 1995). We included drivers’ self-efficacy and drivers’ attitudes toward rule violations and speeding as direct predictors of motivation to drive safely. The incorporation of these two variables is supported by previous research using the theory of planned behavior model (Ajzen, 1991). This model has typically been tested in the general driving population, where researchers have found that attitudes and self-efficacy explain variance in drivers’ intentions to drive safely (D. Parker et al., 1992; D. Parker, Stradling, & Manstead, 1996). The theory has also been used to investigate intention to speed in a work vehicle (Newnam, Watson, & Murray, 2004).

Self-Efficacy

Self-efficacy is defined as the belief in one’s ability to perform a specific task through successfully executing the behavior to produce the desired outcome (Bandura, 1977). Self-efficacy predicts task effort and work behavior (Gist & Mitchell, 1992; Stajkovic & Luthans, 1998) and may be a better predictor of work-related behavior than many personality trait-based constructs (Stajkovic & Luthans, 1998). Although self-efficacy has been widely investigated in the organizational literature (e.g., Bandura, 2000; Chen, Gully, & Eden, 2001; Gist, 1987) as well as in the general driving literature (Tay, 2004, 2005; Tay & Watson, 2002), it has not yet been tested in studies of work-related driving.

In some studies, self-efficacy is treated as an inherently motivational construct, where positive correlations between behavior and self-efficacy are interpreted as a motivational effect of self-efficacy on behavior (e.g., Bandura, 1986; Judge, Erez, & Bono, 1998; Vancouver, Thompson, & Williams, 2001). Other researchers have argued motivation is a distinct construct, which can be used to explain variability in behavior (e.g., Brown & Leigh, 1996; Griffin & Neal, 2000), independent of self-efficacy or other psychological states. Like the latter researchers, in this study we distinguish self-efficacy from motivation and define driver self-efficacy as the driver’s belief in his or her own ability to drive safely. Thus, in the safety framework, self-efficacy represents an antecedent variable, indirectly related to self-reported crashes through its effect on motivation. Thus, we hypothesized the following:

Hypothesis 7: Drivers’ self-efficacy will be positively related to their safety motivation.

Attitudes Toward Rule Violations and Speeding

An attitude is a favorable or unfavorable evaluation of an object (person, entity, or idea) that exerts a direct impact on social behavior (Eagly & Chaiken, 1993). Attitudes have been widely used to predict behavior, but early research indicated only a weak direct relationship between individuals’ attitudes and their behavior (Ajzen, 1988; Wicker, 1969). Stronger relationships between attitudes and behavior have been observed by assessing more specific attitudes that relate to the behavior in question.

In the work-related driving context, the specific attitudes we chose to assess were attitudes toward rule violations and speeding. Iversen and Rundmo (2004) found attitudes concerning rule violations and speeding were associated with risky driving behavior. Although the connection between attitudes toward driving safely and self-reported driving outcomes has been made in previous research (e.g., Lawton, Parker, Manstead, & Stradling, 1997; D. Parker, Lajunen, & Stradling, 1998; Tay, 2004), the aim of this study was to test these attitudes within the context of the safety framework. Within the framework, we expected attitudes to represent an antecedent to the motivational determinants of self-reported crashes. Although there has been no research investigating the relationship between safe driving attitudes and safety...
motivation, research in other areas of work behavior has suggested that attitudes play an important role in influencing work behavior (e.g., Hofmann et al., 1995). Thus, in the safety framework, attitudes represent an antecedent variable, indirectly related to self-reported crashes through their effect on safety motivation. Therefore, we hypothesized the following:

Hypothesis 8: Drivers’ attitudes toward rule violations and speeding will be positively related to their safety motivation.

Self-Reported Crashes as an Outcome Variable

Unlike other types of safety behavior that can be directly monitored by a workgroup supervisor or safety representative within the organization, there is currently no objective method (e.g., supervisor ratings of performance) of studying individuals’ behavior in the work-related driving context. Work-related driving is generally performed in isolation, and as such, measures of work-related driving performance are generally gauged through self-report data. A number of studies have assessed work-related driving behavior using questionnaires (e.g., Davey, Wishart, Freeman, & Watson, 2007; Wills, Watson, & Biggs, 2004). However, the questionnaires utilized in these studies were developed for the general driving population (e.g., Driving Behavior Questionnaire; Reason, Manstead, Stradling, Baxter, & Campbell, 1990), adapted to the work-related driving context, and have not been developed on the basis of theoretical grounds. The problem associated with adapting driving behavior measures from the general driving population is that job performance is believed to be a function of the goals established by the organization, and so adapting measures from a context with different goal perspectives may produce a contaminated source of variance (Campbell et al., 1993). In other words, driving for personal and work purposes may not be equivalent. In support, research has found differences in the degree to which driving behaviors are performed between the personal and work settings (Newnam et al., 2002). To overcome this issue, we chose to utilize crash involvement as an outcome measure. The premise of this variable as an outcome measure is that individuals are more likely to be involved in a crash if they drive unsafely in a work vehicle.

Although it would have been ideal to obtain an objective measure of crash outcomes or an alternative criterion measure that would be considered more reliable and valid (e.g., infringement data), due to limitations associated with the organization’s database system, this was not possible. First, due to inaccurate data entry and missing entry fields in the organizational database system, we were unable to match driver details with claim inputs for the 6 months preceding the completion of surveys. Furthermore, according to the organization’s crash database system, the majority of crashes that have occurred in the past 6 months were single vehicle crashes (e.g., rear-end crashes), which suggest that no police reports would have been involved. As such, there was no method of externally validating the crash data. Second, infringement data (i.e., loss of demerit points) were not available through the organization’s database system.

Based on these limitations, self-report crash involvement was considered appropriate in this context. To provide some information about the external validity for the self-report data, we compared the percentage of crashes in the total number of respondents in the survey to the leasing vehicle agency’s claims benchmark for that year. It was found that 5% of individuals reported being involved in a crash over the 6-month period preceding the completion of the survey, whereas the vehicle leasing agency reported that 16% of their fleet were involved in a crash for that year. The vehicle leasing agency’s benchmark figure suggests that approximately 8% (with a total cost at $450,759) of the vehicle leasing agency’s fleet would have been involved in a crash over the 6-month period preceding the completion of the survey. In summary, these figures provide some support for the self-report data, as the actual claims benchmark was close to the percentage of crashes reported in the survey. In further support of this criterion, past research has found self-report measures of crashes strongly correlate with objective measures of crashes (e.g., Lajunen & Summala, 2003).

Control Variables

This study also included a number of control variables, on the basis of previous research. The driver-level control variables were vehicle accidents while not at work, kilometers driven per week in a work vehicle, and driver age. Work-related drivers, on average, accumulate higher mileage in comparison to the average private motorist (Downs et al., 1999) and have been found to have a higher rate of crashes when driving for work purposes than for personal purposes (Newnam et al., 2002). In addition, younger drivers are known to have higher accident rates than older, more experienced drivers (Caird & Kline, 2004; Lynn & Lockwood, 1998). These findings constituted an argument for using these variables as controls within the current study.

Method

Participants and Procedure

The research was conducted in partnership with a vehicle leasing agency that is a government provider of vehicle leasing and fleet management services in a state of Australia. The study participants came from a sample of six government agencies, representing the following business portfolios: health, environmental protection, public works, road management, education and training, and emergency services. We chose this subset of agencies as being representative of the state public sector, including both small and large departments, and of a good mix of portfolios. Within some of these agencies, driving was relatively important for the core business, but in other agencies or sections of these agencies, only a small proportion of employees met our criteria (see below) to be identified as a work-related driver. To ensure that all participants understood the purpose of the study, we provided an information sheet to the fleet managers and drivers defining motor vehicle safety as one’s behavior when driving for work purposes.

For reasons of confidentiality, we were not able to obtain a list of the drivers within each agency, so instead the fleet managers within each agency were responsible for distributing the questionnaire to drivers. The researchers asked the fleet managers to distribute the questionnaire to as many drivers as possible, on a random basis if there was a large number of drivers involved. The
questionnaire was distributed only to individuals who drove at least once per week for work-related purposes.

The supervisor and fleet manager questionnaires were collected at the same time as the driver questionnaire. However, the procedure for collecting the data was different in the supervisor and fleet manager groups. In regard to the supervisors, the contact details of the supervisors were provided by the drivers after they had completed and returned their own questionnaires. The drivers were requested to provide their supervisor’s contact details, and their anonymity was assured. An e-mail was then sent to the supervisors stating they were believed to be a supervisor of an individual who drove a work vehicle. The e-mail also detailed the purpose of the study, with a questionnaire attached. After the supervisors completed the questionnaire, they were requested to return them via e-mail or the postal system. For the fleet managers, a list of fleet managers’ names was provided by the vehicle leasing agency. A detailed e-mail was sent to fleet managers detailing the purpose of the study, with the questionnaire attached. After the fleet managers completed their questionnaire, they were requested to return them via e-mail or the postal system.

Drivers. Completed questionnaires were returned by 385 drivers, all of whom drove a work vehicle at least once per week for work-related purposes. Due to the process of fleet managers distributing the questionnaire, a response rate for the driver questionnaire was not available. However, 102 fleet managers were contacted and asked to distribute the questionnaire to drivers, and there was a response rate of 51% from the fleet managers. The majority of the drivers were male (76%) and fell within the 40–59 years age category (65%). Over 70% had held their license for a minimum of 21 years, and the majority of the participants drove every day of the week (55%), with a driving average of 365 kilometers per week. After deleting missing data, a sample of 385 driver responses was available for analysis, of which 300 could be matched to fleet managers, as described below, and utilized in the analyses.

Supervisors. A total of 88 supervisors participated in the questionnaire, with a response rate of 53%. The majority of the sample was male (86%) and between the ages of 40–59 years (82%). The response to the questionnaire from the supervisors meant that 121 of the original sample of 385 drivers were able to be matched with their supervisors.

Fleet managers. A total of 52 fleet managers participated in the questionnaire, representing a response rate of 51%. The majority of the fleet managers participants were male (67%) and between the ages of 40–59 years (67%). This sample of fleet managers meant that this study was able to match 342 of the original sample of 385 drivers with their fleet manager. Following the deletion of cases with missing values, the final driver sample size was 300. The final sample consisted of 47 groups, with a mean of 25 drivers represented in each fleet manager group.

Although all drivers identified their fleet manager, not all drivers identified their supervisor, so we could not link every driver to an individual supervisor. However, all drivers with the same supervisor had the same fleet manager. We therefore used the fleet management group structure as the basis for aggregating data to the group level. If there were two or more supervisors within a fleet manager group, we aggregated the supervisors’ responses and used this measure as the supervisor variable at the fleet level. On average there were 2.8 supervisors within each fleet manager group. In the analyses, we also controlled for group size, as the interaction between drivers within each workgroup may have an influence on the dependent measure.

Measures

Safety motivation. We assessed safety motivation using Neal and Griffin’s (2006) safety motivation scale. The items were reworded slightly to suit the driving context. An example item is “I feel it is worthwhile to put in effort to improve my driving in a work vehicle.” These items were measured on a 5-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

Perceived managerial safety values. Drivers’ perceptions of their supervisor’s and fleet manager’s safety values were assessed from the managerial values dimension of Griffin and Neal’s (2000) safety climate measure. The three items making up this measure appeared twice in the questionnaire, once to assess drivers’ perceptions of supervisors’ values, and again to assess drivers’ perceptions of fleet managers’ values. The items were reworded to suit the driving context. An example item is “My fleet manager/ workgroup manager places a strong emphasis on motor vehicle safety.” These items were measured on a 5-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

Perceived organizational safety values. Supervisors’ and fleet managers’ perceptions of organizational safety values were also assessed from the managerial values dimension of Griffin and Neal’s (2000) safety climate measure. The items were reworded so that the referent was the organization (rather than a manager) and to suit the driving context. An example item is “This organization places a strong emphasis on motor vehicle safety.” These items were measured on a 5-point Likert scale, ranging from strongly disagree (1) to strongly agree (5).

Self-efficacy. Self-efficacy was assessed by three items adapted from Renn and Fedor (2001). An example item is “Feel confident about your ability to drive safely in a work vehicle.” Due to the complexity of the driving task, it was considered appropriate to measure only the strength aspect of drivers’ belief in their ability to drive safely in a work vehicle (i.e., Gist & Mitchell, 1992). In support, past research has found that strength measures of self-efficacy correlated with performance just as strongly as composite measures did (strength and magnitude measures; Lee & Bobko, 1994). These items were measured on a 5-point Likert scale, ranging from never (1) to very often (5).

Attitudes toward rule violations and speeding. Attitudes toward rule violations and speeding were assessed from 11 items. These items were adopted from Iversen and Rundmo’s (2004) rule violations and speeding scale. An example item is “Speed limits are exceeded because they are too restrictive.” These items were measured on a 5-point Likert Scale, ranging from strongly disagree (1) to strongly agree (5). In the analyses, the 11 items comprising the scale were randomly allocated into three item-parcels to systematically randomize the error variance and reduce the number of indicators for the latent construct (see S. West, Finch, Curran, & Patrick, 1995). As this scale was negatively worded, the items were reversed in the analyses.

Self-reported crashes. A final item assessed crash involvement in a work vehicle in the 6-month period prior to completion
of the questionnaire. A 6-month period was chosen to ensure accurate recall of crashes (Landen & Hendricks, 1995). On the questionnaire, a road traffic crash was described as “an incident of at least one road vehicle involving death, injury to a person, or property damage.” Drivers responded either “yes” or “no” to this question: “In the last 6 months, have you been involved in a traffic crash when driving a work vehicle with your current employer?”

The majority of drivers reported having only one crash in the past 6-month period, and only a few reported having two crashes. Due to current methods of determining a work-related road crash (i.e., Murray et al., 2003), it is uncertain how representative these statistics are of the national work-related road crash average.

Control measures. Age was measured as a categorical variable. A space was also provided for the participants to indicate how many kilometers they drove per week. In regards to the number of crashes when driving for personal purposes, drivers responded either “yes” or “no” to this question: “In the last 6 months, have you been involved in a traffic crash when driving for personal purposes?” Group size was also used as a control variable, as the interaction between drivers within each workgroup may have an influence on the dependent measure.

Measurement Properties

Exploratory factor analysis was used to evaluate the factor structure of the items used to measure safety motivation, driving self-efficacy, safety attitudes, perceptions of fleet managers’ safety values, and perceptions of supervisors’ safety values. Five factors with eigenvalues greater than 1 were extracted using maximum likelihood estimation and varimax rotation. The loadings of the factors corresponded to the hypothesized factors, and all relevant factor loadings were above .40. No cross-loadings were above .40 in the rotated solution. The results of the analysis are reported in Table 1 and support the proposed factor structure of the items. Confirmatory factor analysis also showed the five-factor model was a good fit to the data, \( \chi^2(80, N = 300) = 130.00, p < .001 \), comparative fit index = .98, root-mean-square error of approximation = .042. All hypothesized loadings were statistically significant, and the highest factor correlation was \( r = .51 \) for perceptions of supervisors’ safety values and perceptions of fleet managers’ safety values.

In regard to the deletion of missing values, we examined whether the 85 cases not included in the analysis differed from the included cases on available measures. There were no significant differences in mean values for the number of crashes, age, or the five individually assessed scales described above.

Results

The correlations among the driver-level measures and disaggregated fleet managers’ and supervisors’ perceptions of organizational safety values are reported in Table 2. However, to show the full set of relationships depicted in Figure 1, multilevel modeling was required. Our main purpose in using multilevel modeling was to assess the driver-level variables within fleet manager workgroups and the cross-level relationships between the group-level influences of supervisors and fleet managers and the individual-level driver safety perceptions. For the analyses, all drivers were nested within fleet manager

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
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<tbody>
<tr>
<td>I feel that it is worthwhile to put in effort to improve my driving</td>
<td>.10</td>
<td>.08</td>
<td>−.11</td>
<td>.44</td>
<td>.08</td>
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<tr>
<td>I feel that it is important to maintain safe driving practices at all times</td>
<td>.05</td>
<td>.03</td>
<td>−.19</td>
<td>.83</td>
<td>.14</td>
</tr>
<tr>
<td>I believe that it is important to reduce the risk of accidents in a work vehicle</td>
<td>.05</td>
<td>.04</td>
<td>−.12</td>
<td>.98</td>
<td>.11</td>
</tr>
<tr>
<td>Feel confident about your ability to drive safely in a work vehicle?</td>
<td>.06</td>
<td>.06</td>
<td>−.07</td>
<td>.08</td>
<td>.90</td>
</tr>
<tr>
<td>Feel confident about your ability to avoid an accident?</td>
<td>.11</td>
<td>.05</td>
<td>−.12</td>
<td>.15</td>
<td>.67</td>
</tr>
<tr>
<td>Feel certain you can drive safely in a work vehicle?</td>
<td>−.01</td>
<td>.13</td>
<td>−.12</td>
<td>.09</td>
<td>.67</td>
</tr>
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<td>Safety Attitude Composite 1</td>
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<td>−.06</td>
<td>.89</td>
<td>−.16</td>
<td>−.15</td>
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<td>Safety Attitude Composite 2</td>
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<td>−.09</td>
<td>.79</td>
<td>−.16</td>
<td>−.09</td>
</tr>
<tr>
<td>Safety Attitude Composite 3</td>
<td>−.05</td>
<td>−.07</td>
<td>.71</td>
<td>−.12</td>
<td>−.09</td>
</tr>
<tr>
<td>My work unit manager places a strong emphasis on motor vehicle safety</td>
<td>.25</td>
<td>.88</td>
<td>−.07</td>
<td>.05</td>
<td>.08</td>
</tr>
<tr>
<td>Motor vehicle safety is given a high priority by my work unit manager</td>
<td>.25</td>
<td>.93</td>
<td>−.10</td>
<td>.04</td>
<td>.10</td>
</tr>
<tr>
<td>My work unit manager considers motor vehicle safety to be important</td>
<td>.21</td>
<td>.84</td>
<td>−.10</td>
<td>.12</td>
<td>.12</td>
</tr>
<tr>
<td>My fleet manager places a strong emphasis on motor vehicle safety</td>
<td>.89</td>
<td>.27</td>
<td>−.05</td>
<td>.09</td>
<td>.11</td>
</tr>
<tr>
<td>Motor vehicle safety is given a high priority by my fleet manager</td>
<td>.95</td>
<td>.25</td>
<td>−.01</td>
<td>.10</td>
<td>.07</td>
</tr>
<tr>
<td>My fleet manager considers motor vehicle safety to be important</td>
<td>.91</td>
<td>.22</td>
<td>−.02</td>
<td>.10</td>
<td>.07</td>
</tr>
</tbody>
</table>
groups. Although some fleet manager groups had more than one supervisor, to analyze the data using one set of analyses, we aggregated supervisor data to the fleet manager level. In other words, aggregating supervisors to the fleet manager level provided a common level of analysis. Figure 1 also depicts the hierarchical nature of the data.

The analyses were conducted using MLwiN (Goldstein et al., 1998). For all analyses we included control variable of vehicle accidents when not at work, age, and distance traveled at the individual level of analysis and number of respondents in each fleet manager group at the work unit level of analysis.

In the first analysis, we regressed self-reported crashes on the control variables and safety motivation. The analysis assumed a negative binomial distribution for reported crashes (Gardner, Mulvey, & Shaw, 1995). We used a negative binomial regression to estimate the probability distribution of our dependent measure, as the data showed more dispersion that could be accounted for under the Poisson regression model (see Table 3). The results supported Hypothesis 1, as motivation was a significant predictor of self-reported crashes, \( \theta = -.747, t = -2.20, p < .05 \). Consistent with previous research, number of kilometers driven per week was also a significant predictor in this analysis, \( \theta = .118, t = 2.15, p < .05 \).

In the next analysis we assessed the driver-level predictors of safety motivation, specifically, drivers’ self-efficacy, drivers’ safety attitudes, drivers’ perceptions of fleet managers’ safety values, and drivers’ perceptions of supervisors’ safety values. We entered all variables in a single step with the control variables, and the results are reported in Table 4. In support of Hypothesis 3, perceived fleet managers’ values, \( \gamma = 0.07, p < .05 \), were positively related to motivation, but perceived supervisor values were not, \( \gamma = 0.02, ns \). Therefore, Hypothesis 2 was not supported.

To test Hypothesis 4, which predicted that drivers’ perceptions of fleet managers’ and supervisors’ safety values would interact in their effect on drivers’ safety motivation, another step was added to the analysis. In this second/third step, the interaction term was added to the analysis. Table 4 shows that this interaction was significant, and we have depicted the nature of the interaction in Figure 2 using procedures recommended by Aiken and West (1991). The graph shows that perceptions of fleet managers’ values were more strongly related to drivers’ motivation when perceptions of supervisors’ values were higher, \( \gamma = .09, p < .01 \). Alternatively, the interaction could be interpreted as showing that the perceptions of supervisors’ values were more strongly related to drivers’ motivation when perceptions of fleet managers’ values were higher. Thus, the form of the interaction was consistent with our hypothesis, namely, that drivers would report higher motivation to drive safely if they perceived both their supervisor and their fleet manager to value safety.

The individual difference variables, safety attitudes and self-efficacy, were also examined as driver-level predictors of safety motivation (see Table 4). The results found that both safety attitudes, \( \gamma = 0.27, p < .001 \), and self-efficacy, \( \gamma = 0.14, p < .05 \), were also significantly and positively related to motivation. These results supported Hypotheses 7 and 8.

We next tested the cross-level relationships between fleet managers’ and supervisors’ perceptions of organizational safety

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter</th>
<th>Standard error</th>
<th>t value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Km driven</td>
<td>.118</td>
<td>0.055</td>
<td>2.15*</td>
</tr>
<tr>
<td>Age</td>
<td>.829</td>
<td>0.497</td>
<td>1.67</td>
</tr>
<tr>
<td>Group size</td>
<td>.022</td>
<td>0.011</td>
<td>2.00*</td>
</tr>
<tr>
<td>Personal accidents</td>
<td>.083</td>
<td>1.377</td>
<td>0.06</td>
</tr>
<tr>
<td>Motivation</td>
<td>−.747</td>
<td>0.339</td>
<td>−2.20*</td>
</tr>
</tbody>
</table>

* \( p < .05 \).
values and drivers’ perceptions of managerial (fleet manager and supervisor) safety. Two multilevel regression analyses were carried out, one in which the criterion was drivers’ perceptions of fleet managers’ safety values and another in which the criterion was drivers’ perceptions of supervisors’ safety values. Supervisors’ and fleet managers’ own perceptions of organizational safety values were tested as predictors in both analyses. The results of these analyses are reported in Table 5. The results revealed that only fleet managers’ perceptions of organizational safety values were significantly related to drivers’ perceptions of fleet managers’ safety values, $\gamma = 0.09, p < 0.05$, supporting Hypothesis 6. However, supervisors’ perceptions of organizational safety values were not related to drivers’ perceptions of supervisors’ safety values, $\gamma = 0.14, p > 0.05$, indicating that Hypothesis 5 was not supported.

### Discussion

This study explored multilevel influences on self-reported crashes in the workplace. Specifically, the study investigated the relationships between supervisors’ and fleet managers’ perceptions of organizational safety values, drivers’ perceptions of supervisors’ and fleet managers’ safety values, and drivers’ attributes in predicting self-reported crashes in the workplace. This study therefore contributes to the field of occupational safety by integrating workplace safety value perceptions with individual attributes and using the combined set of variables to predict motivation to drive safely in a work vehicle. We found that drivers’ perceptions of supervisors’ and fleet managers’ safety values interacted to determine drivers’ safety motivation, in combination with drivers’ self-efficacy and safety attitudes. Furthermore, we were able to delineate the cross-level influence of fleet managers’ perceptions of organizational safety values on drivers’ perceptions of fleet managers’ safety values.

Consistent with research investigating other forms of safety performance (Griffin & Neal, 2000; Neal & Griffin, 2004; Probst & Brubaker, 2001), in this study, motivation was found to be a critical determinant of self-reported crashes. This finding suggests that drivers are less likely to report crashes while driving for work purposes if they are motivated to drive safely.

A unique aspect of this study was that we assessed multiple influences on drivers’ perceptions of managerial safety values. Although managerial safety values have been shown to be important for other forms of safety behavior (e.g., Neal & Griffin, 2006; Zohar, 2000), this study is the first to extend this finding to safe driving motivation and to investigate the role of fleet managers in the safety of work-related drivers. First, we were able to show that

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1 To assess whether aggregating to the fleet management group level of analysis underestimated the results obtained in the supervisory sample, we conducted a further analysis on a smaller subset of the data, where we matched the 121 supervisory responses to their specific supervisory workgroups. For this analysis, fleet manager measures were disaggregated to groups. In this analysis, the pattern of results was unchanged. The correlation between drivers’ perceptions of supervisors’ values and supervisors’ own reports was $r = .02 (p > .05)$, compared to $r = .06 (p > .05)$ in the full sample. The correlation between drivers’ perceptions of fleet managers’ values and the fleet managers’ own reports was $r = .18 (p > .05)$, compared to $r = .15 (p < .001)$ in the full sample. Therefore, we can conclude that aggregating the results to the fleet management level of analysis did not appear to influence the results relating to the role of supervisors.
drivers’ perceptions of fleet managers’ safety values, but not drivers’ perceptions of supervisors’ safety values, were related to their motivation to drive safely. This finding supports past research that has found that fleet managers play an important role in influencing the safety performance of their fleet (Newnam & Tay, 2007; Newnam et al., 2006). The nonsignificant result for supervisors was not surprising, as work-related driving safety has not been well integrated within the occupational health and safety system. As such, it is uncertain whether senior-level managers had given supervisors the directives to safely manage their fleet.

Although drivers’ perceptions of supervisors’ safety values was not found to have an independent effect on their safety motivation, supervisors were found to play an important role in the safety management of drivers. Our study found that the influence of supervisors and fleet managers interacted such that drivers were more motivated to drive safely if they perceived both their supervisor and fleet manager to value safety. These findings suggested that the combined influence of supervisors and fleet managers was likely to have a stronger effect on drivers’ safety motivation, as the climate that supervisors shaped had an effect on drivers’ perceptions of the value given to safety by their fleet manager. In support of these results, the influence of more senior leaders within an organization has been found to be mediated by group leaders (Zohar & Luria, 2005). Therefore, within the realm of safety in the work-related driving context, there are two routes through which safety in the work vehicle can be fostered, and both fleet managers and supervisors need to be seen to promote safety values if high safety motivation is to be achieved.

Second, the multilevel component of this study was introduced by exploring the cross-level relationships between supervisors’ and fleet managers’ perceptions of organizational safety values and drivers’ perceptions of managerial safety values. We were able to show a relationship between fleet managers’ perceptions of organizational safety values and drivers’ perceptions of fleet managers’ safety values, which illustrates that perceptions of workplace safety values are transmitted across levels of the organization. The relationship between supervisors’ perceptions of organizational safety values and drivers’ perceptions of supervisors’ safety values was not significant, but this may have been because we had to aggregate supervisor groups to the fleet manager level, which meant loss of variance and power for the analysis. It is worth noting that fleet managers’ perceptions of organizational safety values did not predict drivers’ perceptions of supervisors’ safety values, even though they did predict drivers’ perceptions of fleet managers’ safety values. This finding further supports our proposition that fleet managers and supervisors represent independent sources of influence on safety motivation.

Potentially, there are other workplace contexts where there may be multiple managerial influences at work. For example, in organizations where there is both a discipline-based manager (who is responsible for maintaining professional standards) as well as a worksite manager (who is responsible for managing workloads and providing day-to-day supervision), there is potential for dual influences on employee performance outcomes. We are not aware of any research that has attempted to delineate how these two sources of managerial influences interact under these circumstances, but our findings suggest that this may be an important area for further research.

This study also revealed that the measures of drivers’ self-efficacy and attitudes could explain additional variance within the safety framework. In particular, attitudes toward rule violations and speeding explained a relatively large proportion of variance in drivers’ safety motivation. By integrating variables from the driving literature within the safety framework, we have been able to build a more inclusive model of the range of factors contributing to self-reported crashes and the pathways through which these effects occur. Furthermore, the fact that these individual attributes explained unique variance in the model supports the proposition that greater variability in safety outcomes can be taken into account when individual attributes are assessed in combination with climate perceptions (Brown & Leigh, 1996; Hofmann et al., 1995). It may be that research into other forms of safety outcomes can be developed by incorporating relevant individual attributes in the safety framework.

**Practical Applications**

This study has applied a framework for systematically assessing safety value perceptions across multiple levels within an organizational hierarchy, combining these with individual attributes and using the combined set of variables to predict motivation to drive safely in a work vehicle. The results of the current study offer some practical suggestions for interventions designed to improve work-related road safety outcomes.

First, individual motivation was found to be a significant predictor of work-related crashes, which suggests an avenue to directly influence crash involvement. This study assessed the intrinsic value of safety, rather than extrinsic motivators such as rewards...
and punishment (e.g., Probst & Brubaker, 2001). As such, a possible intervention could focus on providing feedback to drivers on their safety performance in a work vehicle. This type of intervention would aim to enhance drivers’ belief in the intrinsic value associated with safety through a system of positive reinforcement (e.g., Prue & Fairbank, 1981).

Second, the study suggested that drivers reported a higher motivation to drive safely if they perceived both their supervisor and fleet manager to value safety. The findings from this study, therefore, constitute a recommendation for integrating fleet safety responsibilities within the roles and responsibilities of supervisors and fleet managers. Furthermore, the results also confirm that the fleet manager, as the principal contact for driving-related matters in the organization, contributes to drivers’ safety value perceptions, which in turn predict their motivation to drive safely. This finding suggests that fleet managers are seen by drivers as a legitimate source of power within the driving context. As such, the responsibility of fleet managers in safety management could be acknowledged more formally, so that it is understood to be part of the fleet manager’s role to ensure that he or she supports the integrated organizational approach to fleet safety.

Third, the findings suggest individual-level interventions, promoting the negative consequences associated with rule violations and speeding and strengthening drivers’ beliefs in their ability to drive safely, should also be effective in increasing levels of safety motivation, which, in turn, reduce work-related road crashes. An intervention designed to enhance drivers’ attitudes toward traffic safety could involve an information campaign promoting the value and importance associated with complying with the traffic rules and speed limits. This strategy could be combined with driver training (Christie, 1995) or worker participation programs (Gregersen, Brehmer, & Moren, 1996).

Limitations

There are some limitations associated with this study. First, in this study we relied on self-report data for the outcome measure, which are open to socially desirable responding. However, this is less likely to be an issue in this particular study for two reasons. First, crashes represent infrequent and salient events, so unlike other forms of behavior (e.g., absenteeism), they are less likely to be affected by poor recall. To ensure accurate recall of crashes we also opted to use a 6-month period of recall. Second, it has been shown that self-report driving questionnaires are associated with minimal social desirability bias (Lajunen & Summala, 2003). In support of these assertions, self-report measures of crashes have been found to be strongly correlated with independent observations (Lusk, Ronis, & Baer, 1995), and accurate recall of workplace accidents has also been found to be acceptable in older age groups (25–54) for up to a period of 12 months (Landen & Hendricks, 1995). Third, past research has found self-report measures of crashes strongly correlate with objective measures of crashes (e.g., Lajunen & Summala, 2003). Last, organizational records of driving behaviors are known to be unreliable, as they are insufficiently sensitive, inaccurate, and retrospective, and they ignore risk exposure (Glendon & McKenna, 1995). On the basis of these justifications, we believed self-reported crashes to be a suitable outcome variable.

A second limitation was that we could not link every driver to a single supervisor. Therefore, we used the fleet management group as the unit of analysis at the aggregate level. By aggregating supervisor measures to the fleet level we may have underestimated the role of supervisors in safety processes. However, as noted in the results section, we conducted further analysis where we matched the 121 supervisory responses to their specific workgroup and found that the pattern of results was unchanged. Therefore, we can conclude that aggregating the results to the fleet management level of analysis did not influence the results relating to the role of supervisors in influencing fleet safety.

A third limitation relating to the outcome measure concerns its inability to determine culpability. In this study, we assessed drivers’ ability to recall crashes but did not distinguish responsibility for the crash. As such, it could be argued that crashes in which an individual is not culpable could be predicted by another variable (Wahlberg, 2003).

A fourth limitation was not directly assessing driving behavior. Considering that past research in the safety domain has investigated the link between motivation and performance (e.g., Griffin & Neal, 2000; Neal & Griffin, 2006), the proposed model may be viewed as making a substantial leap from motivation to self-reported crashes. However, we believed self-reported crashes to be an appropriate outcome for three reasons. First, as noted in the introduction, there is no questionnaire currently available to accurately assess work-related driving behavior. Second, some research has used a measure of accidents within an organization as a behavior-based criterion measure (Zohar, 2000; Zohar & Lorius, 2004). Third, self-report measures of crashes have been found to be associated with other forms of unsafe driving behavior (e.g., speeding; e.g., D. Parker, Reason, Manstead, & Stradling, 1995; R. West, French, Kemp, & Elander, 1993). As such, we believed that self-reported crashes, rather than driving behavior, to be an appropriate outcome measure for this setting.

A final limitation relates to the cross-sectional measurements. It was not possible to test the casual relationships proposed in this research. Therefore, reverse causation could also explain the relationship between the driver variables. For example, it is possible that drivers who have had a crash and did not experience any adverse outcomes then experience lower motivation to drive safely. Future research is needed to test the casual relationships proposed in the safety framework longitudinally to provide further validation of the hypothesized relationships.

Conclusion

We assessed perceptions of workplace safety values at the driver, supervisor, and fleet manager levels and used these constructs to predict motivation to drive safely in a work vehicle. By distinguishing safety values at multiple levels of the work-related organizational hierarchy, we were able to show a multilevel organizational process of effects whereby drivers, supervisors, and fleet managers influence work-related driving outcomes. We also found that incorporating drivers’ attitudes and self-efficacy into the safety framework explained additional variance in driver motivation. This research thus expands on the very limited and much needed research exploring the factors influencing self-reported crashes in the fleet setting.
References


