HHS Public Access

Author manuscript

J Safety Res. Author manuscript; available in PMC 2024 September 01.

Published in final edited form as:

J Safety Res. 2023 September ; 86: 12–20. doi:10.1016/j.jsr.2023.05.015.

Risky driving behaviors and employer motor vehicle safety policies among U.S. oil and gas extraction workers

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Abstract

Introduction: Over half of fatal occupational injuries in the oil and gas extraction (OGE) industry are due to transportation incidents. While driving for work is common in this industry and risky driving behaviors have been identified as contributing factors to fatal crashes among OGE workers, limited information is available on the frequency of risky driving behaviors and employer policies to reduce these behaviors.

Methods: Researchers conducted a cross-sectional survey of OGE workers in three states. Responses from 363 OGE workers who drive as a part of their work duties were analyzed to evaluate relationships between self-reported risky driving behaviors (i.e., speeding, cell phone use, and driving unbelted) and awareness of motor vehicle safety policies by their employers.

Results: Hands-free cell phone use was the most common risky driving behavior among participants (59.8%), while a hands-free cell phone ban was the least commonly reported employer motor vehicle safety policy (34.7%). Multiple logistic regression results identified longer work and commuting hours, lack of employer motor vehicle safety policies, having ever been in a work crash, and being employed by an operator to be significantly associated with risky driving behaviors.

Conclusions: Workers whose employers lacked motor vehicle safety policies were more likely to engage in risky driving behaviors.

Practical applications: Results of this survey support the implementation of motor vehicle safety interventions such as bans on texting and handheld and hands-free cell phone use, speed management, and in-vehicle monitoring systems by OGE employers as well as research focusing

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jsr.2023.05.015.

on the effectiveness of these interventions in OGE. Additional research could examine worker driving behaviors through self-reported data in combination with objective measures.

Keywords

Cell phone use; Distracted driving; Driving for work; Seat belt use; Speeding

1. Introduction

Transportation incidents are the leading cause of fatal occupational injuries in the United States, accounting for 37% of all deaths in 2020 (Bureau of Labor Statistics, 2021). In the oil and gas extraction (OGE) industry, transportation incidents accounted for over 55% of these fatalities in 2019 (Bureau of Labor Statistics, 2020b).

In 2020, 353,487 workers were employed in the OGE industry (Bureau of Labor Statistics, 2020a). Approximately one-third (36%) were employed by operators (coded as 211 by the North American Industry Classification System [NAICS]) that own and manage leased properties. Over half of the OGE workforce (54%) consisted of contractors hired by operators to perform specialized well servicing activities (NAICS 213112), and the remaining 11% were drilling contractors (NAICS 213111). Additional workers classified under other NAICS codes (e.g., specialized freight trucking [NAICS 4842]) perform transportation-related activities such as hauling fluids to and from OGE worksites.

Several motor vehicle crash risk factors (such as fatigue, long work hours, and long commutes) are common in OGE (HaganHaynes et al., 2021; Hagan-Haynes et al., 2022; Krum, Miller, & Soccolich, 2020). Oil and gas well sites are often located in remote areas, requiring long hours of driving during the workday from one worksite to another and long-distance commutes (CDC 2008). Industry-wide data on commuting distances are not available. A recent survey of OGE workers found that workers reporting long commutes, nonstandard work schedules, less sleep, and a lack of employer safety policies were more likely to report one or more potentially harmful events while driving a work vehicle (i.e., drowsy driving, ever fallen asleep while driving, and a near miss in the past week; Hagan-Haynes et al., 2022). Almost 30% of workers reported driving more than 50,000 miles each year. While motor vehicle fatality rates have historically been higher among contractors (Retzer, Hill, & Pratt, 2013), findings from this survey found no differences in risky driving-related outcomes by company type (Hagan-Haynes et al., 2022).

Few studies have examined the frequency of risky driving behaviors such as cell phone use, speeding, and driving unbelted among OGE workers who drive for work. One study that included an OGE fleet found that driving unbelted and speeding were commonly reported risky driving behaviors, accounting for 41% and 7% of risky driving events recorded by in-vehicle monitoring systems (IVMS), respectively (Bell, Taylor, Chen, Kirk, & Leatherman, 2017). Further, a review of case narratives for OGE workers who died in work-related crashes found that 38% of OGE workers were not belted and an additional 12% were ejected from the vehicle and thus presumed to have also been unbelted (Retzer, Hill, & Pratt, 2013). A qualitative study of Canadian OGE workers found that seat belt use tended to be situational; workers reported wearing them most often in inclement weather, on poor roads,

or when they were worried that other motorists were not driving safely (Rothe, 2008). Data for the general population confirm the contribution of risky driving behaviors to crashes and fatalities. Naturalistic driving data for the general U.S. population showed that driving over the speed limit or too fast for conditions and dialing a cell phone or texting increased the risk of a crash compared to baseline driving (Dingus et al., 2016). Because crash severity and the likelihood of a fatality increases as speed increases (International Transport Forum, 2018), it is important to ascertain the frequency of speeding among OGE workers and develop strategies to reduce speeding. Crash risk has also shown to be increased for drivers with recent crash involvement or prior citations (Chandraratna, Stamatiadis, & Stromberg, 2006).

The lack of industry-specific information on cell phone use while driving and related employer policies is of particular concern because the OGE working environment – long work hours, long commutes, work in remote and rural areas, frequent travel between worksites, and productivity pressures – might create an increased incentive and opportunity to use a phone while driving. Meta-analyses have confirmed that both hands-free and handheld cell phone use have been associated with increased crash risk and declines in driving performance (Atchley, Tran, & Salehinejad, 2017; Lipovac, Đerić, Tešić, Andrić, & Marić, 2017).

Employer policies and technologies adopted with the intention of reducing employee drivers' risk of crashes and injuries are especially important for cell phones and other policy areas where federal safety regulations are limited and in states with less stringent traffic laws. Previous research has identified motor vehicle safety interventions used in the OGE industry, including IVMS, journey management, and driver training (Retzer, Hill, & Burton, 2013). However, it is unknown how often these interventions are used across the industry and whether the presence or absence of these policies or other factors are associated with the risky driving behaviors they are intended to prevent. The analysis presented here adds to the literature by addressing questions surrounding the relationships between driving behaviors and company policies, and the results suggest directions for future research.

2. Methods

2.1. Survey methods

Researchers conducted an in-person survey of a convenience sample of 500 oil and gas extraction workers employed by 13 different companies in Colorado, Texas, and North Dakota between October 2017 and February 2019. The study team used diverse recruitment methods (e.g., industry health and safety meetings, conferences, e-mail, listservs, personal contacts) to identify companies. Participating companies and researchers jointly identified survey sites based on logistical considerations, including the location of active well sites and the number of workers available to be surveyed on the site. The survey included previously published questions related to driving (Sieber, et al., 2014) and new industry-specific questions developed based on existing literature and consultation with subject matter experts. Pilot testing was conducted to determine whether survey questions were understood as intended and to test the survey length. Pilot testing showed that many workers' primary language was Spanish. Based on this, all study materials were translated into Spanish, and a Spanish-speaking researcher attended all survey administrations unless informed that all

participants on-site were proficient in English. Workers who drove for work completed a module with questions about driving patterns; history of work-related near misses, motor vehicle crashes, and injuries; driving behaviors; and their employer's motor vehicle safety programs and policies. The study protocol, which included the survey, was reviewed and approved by the National Institute for Occupational Safety and Health (NIOSH) Institutional Review Board (IRB). Additional details describing the survey design and administration can be found elsewhere (Hagan-Haynes et al., 2022; Wingate et al., 2022). The survey consisted of 117 questions and took approximately 30 minutes to complete. The survey questions included in this analysis can be found in the supplementary files.

Surveys were conducted at work sites, contractor meetings, and company field offices. All workers on site were invited to complete the survey on the days researchers were present, including contractors as well as employees of the participating employer. Workers were screened verbally for eligibility based on two questions: (1) "Have you worked in OGE for at least 1 month during the past year?" and (2) "Do your work duties take you to a well site at least 2 days per week or more?" Workers with less than 1 month of experience in the OGE industry were excluded to ensure all respondents had sufficient knowledge about the work environment and their employer's policies. Eligibility to take the driving module was based on a "yes" response to the question "Do you drive a vehicle as part of your work duties?" Participating workers were given gift cards in nominal amounts ($10 if on-duty and $30 if off-duty) as tokens of appreciation for completing the survey.

2.2. Data analysis

Statistical analysis was performed using R (R Core Team, 2022). The data were subset to the 363 respondents who answered "yes" to the question "Do you drive a vehicle as part of your work duties?" This analysis focuses on five outcomes, which were the self-reported frequency of five risky driving behaviors: driving 10 or more miles per hour (mph) above the speed limit, talking on a handheld cell phone, talking on a hands-free cell phone, sending text messages while driving, and not always wearing a seat belt.

For analyses by company type, workers who reported a company type of "drilling contractor," "servicing company," or "other," were grouped into a "contractor" category for comparison with workers who reported a company type of "operator." Workers were categorized in the following racial and ethnic groups: Hispanic or Latino; Non-Hispanic, White; and Non-Hispanic, Non-White. Workers who indicated their employer did not have a motor vehicle safety policy were grouped with workers who did not know; the rationale for this was that if workers were unaware of a particular policy, it would be unlikely for that policy, even if there was one, to affect driving behaviors. For the question on seat belt use, responses of "often," "sometimes," "rarely," and "never" were grouped together as the risky driving behavior; the rationale for this was that "always" wearing a seat belt is the only safe behavior. For other questions on driving behaviors, responses of "always," "often," and "sometimes" were combined to represent the risky driving behavior, and responses of "rarely" and "never" were combined to represent the safer driving behavior.

Descriptive statistics were calculated, with missing responses removed from the denominator for percent calculations. Bivariate chi-square tests were performed to examine

differences in five risky driving behaviors by race and ethnicity, company type, work crash history, and employer motor vehicle safety policies. Multiple logistic regression was used to assess the relationships between race and ethnicity, company type, policies, work crash history, age, and work and commute hours with each of the five risky driving behaviors. Race and ethnicity, company type, ever having been in a work crash, and employer motor vehicle safety policies were included in the initial regression model when significant ($p < 0.1$) in the bivariate analysis. Three continuous variables that were previously determined to be associated with poor driving outcomes (Hagan-Haynes et al., 2022; number of hours worked per day, daily roundtrip commuting time, and usual hours of sleep on workdays) were also included in the initial regression model if significantly associated with the risky driving behavior based on t-test results ($p < 0.1$). Age was also included in the initial regression model if significantly associated with the risky driving behavior based on t-tests ($p < 0.1$). Sex was not included in this analysis as 96.1% of survey respondents were male (Hagan-Haynes et al., 2022). Initial models were created for each risky driving behavior and included variables that were significantly associated at $p < 0.1$ in the bivariate analysis. The STEP function in R was used to build the final model using the process of stepwise regression based on the Akaike information criterion (AIC), where the final model has a set of variables that results in the lowest AIC score among all possible variable combinations (Yamashita, Yamashita, & Kamimura, 2007). Observations with missing values for any variable in the initial model were removed before performing the stepwise procedure. The STEP function performed both backward and forward search directions. Bi-directional selection was used with the STEP function to increase the variety of variable combinations in the model selection process. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for all variables included in the final models.

3. Results

3.1. Driver characteristics and employer motor vehicle safety policies

The mean age for all respondents was 37.7 years (Table 1). Overall, 29.7% of respondents reported Hispanic or Latino ethnicity, with significantly different distributions among contractors (36.7%) compared to operators (10.0%, $p <.001$). Most operators were Non-Hispanic, White, compared to about half of contractors (82.2% vs. 54.9%, $p <.001$). Over one-third of respondents (35.2%) had more than 10 years of experience driving for work, followed by 26.2% with more than 5 to 10 years, 23.1% with more than 1 to 5 years, and 15.5% with 1 year or less of experience driving for work. Thirty-four respondents (9.6%) reported having ever been in a work crash as a driver or passenger in which there was a death, injury requiring medical attention, or a vehicle was towed.

Workers' awareness of employer motor vehicle safety policies related to cell phone use while driving varied. Over three-fourths of respondents reported texting bans (89.2%) or handheld cell phone bans (78.5%) and only about one-third (34.7%) reported hands-free cell phone bans. Use of IVMS was reported among 70.7% of respondents. Over 90% of operators reported that their employer used IVMS, compared to 62.6% of contractors ($p <.001$). Less than half of respondents (46.7%) reported that their employer had journey

management policies, with significantly fewer operators reporting these compared to contractors (25.3% vs. 54.7%, respectively, p <.001).

3.2. Risky driving behaviors

Overall, the most frequently reported risky driving behavior was talking on a hands-free cell phone sometimes or more often (59.8%, Table 2). Operators were significant more likely to report hands-free cell phone use compared to contractors (68.1% vs. 56.3%, p <.05), as were workers who reported having ever been in a work crash compared to workers who did not report ever having been in a work crash (88.2% vs. 56.8%, p <.001). Talking on a hands-free cell phone was also associated with not banning hands-free cell phones (73.5% vs. 32.5%, p <.001) and not banning handheld cell phones (69.7% vs. 56.7%, p <.05).

About one-fourth of respondents reported driving 10 mph or more above the speed limit sometimes or more often (24.9%). Compared to Hispanic or Latino respondents, Non-Hispanic, White respondents were significantly more likely to report driving 10 mph or more above the speed limit (30.1% vs. 15.0%, p <.05).

About one-fourth of respondents reported talking on a handheld cell phone sometimes or more often (24.1%). Handheld cell phone use was significantly more likely to be reported by Non-Hispanic, White respondents compared to Hispanic or Latino respondents (28.5% vs. 16.7%, p <.05) and operators compared to contractors (34.1% vs. 19.1%, p <.01). Talking on a handheld cell phone was also more likely among workers who reported having ever been in a work crash compared to workers who did not report ever having been in a work crash (38.2% vs. 22.6%, p <.05). A greater likelihood of talking on a handheld cell phone was associated with no employer ban on handheld cell phones (39.5% vs. 19.9%, p <.001) and no employer ban on texting while driving (44.7% vs. 21.8%, p <.01).

Reported less often were sending text messages while driving sometimes or more often (17.9%). Sending text messages while driving was more likely among operators compared to contractors (27.5% vs. 13.7%, p <.01) and among workers who reported having ever been in a work crash (32.4% vs. 15.9%, p <.05).

The least frequently reported risky driving behavior was not always wearing a seat belt (12.2%). Not always wearing a seat belt while driving at work was significantly associated with not receiving a driver safety orientation upon hire (19.0% vs 10.4%, p <.05) and the employer not using IVMS (19.2% vs. 9.3%, p <.05).

There were no significant relationships between years of experience driving in the oilfield and any of the risky driving behaviors (data not shown).

3.3. Logistic regression results

The final regression models for each risky driving behavior are reported in Table 3. Hispanic or Latino workers were significantly less likely to report driving 10 or more mph over the speed limit sometimes or more often compared to non-Hispanic, White workers (OR = 0.35, 95% CI: 0.17–0.70). Driving 10 or more mph over the speed limit had a significant positive

association with the number of hours worked per day ($p < .05$). For each additional hour of work, workers were 18% more likely to report speeding (OR = 1.18, 95% CI: 1.03–1.35).

Contractors were significantly less likely than operators to talk on a handheld cell phone sometimes or more often (OR = 0.46, 95% CI: 0.27–0.79), talk on a hands-free cell phone sometimes or more often (OR = 0.47, 95% CI: 0.25–0.89), and send text messages sometimes or more often (OR = 0.48, 95% CI: 0.26–0.91). Workers whose employers did not ban texting while driving were almost three times as likely to talk on handheld cell phones compared to workers whose employers did ban texting while driving (OR = 2.97, 95% CI: 1.45–6.08). Workers whose employers did not ban hands-free cell phones were more than eight times more likely to talk on hands-free cell phones (OR = 8.08, 95% CI: 4.38–14.88). Workers who had ever been in a work crash were over five times more likely to talk on hands-free cell phones (OR = 5.09, 95% CI: 1.58–16.41) and twice as likely to send text messages (OR = 2.57, 95% CI: 1.06–6.22) compared to workers who did not report having ever been in a work crash. Each additional hour of daily commuting time was associated with a 50% increase in the odds of workers talking on a hands-free cell phone (OR = 1.50, 95% CI: 1.18–1.90). Older age was significantly associated with talking on a hands-free cell phone (OR = 1.03, 95% CI: 1.00, 1.05), while younger age was significantly associated with sending text messages (OR = 0.97, 95% CI: 0.94, 0.99).

Workers whose employers did not use IVMS and workers who reported longer daily commuting times were more likely to not always wear their seat belts sometimes or more often (OR = 2.08, 95% CI: 0.97–4.44; OR = 1.22, 95% CI: 0.94–1.57, respectively); however, this association was not significant in the final model.

4. Discussion

This study adds to the small number of studies that focus on motor vehicle crash risk factors for OGE workers, comparing workers' self-reported risky driving behaviors with awareness of their employers' motor vehicle safety policies. Lack of awareness of employer motor vehicle safety policies, longer work hours and commuting times, and a prior history of being in a work crash were associated with increased odds of reporting some risky driving behaviors. In contrast, working for a contractor and Hispanic or Latino ethnicity were associated with decreased odds of reporting some risky driving behaviors compared to working for an operator.

4.1. Cell phone use and policies

A substantial proportion of workers in this study reported using their cell phones sometimes or more frequently while driving for work. The proportion of respondents reporting handheld cell phone use was much higher than estimates of U.S. drivers, which was 2.9% in 2019 according to the National Highway Traffic Safety Administration (NHTSA) National Occupant Protection Use Survey (National Center for Statistics and Analysis, 2021). Operating a cell phone while driving reduces a driver's performance and increases crash risk due to the visual, manual, and cognitive distractions created by its use (Atchley et al., 2017; Dingus et al., 2016). Text messaging is considered highly distracting for the driver because it includes all three types of distraction. While hands-free cell phone use largely

removes manual distraction, hands-free phone conversations reduce driving performance because cognitive distractions are still present. In fact, there is substantial evidence that hands-free cell phone use leads to the same level of driver performance decrements as handheld cell phone use (Atchley et al., 2017).

4.1.1. Factors associated with cell phone use—The high frequency of hands-free cell phone use found in this study may be linked to a perception by workers and employers that it is safer than using a handheld phone or texting. One study of 500 Texas drivers showed that drivers who used a cell phone while driving were more likely to agree that using a hands-free device is much safer than using a handheld cell phone (Sun & Jia, 2016). High levels of hands-free cell phone use might also reflect the substantial mileage and driving hours associated with OGE work, which includes long drives between worksites and long commutes. A previous analysis of these survey data reported that almost 30% of respondents drove more than 50,000 miles a year for work, and respondents had an average daily commute of 1.82 hours (Hagan-Haynes et al., 2022). The regression analysis reported here showed that longer daily commuting times were significantly associated with talking on a hands-free cell phone. It is possible that respondents used talking on a hands-free phone as a strategy to stay alert during long drives, although the survey did not ask respondents to distinguish use of hands-free cell phones while driving during the workday from using them while commuting in a company vehicle. Naturalistic studies of commercial vehicle drivers provide some support for this strategy, where talking on a hands-free phone was found to be associated with significantly lower odds of a safety–critical event. However, these same studies showed that dialing, texting, or otherwise manipulating the phone significantly increased the odds of an event (J. Hickman & Hanowski, 2011; Olson, Hanowski, Hickman, & Bocanegra, 2009).

Sending text messages while driving was significantly associated with younger age, which is consistent with other research examining cell phone-related distraction and age (Gliklich, Guo, & Bergmark, 2016; Kim, Ghimire, Pant, & Yamashita, 2019). In contrast, talking on a hands-free cell phone was associated with older age; however, the adjusted odds ratios for age were close to one.

Contractors were significantly less likely to engage in all three cell phone behaviors compared to operators. Previously published results from this survey showed that contractors were also significantly less likely than operators to report feeling very drowsy while driving for work once a month or more often (HaganHaynes et al., 2022). However, lower levels of cell phone use do not appear to be linked to better road safety outcomes for contractors, as drilling and well servicing contractors have been shown to have significantly higher crash fatality rates compared to operators (Retzer, Hill, & Pratt, 2013).

Workers reporting a history of a work crash were significantly more likely to report talking on a hands-free cell phone and sending text messages while driving. For the general population, crash history has been shown to be associated with all types of cell phone use and speeding and a predictor of future at-fault crashes (AAA Foundation for Traffic Safety, 2020; Chandraratna, et al., 2006). Preliminary results of one study of OGE workers found that workers who have experienced at least one work-related crash in the last five

years tended to drive longer distances and be younger and less experienced compared to workers who have not experienced a crash in that time (Moffis, Martinez, & Choi, 2022). Best practices for motor vehicle safety management call for companies to check a driver's records as part of the hiring process and periodically thereafter to identify previous crashes, license suspensions, moving violations, and DUI convictions (American National Standards Institute/American Society of Safety Engineers, 2017; International Association of Oil & Gas Producers, 2020). Companies could also consider implementing road safety interventions for new workers or workers who drive longer distances for work.

Further research is needed to understand the factors leading to the use of hands-free versus handheld cell phones as well as drivers' perceptions of the risks of hands-free versus handheld cell phone use. Work organization factors such as safety climate, regulatory requirements, and state laws might be relevant to this type of analysis. Researchers should also consider vehicle type in combination with regulatory requirements, as over three-fourths of workers in this survey reported driving a pickup truck for work (Hagan-Haynes et al., 2022). The Federal Motor Carrier Safety Regulations that cover large trucks and buses prohibit texting and use of handheld cell phones (49 CFR 392 Subpart H), while drivers of vehicles weighing 10,000 pounds or less do not fall under any such regulation.

4.1.2. Policies to prevent cell phone use—In this study, workers who were not aware of an employer ban on hands-free cell phone use were much more likely to use them. A lack of handheld cell phone bans was also associated with greater use of handheld cell phones; however, this relationship was not significant in the regression analysis. Similarly, one study of texting prevalence among commercial truck drivers prior to the regulatory ban on texting found that drivers whose employers did not have texting bans were much more likely to text than drivers whose employers banned texting (J. Hickman, Hanowski, & Bocanegra, 2010). An employer's implementation of a total ban on cell phone use (i.e., banning texting and handheld and hands-free cell phone use) lets workers know that driving is their primary task and that they are not expected to be available by phone while they are driving. A study of unionized truck drivers found that drivers saw a need for clearly enforced, explicit company policies on distracted driving (Swedler, Pollack, & Gielen, 2015). Further, this and other research has shown that drivers pay attention to safety information and rules communicated by supervisors and fleet managers, suggesting that employer policies add value in the presence or absence of laws and regulations (Newnam, Griffin, & Mason, 2008; Swedler et al., 2015).

Other research has reported that state laws prohibiting texting and handheld phone use are associated with reduced levels of device use, which may explain why in the final models, awareness of employer bans was not associated with these behaviors (McCartt, Kidd, & Teoh, 2014; Rudisill, Zhu, & Chu, 2019). The low awareness of employer hands-free cell phone bans and the high frequency of hands-free cell phone use among this sample of oil and gas workers demonstrate the value of employer policies in the absence of laws and regulations. These findings also suggest the need for increased communication to employers about the benefits of total cell phone bans and more interventions by employers to address driver distraction and distraction-related crash risk. One study found that companies that

prohibit the use of cell phones while driving have significantly lower crash rates in their fleets than those who do not (Vivoda, Pratt, & Gillies, 2019).

Rigorous evaluation of the effectiveness and productivity impacts of employer-level policies banning all cell phone use while driving is needed. A better understanding of workers' needs to use electronic devices while driving for personal versus work-related purposes would help to steer the development of effective employer interventions (Pratt, Retzer, Rodríguez-Acosta, Olsavsky, & Fosbroke, 2020). The use of technologies, including phones themselves, as an intervention to prevent distraction has promise. An evaluation of an app-based technology to reduce interaction with smartphones in an occupational setting yielded positive results (Rispler & Luria, 2020).

4.2. Other employer policies and interventions

4.2.1. Speed management—In the regression analysis, daily work hours had a significant positive association with driving 10 or more mph over the speed limit while driving a company vehicle. This study could not ascertain the reason for this relationship, but it is possible that respondents might have viewed speeding as a way to reduce the amount of time spent working and commuting. Speed management is considered to be essential to reducing crash risk in the workplace (American National Standards Institute/ American Society of Safety Engineers, 2017; International Association of Oil & Gas Producers, 2020). As speed increases, the driver has less time to react to road hazards and less opportunity to maneuver to avoid a crash (International Transport Forum, 2018). Speeding was the second most common factor listed in crash reports in an analysis of OGE worker motor vehicle crash fatalities (Retzer, Hill, & Pratt, 2013). Because speeding and work hours are both contributors to crash risk, adoption of measures to reduce speeding (e.g., using speed governors on heavy vehicles, using IVMS to monitor speeds of all fleet vehicles, and setting schedules that allow sufficient time to get from one worksite to another without speeding) can be effective road safety interventions for workers (American National Standards Institute/American Society of Safety Engineers, 2017; Boodlal & Chiang, 2014; Bui et al., 2018; Smith & Jones, 2016). There are currently no federal transportation or occupational safety regulations intended to manage speeds of commercial motor vehicles (CMVs) (i.e., large trucks and buses weighing 10,001 pounds or more). However, in 2022 the Federal Motor Carrier Safety Administration (FMCSA) published a Notice of Intent (NOI) to propose rulemaking that would require CMVs greater than 26,000 pounds equipped with electronic engine control units capable of governing vehicle speed to be set at a maximum speed to be determined by the final rule (87 FR 26317).

The only significant difference in driving behaviors for Hispanic or Latino workers in this study was that they were significantly less likely to report driving 10 or more mph over the speed limit compared to non-Hispanic, White workers. This safer driving behavior is consistent with survey results for the general population in which 94% of Hispanic or Latino persons stated they always wore a seat belt versus 93% for non-Hispanic persons (Spado, Schaad, & Block, 2019). Rates of work-related deaths due to highway incidents among Hispanic workers are not significantly different from those for all workers (Pratt & Rodríguez-Acosta, 2013; Steege, Baron, Marsh, Menéndez, & Myers, 2014).

4.2.2. In-vehicle monitoring systems (IVMS)—More research is also needed on policies related to IVMS. Employers implement IVMS to monitor driving performance and help employees improve their performance. IVMS identify risky driving behaviors (e.g., driving unbelted, speeding, harsh braking) that exceed a set of predetermined vehicle parameters. IVMS can alert the driver to unsafe behaviors in real time or notify supervisors about these events so they can initiate driver coaching or other actions. In this study, operators were significantly more likely than contractors to report that their employer used IVMS. It is unclear why this would be the case, but it is possible that operators have more resources that would allow them to implement and support IVMS. Using IVMS requires purchase or lease of equipment and maintenance fees and, if properly implemented, review of data followed by driver counseling. Journey management, on the other hand, may require less resources to implement than IVMS and was reported more often by contractors compared to operators.

In the bivariate analysis, not always wearing a seat belt was the only risky driving behavior significantly related to the employer not using IVMS, but this association was no longer significant in the regression analysis. Lack of seat belt use among employees and not using IVMS both may suggest a lack of attention to motor vehicle safety by the employer as well as a lack of emphasis, resources, and follow-up to ensure employees are following company policy. Additionally, the Federal Motor Carrier Safety Regulations require that seat belts are properly worn by drivers and passengers in large trucks weighing 10,001 pounds or more (49 CFR 392 Subpart B), while occupants of lighter work vehicles are subject to state laws and the policies of their company. Evidence of the effectiveness of IVMS to reduce risky driving behaviors is growing. Several studies have reported that IVMS use led to significant decreases in safety–critical events (SCEs) (Bell, et al., 2017; Boodlal & Chiang, 2014; J. Hickman & Hanowski, 2011; Sullman, 2020; G. Toledo & Shiftan, 2016). However, only two studies were able to show that IVMS use led to significant reductions in crash or incident rates (Smith & Jones, 2016; T. Toledo, Musicant, & Lotan, 2008).

Two IVMS studies found that SCE reductions were greater when the technology was combined with driver coaching (Bell, et al., 2017; Mase, et al., 2020). Two studies that collected post-intervention data found that not all improvements were maintained after IVMS feedback and coaching were removed (Bell, et al., 2017; J. S. Hickman & Geller, 2005), suggesting the need for sustained implementation of IVMS. Additional industry-focused research could explore how IVMS with various features (e.g., with and without cameras, coaching, and real-time alerts in the vehicle) might best be used to improve driving performance and reduce crashes in the OGE work environment.

4.3. Strengths and limitations

This study is the first to ascertain self-reported risky driving behaviors among OGE workers and assess the relationships between these behaviors and related employer motor vehicle safety policies. While most of the available literature focuses on drivers of large trucks and buses for whom driving is their primary job, this study provides valuable insights into workers who use lighter vehicles and who drive as a substantial part of their work duties. The results demonstrate the value of employer policies in promoting safer driving behaviors

and identifying gaps in certain policies in the OGE industry. One strength is that the study participants represented multiple employers, both operators and contractors, and three states with substantial OGE activity. In addition, the study population was large enough to allow for a subset of workers who drove as part of their job duties, such that their self-reports were based on actual work experience rather than hypothetical scenarios.

Several limitations must also be acknowledged. The frequency of risky driving behaviors may have been underestimated in this study, as workers were asked to self-report their behaviors and thus may have been hesitant to respond accurately. However, the survey was administered using tablets and paper with no supervisors present, and it did not collect any personally identifiable information. Respondents were also assured that all responses would be aggregated for analysis and publication. The self-report nature of the survey also meant that the presence of employer policies was based on employees' awareness of these policies; the study design did not include confirmation that employer policies were actually in place. Additional factors, such as education level, experience, or company size, may have affected a respondent's awareness of a policy at their company. Additional bias may have been introduced by combining responses of "don't know" with "no" to measure respondents' access to motor vehicle safety policies. Individuals who indicated "don't know" may have been covered by or influenced by a policy, even if they were unaware of its existence. Among workers providing a response to these questions, 10–20% responded "don't know" to the following policies: banning handheld cell phones, banning hands-free cell phone use, using IVMS, and journey management. The accuracy of some responses may also have been affected by recall bias. To address the shortcomings of self-reported behaviors, objective data on driving behaviors such as those obtained through IVMS would have provided valuable comparisons to self-reports. Researchers were unable to assess correlation of employer policies within the company sites, due to representation of additional subcontractor companies that were not accounted for in the dataset. The convenience sample strategy used by researchers did not allow the results to be generalized to the U.S. OGE industry.

Additionally, while respondents reported both the frequency of risky driving behaviors and their history of having been in a motor vehicle crash while at work, the survey did not ask respondents to link self-reported behaviors to these prior crashes. It also did not ascertain whether the reported risky driving behaviors occurred while the worker was driving during the workday or while using the company vehicle to commute. Because the survey asked workers to report frequency of behaviors while driving a company vehicle, it is possible that those who used a company vehicle to commute responded with both commuting and workday driving behaviors in mind.

5. Conclusion and practical applications

This survey of OGE workers who drive for work identified several risky driving behaviors, including a high frequency of hands-free cell phone use. Greater self-reported frequencies of certain risky driving behaviors, such as handheld and hands-free cell phone use, were associated with a lack of an employer ban on the corresponding behavior. Several factors were associated with a greater likelihood of reporting risky driving behaviors, including long

work hours, long commutes, prior history of a work crash, and a lack of employer motor vehicle safety policies. Employer interventions, such as total bans on cell phone use while driving, speed management, journey management, and in-vehicle monitoring systems have been recommended to reduce crash risk and promote safe driving among OGE workers. Effectiveness and implementation studies on total cell phone bans, journey management, and other employer interventions in OGE are needed to help develop scalable programs based on company resources. Other future research could investigate factors that influence the use of hands-free cell phones or other risky driving behaviors among workers, ideally by supplementing self-reported or qualitative data with objective measures from IVMS.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

The authors thank Jennifer Bell, PhD, National Institute for Occupational Safety and Health, Division of Safety Research, Ken Scott, PhD, MPH, National Institute for Occupational Safety and Health, Western States Division, and Ryan Hill, MPH, National Institute for Occupational Safety and Health, Western States Division, for their thoughtful reviews of the manuscript. The authors also thank the employers and workers who participated in the survey.

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Table 1

Driver characteristics and employer motor vehicle safety policies among respondents who drove for work, by company type (n = 363).

	Total n (%)[A]	Company type	
		Operator (n = 91) n (%)[A]	Contractor[B] (n = 266) n (%)[A]
Age (mean years)	37.7	38.1	37.7
Race and ethnicity ***			
Hispanic or Latino	107 (29.7)	9 (10.0)	97 (36.7)
Non-Hispanic, White	224 (62.2)	74 (82.2)	145 (54.9)
Non-Hispanic, Non-White	29 (8.1)	7 (7.8)	22 (8.3)
Years driving for work			
1 year or less	55 (15.5)	7 (7.7)	46 (17.8)
>1 to 5 years	82 (23.1)	24 (26.4)	56 (21.7)
>5 to 10 years	93 (26.2)	24 (26.4)	68 (26.4)
More than 10 years	125 (35.2)	36 (39.6)	88 (34.1)
Ever been in a work crash [C]	34 (9.6)	9 (10.0)	24 (9.3)
Employer motor vehicle safety policies			
Bans texting while driving	314 (89.2)	81 (89.0)	228 (89.4)
Bans handheld cell phone use while driving	278 (78.5)	68 (74.7)	208 (80.9)
Bans hands-free cell phone use while driving	122 (34.7)	30 (33.0)	92 (36.1)
Has driver safety orientation at hire	270 (77.1)	71 (78.0)	194 (76.4)
Uses in-vehicle monitoring systems (IVMS) ***	248 (70.7)	85 (93.4)	159 (62.6)
Has journey management policy ***	164 (46.7)	23 (25.3)	139 (54.7)

* p <.05

** p <.01

*** p <.001 based on chi-square tests.

[A] Missing responses were removed from the denominator for percent calculations.

[B] Contractors are workers who reported company type as drilling contractor, servicing company, or other.

[C] Respondents were asked: “In your working career driving in the oilfield, have you ever been in a crash as a driver or passenger in which there was a death, injury requiring medical attention, or a vehicle was towed?”.

J Safety Res. Author manuscript; available in PMC 2024 September 01.

Table 2

Percentages of risky driving behaviors[A] by driver characteristics and employer motor vehicle safety policies among respondents who drove for work (n = 363).

	Driving 10 or more mph over the speed limit		Talking on handheld cell phone		Talking on hands-free cell phone		Sending text messages		Not always wearing a seat belt	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Total	75.1	24.9	75.9	24.1	40.2	59.8	82.1	17.9	87.8	12.2
Race and ethnicity										
Hispanic or Latino	85.0	15.0 *	83.3	16.7 *	45.1	54.9	84.2	15.8	89.1	10.9
Non-Hispanic, White	69.9	30.1 *	71.5	28.5 *	37.1	62.9	81.0	19.0	87.3	12.7
Non-Hispanic, Non-White	78.6	21.4 *	82.1	17.9 *	50.0	50.0	82.1	17.9	85.7	14.3 D
Company type										
Operator	79.1	20.9	65.9	34.1 **	31.9	68.1 *	72.5	27.5 **	89.0	11.0
Contractor B	73.5	26.5	80.9	19.1 **	43.8	56.3 *	86.3	13.7 **	87.8	12.2
Ever been in a work crash C										
Yes	64.7	35.3	61.8	38.2 *	11.8	88.2 ***	67.6	32.4 *	79.4	20.6 D
No	76.5	23.4	77.4	22.6 *	43.2	56.8 ***	84.1	15.9 *	89.2	10.8
Employer motor vehicle safety policies										
Bans texting while driving										
Yes	76.7	23.3 *	78.2	21.8 **	40.5	59.5	83.3	16.7	89.0	11.0 *
No or Don’t know	59.5	40.5 *	55.3	44.7 **	42.1	57.9	71.1	28.9	76.3	23.7 *D
Bans handheld cell phones										
Yes	76.2	23.8	80.1	19.9 ***	43.3	56.7 *	83.6	16.4	88.7	11.3
No or Don’t know	70.7	29.3	60.5	39.5 ***	30.3	69.7 *	76.3	23.7	84.0	16.0
Bans hands-free cell phones										
Yes	75.6	24.4	78.3	21.7	67.5	32.5 ***	85.0	15.0	85.0	15.0
No or Don’t know	74.6	25.4	74.3	25.7	26.5	73.5 ***	80.4	19.6	89.1	10.9
Has driver safety orientation at hire										

	Driving 10 or more mph over the speed limit		Talking on handheld cell phone		Talking on hands-free cell phone		Sending text messages		Not always wearing a seat belt	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Yes	75.7	24.3	78.1	21.9	42.8	57.2	84.0	16.0	89.6	10.4*
No or Don't know	73.4	26.6	70.0	30.0	33.8	66.3	77.5	22.5	81.0	19.0*
Uses in-vehicle monitoring systems (IVMS)										
Yes	75.5	24.5	75.2	24.8	41.1	58.9	82.9	17.1	90.7	9.3*
No or Don't know	73.5	26.5	77.0	23.0	38.0	62.0	80.0	20.0	80.8	19.2*
Has journey management policy										
Yes	79.4	20.6	81.4	18.6*	48.8	51.3**	87.5	12.5*	88.8	11.3
No or Don't know	70.9	29.1	70.8	29.2*	33.0	67.0**	77.3	22.7*	87.0	13.0

*p <.05

**p <.01

***p <.001 based on chi-square tests.

[A]For the driving behaviors "driving 10 + mph over the speed limit," "talking on handheld cell phone," "talking on hands-free cell phone," and "sending text messages while driving," the response category "Yes" includes those who responded Always, Often, and Sometimes, and the reference category "No" includes those who responded Rarely and Never. For the driving behavior "not always wearing a seat belt," the response category "Yes" includes those who responded Often, Sometimes, Rarely, and Never to how often they wore a seat belt while driving their company vehicle, and the reference category "No" includes those who responded Always.

[B]Contractors are workers who reported company type as drilling contractor, servicing company, or other.

[C]Respondents were asked: "In your working career driving in the oilfield, have you ever been in a crash as a driver or passenger in which there was a death, injury requiring medical attention, or a vehicle was towed?".

[D]Chi-square results for expected cell sizes < 5 in these cells may be unreliable.

Table 3

Multiple logistic regression results assessing risky driver behaviors among respondents who drove for work (n = 363).

Outcome: Risky Driving Behavior[A]	Predictor: Driver and Workplace Characteristics[B]	z-value	OR (95% CI)
Driving 10 or more mph over the speed limit	Race and ethnicity: Hispanic or Latino	−2.95	**0.35 (0.17, 0.70)** **
	Race and ethnicity: Non-Hispanic, Non-White	−1.30	0.47 (0.15, 1.46)
	Number of hours worked per day	2.32	**1.18 (1.03, 1.35)** *
	Employer does not ban texting while driving	1.97	**2.15 (1.00, 4.59)** *
Talking on handheld cell phone	Company type: contractor	−2.83	**0.46 (0.27, 0.79)** **
	Employer does not ban texting while driving	2.97	**2.97 (1.45, 6.08)** **
Talking on hands-free cell phone	Company type: contractor	−2.31	**0.47 (0.25, 0.89)** *
	Age (years)	2.06	**1.03 (1.00, 1.05)** *
	Total daily commuting time (hours)	3.38	**1.50 (1.18, 1.90)** ***
	Ever been in a work crash[C]	2.73	**5.09 (1.58, 16.41)** **
	Employer does not ban hands-free cell phones	6.70	**8.08 (4.38, 14.88)** ***
Sending text messages	Company type: contractor	−2.27	**0.48 (0.26, 0.91)** *
	Age (years)	−2.37	**0.97 (0.94, 0.99)** *
	Ever been in a work crash[C]	2.09	**2.57 (1.06, 6.22)** *
	Employer has no journey management policy	1.68	1.73 (0.91, 3.27)
Not always wearing a seat belt	Total daily commuting time (hours)	1.50	1.22 (0.94, 1.57)
	Employer does not use in-vehicle monitoring systems	1.88	2.08 (0.97, 4.44)

Note: OR = odds ratio; CI = confidence interval.

* p <.05

** p <.01

*** p <.001, based on multiple logistic regression.

[A] For the driving behaviors “driving 10 + mph over the speed limit,” “talking on handheld cell phone,” “talking on hands-free cell phone,” and “sending text messages while driving,” the response category “Yes” includes those who responded Always, Often, and Sometimes, and the reference category “No” includes those who responded Rarely and Never. For the driving behavior “not always wearing a seat belt,” the response category “Yes” includes those who responded Often, Sometimes, Rarely, and Never to how often they wore a seat belt while driving their company vehicle, and the reference category “No” includes those who responded Always.

[B] The reference group for company type is operator. For all employer motor vehicle safety policies, the reference group includes those who have the policy. The following are continuous variables: number of hours worked per day and total daily commuting time.

[C] Respondents were asked: “In your working career driving in the oilfield, have you ever been in a crash as a driver or passenger in which there was a death, injury requiring medical attention, or a vehicle was towed?”.