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Examining the impact of opioid analgesics on crash responsibility in truck drivers involved in fatal crashes

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ABSTRACT

Introduction: Commercial motor vehicle (CMV) drivers, particularly drivers of large trucks continue to be a population of concern regarding traffic safety despite the reduction in large truck crash rates over the past decade. Medication and drug use while driving is one important risk factor for large truck crashes. Work-related exposures, such as vibration, manual handling and poor ergonomics contribute to an increased risk for injuries and chronic conditions and are common reasons for opioid analgesic (OA) use by CMV truck drivers. The objectives of this study were to examine the role of OA use in CMV truck drivers involved in fatal crashes by: (a) generating prevalence estimates of OA use; (b) documenting the relationship between OA use and crash responsibility.

Methods: Case-control study using logistic regression to compare Fatality Analysis Reporting System (1993–2008) record of one or more crash-related unsafe driver actions (UDAs – a proxy measure of responsibility) between drivers with a positive drug test and drivers with a negative drug test for OA, controlling for age, other drug use, and driving history.

Results: The annual prevalence of OA use among all CMV drivers of large trucks involved in fatal crashes did not exceed 0.46% for any year in the study period and mostly ranged between 0.1 and 0.2%. Male truck drivers using OA had greater odds of committing an UDA (OR: 2.80; 95% CI: 1.64; 4.81). Middle-aged users had greater odds than younger or older users.

Conclusion: The results of our study indicate that the presence of OAs is associated with greater odds of committing an UDA. This association may have implications for the commercial transport industry and traffic safety. However, the limited prevalence of OA use is encouraging and further research is needed to address the limitations of the study.

1. Introduction

Commercial motor vehicle (CMV) drivers, particularly drivers of large trucks continue to be a population of concern regarding traffic safety despite the reduction in large truck crash rates over the past decade [1]. Occupational fatality rates for the transport industry are consistently among the highest [2], and in large truck crashes involving multiple vehicles there is a tendency for the occupants of the other vehicle(s) to be severely injured or killed [3–5]. There are also significant economic costs incurred by large truck crashes through medical costs and insurance settlements, lost productivity, and property damage [6].

Medication and drug use while driving is one important risk factor for large truck crashes. Because driving is a complex activity that involves a range of cognitive and psychomotor functions, both licit and illicit drugs effect on the central nervous system can impair driving ability [7]. A recent large-scale study on large truck crash causation found that prescription drug use and over the counter drug use was among the top ten factors associated with crashes out of hundreds of factors examined [8]. Nonetheless, the impact of drug use on driving performance has received little research attention [4], despite the potential for impairment. Opioid analgesics (OAs) are one of the drug groups warranting further attention.

Opioid analgesics are most commonly used to treat pain but they are also used in substitution therapy to treat substance abuse [9]. The term opioid refers to naturally occurring, synthetic and

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semi-synthetic compounds that are derived from the opium of the poppy plant, such as codeine, morphine, oxycodone and hydromorphone [9]. According to the American Chronic Pain Association (ACPA), common and anticipated central nervous system (CNS) side effects of OAs are thought and memory impairment, drowsiness and nausea, mild sedation, and impaired judgment and co-ordination. The ACPA warns against driving until tolerance or a baseline is reached [9].

With respect to OA use and driving performance, there are several reasons why commercial large truck drivers are a population of interest. Truck drivers experience work-related exposures such as vibration, manual handling and ergonomic factors that may increase the risk for injuries and chronic conditions (e.g., lower back pain and musculoskeletal disorders) [10–12] that are typically treated with OAs. In fact, treatment for chronic pain has been recognized as the most common reason for opioid use by CMV truck drivers [4]. Also, fatigue has been recognized as a risk-factor for large truck crashes [5,8,13] and the side effects associated with OAs, such as sedation, might compound the risk of crashes. Finally, there is some evidence that drugs are used by many truck drivers to cope with boredom and other aspects of the job [14].

Beyond these job-related factors, there have been dramatic increases in the prescribing and use of OAs in the general population over the last two decades [4,15–17], as well as some indication of an increased prevalence of detection of opioids among drivers in the general population [18,19]. However, studies of opioid use among CMV truck drivers have found a low prevalence of opioid use (generally not exceeding 4.0% of the study sample) compared to other types of drugs such as stimulants, depressants and cannabinoids [13,14,20,21]. Prevalence studies that have relied on the voluntary provision of biological samples [14,21] may have resulted in the under-detection, and hence underestimation of prevalence rates. Conversely, the use of fatally injured drivers as a study sample population provides an overestimate of prevalence rates within the wider truck driver population [13]. Finally, these prevalence studies [13,14,20,21] have not addressed long-term trends and may not accurately reflect current prevalence rates, especially considering the recent dramatic increase in the prescribing and use of OAs in the general population. It should be noted that even a low prevalence of opioid use can translate into a considerable absolute number of opioid users, given that, in 2012, there were 5,700,000 CMV drivers operating in the U.S. alone [22]. Based on this figure, a prevalence rate of 2.0% among U.S. CMV drivers is equivalent to 114,000 opioid users.

Experimental studies investigating the effect of OAs on driving ability have used driving simulators, on-road driving, and cognitive and psychomotor tests specifically for driving. The key findings from this research are that therapeutic long-term stable doses of opioids do not negatively impact driving ability [23–28], but a change in dosing of opioid medication (30% increase in dose) results in significant cognitive impairment [23]. Furthermore, administering an OA to healthy individuals not previously exposed to OAs did not significantly affect driving ability, but study participants had significantly reduced pupil size and they reported that significantly more effort was needed to perform the driving test and reported significantly more sedation and reduced alertness [29]. But there are several limitations of the experimental research regarding the effect of OAs on driving ability, such as small sample sizes and insufficient statistical power; the use of healthy and young study participants; insufficient doses to elicit effects; and highly controlled environments that do not always reflect actual driving conditions and experiences.

There is scant research from observational studies investigating the association between OA use and crash risk and crash responsibility among CMV drivers of large trucks. We found only one study regarding the association between opioid use and crash risk among CMV drivers. Howard et al. [30] collected self-reported information on crash history, drug and alcohol use from a sample of CMV drivers and found that drivers that reported using narcotic analgesics had greater odds of being involved in a crash than unexposed drivers after adjusting for age, hours of driving and alcohol intake (Adjusted OR: 2.40; CI: 1.46; 3.92). There are, however, a number of observational studies, using samples from the general population, that have investigated the effect of OA use on crash risk and crash responsibility.

A review by Fishbain et al. [7] concluded that there was consistent evidence that opioids are not associated with crashes; but the methodological shortcomings of many of the studies reviewed, such as the lack of control group, weaken their conclusion. A meta-analysis by Monárrez-Espino et al. considered studies from the period between 1991 and 2012 specifically for older drivers ($\geq$55 years old) [31]. They argued that the evidence fails to provide convincing support that opioids are associated with increase crash risk among drivers 55 and older, due to the small number of studies, the generally inadequate control of confounders (e.g., other medications and illness), and inconsistent results.

Conversely, the DRUID Project compared the risk of being seriously injured or killed while driving with psychoactive substances including medicinal opioid use [32,33]. Pooled data from six European countries was used. Cases were obtained from hospitalization data, controls were obtained from roadside surveys. Using odds ratios as an estimate of risk, the DRUID Project reported that drivers had significantly increased estimates of risk of being seriously injured (OR: 9.06; CI: 6.40–12.83) or killed (RR: 4.82; CI: 2.60–8.93) when positive for medicinal opioids. Other studies, using samples from the general population, have demonstrated a small, but positive association between opioid use and increased crash risk [34,35]. Arguably better evidence for the effect of opioids on crash involvement comes from crash culpability studies. Dubois et al. [36] demonstrated a significant positive association between OAs and crash culpability using a sample of passenger vehicle drivers (survivors and fatally injured) who were involved in fatal crashes (controlling for other medications, driving history and other factors). Drummer et al. [18] showed a positive but non-significant association between opioid use and crash culpability study using a sample of fatally injured drivers of all vehicle types (controlling for crash type, drug use and other factors). The DRUID Project considered only illicit opiates in its culpability analysis, and found that the odds of being responsible for a fatal crash did not differ significantly between the drivers that tested positive for illicit opiates and those that tested negative [32]. Overall, factors that may be contributing to the observed inconsistencies for the association between opioids and crash risk and crash culpability include sample type (e.g., fatally vs. no-fatally injured), opioid(s) of interest, determination of opioid exposure (e.g. prescription records vs. blood or urine test), and study design (e.g., cohort or case-control vs. cross-sectional).

We designed our study to: (a) generate estimates of the prevalence of opioid use over time in a sample of drivers of large trucks; and (b) document the relationship between OA use (Schedule II opioid analgesics in particular) and crash responsibility among drivers of large trucks involved in fatal crashes using a representative data source with high external validity and standardized toxicological testing, while controlling for other possible contributory factors to crash initiation including age, previous driving history, and substance use (other than OAs) such as alcohol and other medications. We hypothesized that the odds of committing an unsafe driving action (UDA) preceding a fatal crash would be greater for truck drivers who tested positive for an OA compared to truck drivers who tested negative.