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Incidence of Workers' Compensation Claims in Opioid-Using Truck Drivers

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Abstract

Objective: This study examines the relationship between opioid use prevalence and subsequent filing of workers' compensation claims.

Methods: A retrospective cohort study design was utilized to examine data from drivers' initial commercial driver medical exam, employment data, and workers' compensation claims data.

Results: Data from 57,733 over 7 years were analyzed. Drivers who reported opioid use at their initial medical exam visit filed subsequent workers' compensation claims 1.81 times sooner ($p = 0.0001$; 95% CI 1.34, 2.44) than drivers who did not report opioid use at their CDME when controlling for age, gender, BMI, and diastolic blood pressure.

Conclusions: These findings provide information that may aid in improving regulations to control for incidents, training programs to inform professional drivers of factors that increase accident risk and educating prescribers about increased risks of injury among opioid-using drivers.

Keywords

Truck Driver; Commercial Driver; Trucker; Commercial Motor Vehicle Driver; Transportation; Commercial Driver Medical Exam; DOT Exam; Opioid Use; Opioid; Workers Compensation Claim; Hazard Ratio; Cohort; Retrospective Cohort; Epidemiology

Introduction

With more than 3.5 million truck drivers in the United States, truck drivers make up 2.3% of all employed persons in the United States (1) and have a substantial impact on the global economy. The demands exerted by the need for commercial transportation and shipping requires a healthy occupational population (2). However, truck drivers face a range

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This research has been approved by the Institutional Review Board of the University of Utah

Conflicts of interest:

Dr. Thiese has been a consultant for the American College of Occupational and Environmental Medicine and Reed Group for development of the Best Practice Guidelines, Union Pacific Railroad, Association of American Railroads and is a part owner in SafeLane Health. The other authors have no declared potential conflicts of interest.

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of occupational injury risks, including those that results in vehicle crash or increases the likelihood of crash. In 2012, the Bureau of Labor Statistics reported that rates of fatal and non-fatal injuries and illnesses amongst truck drivers were greater than the average of other occupations in private industry (3). Truck drivers experience a high prevalence of factors that have been linked to increased injury, including high rates of depression, obesity, and cardiovascular disease among drivers, (4–11). Driver accidents have been associated with driver fatigue, obesity, and sleep apnea (4, 6, 12–15). Furthermore, truck drivers are at heightened risk for injuries associated with the non-driving aspect of their jobs, such as falls, cargo handling, and entering and exiting the truck itself (16). Resulting injuries are typically musculoskeletal (e.g., sprains and strains), which truck drivers experience at a rate 3.5 times greater than in the general population (17). This high rate of musculoskeletal injuries may, in particular, heighten the prevalence of opioid use among the truck driver population (18), even though there are recognized increased risks for workers in safety-sensitive positions generally (19, 20).

Opioid analgesics are often the first line of treatment for musculoskeletal injuries in spite of evidence-based guidelines that advise otherwise (21, 22). This early prescription of opioids following injury has been linked to long-term opioid use, opioid-related harms, and dose escalation (23). Opioid use has been linked to increased time off work, increased workers' compensation costs, and increased injuries in safety-sensitive tasks (24, 25). Among truck drivers, opioid analgesics use has been associated with unsafe actions (26) that may be linked to increased injury rates. Given the increased rate of injury in the trucking industry and associations between opioid use and workplace accidents, this research aims to investigate whether truck drivers who use opioid analgesics are more likely to file for workers' compensation claims compared with those who do not use opioid analgesics.

This study will examine the prevalence of opioid use and temporal relationship with subsequent the filing of workers' compensation claims using data sets containing drivers' initial Commercial Driver Medical Examinations (CDME), which are occupational medical exams required every 12 to 24 months and performed by licensed medical examiners to determine medical fitness to perform their job. Truck drivers must pass a CDME in order to legally perform their job duties. The specific aim of this study is to investigate whether truck drivers who reported current opioid analgesic use at their initial CDME visit were more likely to file workers' compensation claims sooner than truck drivers who did not report current opioid analgesic use at their initial CDME, after controlling for potential confounders.

Methods

Study Design

These analyses are part of the largest retrospective-cohort study performed among CMV drivers. Only the methodological details relevant to this manuscript are presented here. Institutional Review Board approval was obtained from the University of Utah (IRB# 35889). This retrospective cohort study examined data collected between 2005 and 2012. The data utilized merged two large datasets: one containing medical data comprised of CDME results and employment dataset containing workers' compensation claims, periods

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of employment, and other relevant information. The employment dataset was provided by a large, nationwide trucking company in the United States. Datasets were merged in order to obtain data for drivers who had both a) completed initial CDME records on in the medical database, and b) employment data including hire date, termination date, if a workers' compensation claim was filed, the date the workers' compensation claim was filed, and the circumstances surrounding the claim, such as mechanism of injury and type of injury. Initial CDME refers to the earliest CDME visit on file during between 2005 and 2012 and does not necessarily indicate that it is the first CDME performed upon hire. Prior publications from this study have additional details about this study, however this manuscript contains all pertinent methodological details. (6–8, 15).

Study Participants

Participants were truck drivers employed by a large, national trucking company between 2005 and 2012. Drivers who were 18 years or older, seen for a CDME visit, and who were employed by the trucking company were eligible for study inclusion. However, drivers who did not have CDME or employment data, or had erroneous body mass indices (BMI) of less than 10 or greater than 89, were deleted from the dataset and excluded from the study to minimize bias.

Commercial Driver Exam Data

CDMEs were performed by qualified examiners on commercial truck drivers licensed in all 48 of the contiguous states. These exams are performed both on new commercial drivers as well as on those drivers renewing Commercial Driver Licenses. The database contains commercial motor vehicle drivers who are employed by both private carriers as well as independent owner/operator drivers. The majority of the drivers are classified as over-the-road or long-haul drivers.

Some of these methods have been reported in other articles using data from this same data set. (6–8, 15). CDMEs were recorded by the examiner and their support staff into a computerized database. The use of this system helps minimize missing data and errors that may occur with paper records. Study timeline for CDME data included all exams conducted by the participating examiners from January 1, 2005 to October 31, 2012. The examination included all of the required the Federal Motor Carrier Safety Administration (FMCSA) Commercial Driver fitness determination form 649-F (6045). This form collects self-reported information from the driver regarding sociodemographic data, including age and gender, and medical history relevant to commercial driving safety concerns. There are also measurements recorded on this form which include anthropometry, blood pressure, heart rate, urinalysis, vision screening, and hearing whisper screening test. There were a small number of drivers who had more than one CDME in the database. If this occurred, we excluded subsequent exams and only analyzed the first examination. These data have also been described in other papers using CDME data (6–8, 15, 27).

Employment and Workers' Compensation data

Employment data including hire and termination data from a large trucking firm were obtained independently from the CDME data. This company also provided workers

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compensation claims for the same time frame as the CDME data. The firm contracted with the medical exam company providing the CDMEs. Therefore, there was a high level of overlap between the CDME drivers and the employees of the large trucking firm. Drivers were excluded if they were employed by the firm for fewer than 7 days. Employment and workers' compensation data were merged with CDME data by driver name, birth date, and employee ID number. Two researchers (LSS and MST) independently assessed each claim to determine the mechanism of injury and categorized claims into Acute, Motor Vehicle Crash, Musculoskeletal and Other using a pre-defined set of criteria and without looking at opioid use data. Discrepancies, which were rare, between the two researchers were discussed and reconciled between the two researchers. Acute claims were typically falls or struck by injuries. Musculoskeletal disorders were often low back pain and shoulder pain. The other category included all other claims that did not fit into the other three categories and included mental health, infectious diseases and insect bites. These categories were not mutually exclusive.

Statistical Methods

All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC). The dataset analyzed included all complete CDMEs from individual, non-overlapping commercial motor vehicle drivers who had employment data. Cox proportional hazard modeling was used to examine time-to-event relationships between current opioid analgesic use reported at the CDME and workers' compensation claims. Hazard ratios (HR) and 95% Confidence Intervals (95% CI) were calculated using the Cox models. The outcome was filing a workers' compensation claim and the time from the start date to the date the claim was filed. Each participants' starting date was either the hire date or the date of the first CDME, whichever was later. Workers were censored at the time employment was terminated or the end of the study period. Time-to-event was calculated in days as the difference between the start date and either the date of the workers' compensation claim (event date) or the censor date. Potential confounding variables included in analyses consisted of age, sex, BMI, tenure with the company, chronic diseases (including diabetes and heart disease), head injuries, history of stroke, and history of seizures. Each of these variables have been reported to be confounding variables in analogous studies examining truck drivers crashes and were therefore included as potential covariates in the Cox model assessing relationships between opioid use and subsequent WC claims. Age, gender and BMI were always included in the adjusted models, and each additional potential confounder was introduced into the Cox model to assess for confounding by that variable on the relationship between opioid use and WC claims. The decision to force age, gender and BMI into the proportional hazard model was made a priori based on the need to control for these confounders regardless of their change in the relationship between opioid use and WC claims. Other confounders were introduced into the model and were retained if the Akaike information criterion (AIC) was lower, indicating a better model fit and there was a change in the HR for the relationship between opioid use. Assessment of the proportional hazard assumption was made in two ways. THe fist is by examining graphical plots of the data, including Kaplan-Meier curves, Cumulative Martingale function form, and Standardized Score Process Plot. The second is testing for a non-zero slope in a generalized linear regression of the scaled Schoenfeld residuals and Cumulative Martingale-based residuals on functions of time. A robustness evaluation was

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also performed using logistic regression to estimate the Relative Risk for the relationship between opioid use and WC claims. The principal results are hazard rate adjusted for potential confounders. An alpha level of $p < 0.05$ was chosen to determine statistical significance.

Results

The dataset containing CDME data had a total of 96,161 examinations, 8,345 of which were excluded from analyses for multiple reasons, 7,939 were excluded because they were a second exam on the same participants, six were a third exam on the same participant, and 400 were excluded for missing or incorrect health data. The remaining 88,246 CDMEs. These were merged with company data, and there was an overlap of 57,733 truck drivers who had both complete health data and employment data were included in analyses.

Most study participants were male (95.43%) and the mean age was approximately 46. Most were obese, with an average BMI of 31.60 kg/m^2. Average company tenure was 0.78 ± 1.39 years. See Table 1 for complete demographic information. At their initial CDME, a total of 57,182 (99.05%) individuals reported never having used or been prescribed opioids while 551 (0.95%) reported using opioids at the time of their CDME. There were a total of 2,631 workers' compensation claims filed. See Table 2 for the mechanism of injury for workers' compensation claim frequencies; mechanism of injury is not mutually exclusive.

Table 3 contains raw data related to the days to a workers' compensation claim or to when drivers become censored at the end of the study period or upon termination of employment. Those drivers who reported opioid use at their CDME were 1.74 times more likely to file a new workers' compensation claim ($p = 0.001$; 95% CI 1.26, 2.38) than those who did not. Proportional hazard analyses (see Table 4) found that truck drivers who reported current opioid use at their initial CDME visit filed a workers' compensation claim 1.81 times sooner ($p = 0.0001$; 95% CI 1.34, 2.44) than drivers who did not report current opioid use at their initial CDME when controlling for age, gender, BMI, and diastolic blood pressure. Additionally, several covariates were statistically significantly related to having a Workers' Compensation Claim. Women filed workers' compensation claims 1.53 times sooner than men ($p < 0.0001$; 95% CI 1.30, 1.80). With each kg/m^2 increase in BMI, there was a HR=1.011 (95% CI 1.00 6, 1.017). With each increase in mmHg of diastolic blood pressure, the HR= 1.012 (95% CI 1.007, 1.017). Age as a continuous variable was not statistically significantly related to opioid use (HR = 1.00, 95% CI 0.996, 1.005). These relationships remained after statistical adjustment. The other potential confounders of tenure with the company, chronic diseases (including diabetes and heart disease), head injuries, history of stroke, and history of seizures that were assessed were not significantly associated with filing a WC claim, nor did they provide a better proportional hazard model for the relationship between opioid use and WC claims.

The survival curve shown in Figure 1 demonstrates differences in time to workers' compensation claim between drivers who reported using opioid analgesics and drivers who did not report opioid use at their CDME visit. There exists a statistically significant difference ($p = 0.0001$) indicating that those drivers who reported using opioids at their

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CDME visit experienced workers' compensation claims significantly sooner than their non-opioid counterparts by nearly twofold. Other graphs were generated for assessment of proportional hazard assumption and to investigate the relationships between opioid use and WC claims but were not included in this manuscript because they did not provide material improvement in the understanding or interpretation of the relationship between opioid use and WC claims. Proportional hazard assumption was met when assessed both graphically and statistically.

Post-hoc examination of tenure with the company as a potential proxy for the measure of driving experience were conducted. These included removing all crash related WC claims from the data and re-analyzing the data. We also excluded drivers with less than 1-year duration of tenure with the company and re-analyzed the data. The relationships were similar to the original analyses, however with significantly less statistical power, resulting in wider confidence intervals and less statistical significance.

Discussion

Results indicate that truck drivers with reported opioid use were more likely to file a workers' compensation claim significantly sooner than their non-opioid using peers after controlling for age, gender, BMI, and diastolic blood pressure. Women were found to file workers' compensation claims sooner than males, and drivers with increased BMI and increased diastolic blood pressure were also more likely to file a workers' compensation claim sooner than drivers with lower BMI and lower diastolic blood pressure. By their nature, workers' compensation claims indicate that workers have a health issue and are an important outcome in occupational health and safety. Furthermore, workers' compensation claims lead to lost work time and modified duty, thus impacting health due to a degree that inhibits how and when work is completed, which in turn negatively impacts business revenue (28, 29). These claims are generally considered a more selective outcome than clinical records or self-reported symptoms (30, 31). Additionally, the costs associated with these claims can have an impact on business. Therefore, reduction of workers' compensation claims can be considered an improvement in driver health. Opioid use in relationship to claims can also have an impact on claim duration and cost, with some studies reporting higher costs associated with claims involving opioids as a treatment as compared to those without opioids (32–34). This study is the first to investigate the temporal relationship between truck driver opioid use and subsequent workers' compensation claims. Other studies have reported statistically significant relationships between opioid use and Workers' Compensation Claims (35, 36). Few studies assessed relationships between other factors and Workers' Compensation Claims among truck drivers (37–40). Although, research has demonstrated the association between opioid use and increased unsafe driver actions among commercial drivers (26), the overarching literature investigating opioid use in the truck driver population is scant. Thus, further investigation of the relationship between prescription drug use and commercial driving outcomes is needed. Additionally, these results indicate a need for continued medical support throughout the opioid treatment period (41), as well as a need for practitioners to question whether opioid analgesics are proper for treating pain in workers in safety-sensitive occupations (19).

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There is evidence that the CDME was not an effective screening tool for identifying if drivers have medical conditions that could affect their ability to safely operate a commercial motor vehicle (42, 43). Drivers have motivation to not report medical conditions that may medically limit or disqualify them from obtaining a commercial driver license. These conditions include sleep apnea, high blood pressure, and opioid use. This systematic underreporting would likely underestimate the magnitude of the relationship between opioid use and WC claims that is identified in this paper.

Moreover, opioids use among commercial motor vehicle drivers is proscribed. CMV Drivers are subject to systematic urinalysis-based drug testing by their employers. A majority of drivers are tested upon being hired, after a crash and at random time-intervals throughout their employment. This environment raises the probability that there is under-reporting of opioid use.

There are many strengths to this study. The largest strength is the demonstration of the temporal relationship between opioid use and subsequent workers' compensation claims among these drivers. Additional strengths of this study include a large sample that is representative of drivers at large primarily truckload motor carriers, which make up a key part of the trucking industry. As well as objective measures of potential confounders and linkage between medical and workers' compensation study data. However, this study is not without limitations. Due to the sources of data, there is limited availability of information regarding other variables, such as years of driving experience. Moreover, as with any data collected from multiple sources, one cannot be sure that all data were collected or maintained with the same level of quality. Medical examiners may rely on their own subjective judgments at times when recording medical data. At the time of filing a workers' compensation claim, opioid use status was self-reported. Likewise, some of the data collected on CDME report forms are self-reported, thus introducing the risk of potential biases, such as recall or reporting bias. However, all data collected as part of the CDME done so with attestation to complete accuracy under penalty of law, thus reducing reporting bias. Anecdotal evidence suggests there may be underreporting of opioid use as opioid use generally bears a recommendation for a limited duration of certification. However, no data exists to quantify the potential of underreporting of opioid use in this population. It is possible that, due to the potential for underreporting, these may be an underestimate of use in this population as well as an underestimate of the twofold relationship between opioid use and workers' compensation claims. Due to the fact that opioid use is generally grounds for CDME failure, it is difficult to obtain an accurate estimate of the number of truck drivers who actually use opioids. An additional weakness of these data are uncontrolled confounding. The largest of which would be driving experience (13, 44, 45). Prior studies have demonstrated that driving experience plays a significant role in factors associated with having a WC claim, specifically crashes. The metric of duration of employment with the company was assessed as potential marker for driving experience, however it was not significantly related to having a WC claim, nor did it improve the proportional hazard model for the relationship between opioid use and WC claims. This may be due, at least in part, to the relatively high turnover rates in the trucking industry of 94% (46). This high turnover may mean that the duration of employment with a single company is a poor proxy for the actual driving experience that the driver has prior to joining the company. Unfortunately,

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these data do not have a more suitable measure for driving experience. This may be due to the fact that a relatively small proportion of the total WC claims were related to a crash (335/2631). Post-hoc evaluation of the relationship between tenure with the company and WC claims did not further elucidate the relationships between opioid use and WC claims. Future research that more deeply investigates the relationship between opioid use in commercial truck drivers and workers' compensation claims is warranted.

The results of this study provide information that may aid in improving regulations to control for incidents of this nature, educational programs and trainings to inform professional drivers of factors that increase the risk of accidents (e.g., opioid use), and educating prescribers and medical professionals who perform occupationally required exams, such as CDMEs, about increased risks of injury and illness among opioid-using drivers. Additionally, this study emphasizes the importance of CDME standardization in provider reporting, as inconsistent reporting may lead to increased risk of driver accidents resulting in workers' compensation claims.

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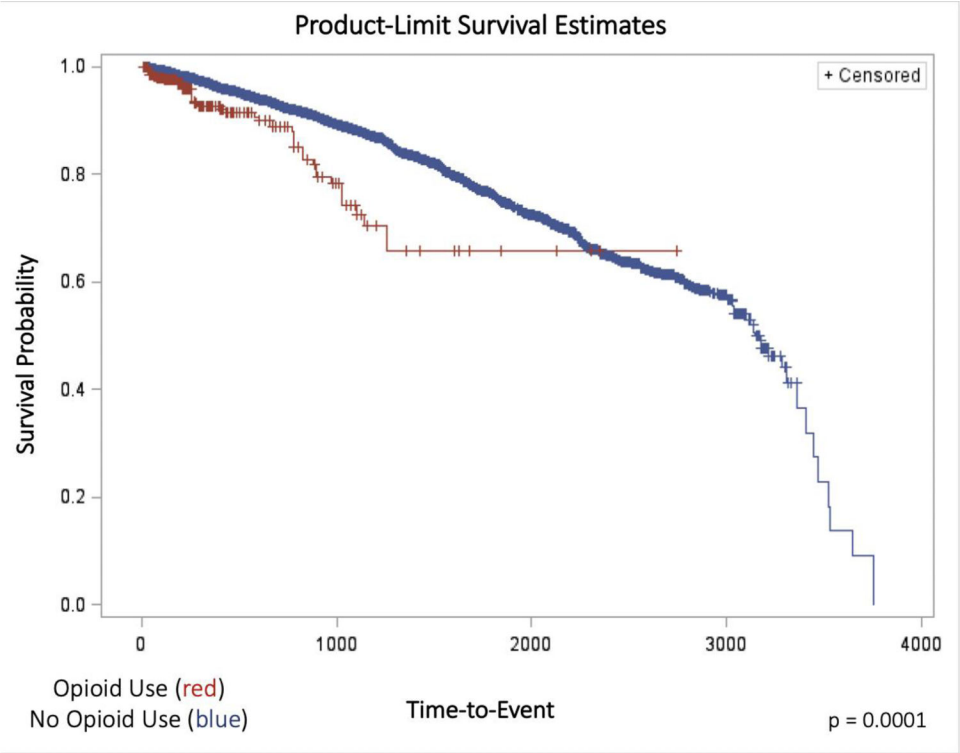

Figure 1.
Survival Curve for having a workers compensation claim stratified by opioid use

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Table 1.

Demographic Information

Variable Frequency (%) or Mean (SD)	Current Opioid Use (*n* = 551)	No Opioid Use (*n* = 57,182)	Total (*n* = 57,733)
Sex			
Male	511 (92.74)	54,585 (95.46)	55,096 (95.43)
Female	40 (7.26)	2,597 (4.54)	2,637 (4.57)
Age (years)	45.82 (10.21)	45.92 (10.32)	45.95 (10.33)
BMI (kg/m^2)	32.38 (7.14)	31.71 (7.09)	31.60 (7.16)
Diastolic Blood Pressure (mmHg)	81.31 (7.67)	80.64 (7.96)	80.72 (8.11)
Systolic Blood Pressure (mmHg)	126.88 (12.72)	126.16 (12.77)	126.30 (13.07)
Company Tenure (years)	1.06 (1.43)	1.06 (1.53)	1.06 (1.53)

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Table 2.

Mechanism of Injury for Workers' Compensation Claim Frequencies

Event Type	Frequency (%)	Incidence Rate (per 1,000 person-years)
Crash related workers' compensation claim	335 (0.60)	5.7
Acute workers' compensation claim	1,915 (3.36)	32.4
Musculoskeletal workers' compensation claim	1,581 (2.79)	26.8
Other workers' compensation claim	124 (0.22)	2.1
Any workers' compensation claim	2,631 (4.56)	44.5

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Table 3.

Time-to-Event Data (in days)

	No Opioid Use Without a Claim	No Opioid Use with a Claim	Opioid Use Without a Claim	Opioid Use with a Claim
Mean (SD)	352.21 (521.27)	832.45 (707.04)	350.72 (512.01)	513.28 (401.34)
Median	131.40	635.00	131.40	401.00
Mode	14.60	515.00	7.30	36.00
Interquartile Range	365.00	1024.00	412.45	688.00
N	54,594	2,588	508	43

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Table 4.

Opioid Use Hazard Ratios by Event Type

Event Type	Relative Risk	95% Confidence Interval
Any Workers' Compensation Claim (Adjusted[1])	1.74*	1.26, 2.38
	Hazard Ratio	**95% Confidence Interval**
Any Workers' Compensation Claim (Unadjusted)	1.83*	1.35, 2.47
Any Workers' Compensation Claim (Adjusted[1])	1.81*	1.34, 2.44
Crash (Adjusted[1])	0.33	0.05, 2.36
Acute (Adjusted[1])	2.08*	1.49, 2.89
Musculoskeletal (Adjusted[1])	2.03*	1.40, 2.92
Other (Adjusted[1])	0.89	0.12, 6.37

*$p \leq 0.001$

[1]Adjusted models adjusted for age, gender, BMI, and diastolic blood pressure