2019

Drugs, Alcohol, and their Impact on the Severity of a Traumatic Work-Related Injury

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CAPSTONE PROJECT PAPER

A paper submitted in partial fulfillment of the

requirements for the degree of

Master of Public Health

in the

University of Kentucky College of Public Health

By

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Lexington, Kentucky

April 18, 2019

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ABSTRACT

Objectives

Traumatic work-related injuries result in thousands of deaths per year in the United States. It is important to determine factors that may contribute to these deaths in order to find ways to decrease the risk of injury. The study objectives were to determine if alcohol and drug (prescription and illicit) use could increase the risk of severe injuries or cause a specific mechanism of injury (being struck by or against an object, a fall, or injured as an occupant in a motor vehicle) when consumed prior to an injury.

Methods

A retrospective, facility-based, case review study of traumatic work-related injuries was conducted using the Kentucky Trauma Registry data set from 2013 to 2017. Subjects who were tested for drugs and alcohol were selected as participants in the study. Descriptive analysis, odds ratios, and logistic regression were performed on these cases.

Results

A person was 55% less likely with alcohol use and 20% more likely with drug use to have a moderate/severe work injury when the substances were consumed prior to the injury. The effect of drug and alcohol use prior to a work-related injury on the mechanism of the injury differed by type of mechanism. However, all of these results were not statistically significant.

Conclusion

Further research with a retrospective case-control study should be done. It might replicate the findings of this study and show results that are statistically significant.

INTRODUCTION

According to the Substance Abuse and Mental Health Services Administration, a serious epidemic of alcohol and drug abuse exists in the United States. In 2017, 140.6 million people that were 12-years-old or older consumed alcohol in the 30 days prior to a survey on alcohol and drug use (Bose, Hedden, Lipari, & Park-Lee, 2018). 66.6 million of these people binged on alcohol and 16.7 million were heavy drinkers. Of note, binge drinking was defined as the consumption of 4 or more alcoholic beverages within 24 hours, and heavy drinking was binge drinking for 5 or more days in the previous 30 days (Bose et al., 2018). In terms of drug abuse in 2017, approximately 30.5 million people that were 12-years-old or older had taken an illicit (defined as illegal) drug in the past 30 days (Bose et al., 2018). In terms of opioid misuse in 2017, which was defined as using heroin or inappropriately using prescription drugs, approximately 11.4 million people met this definition within the last year (Bose et al., 2018).

Whether or not alcohol and drugs (prescription and/or illicit) are being abused by workers would be important to know, because its use can have an effect on an individual's ability to safely perform his or her job. Both alcohol and drugs, regardless of whether it is a prescription or an illicit drug, can affect one's ability to perform a skill, decrease coordination, increase risk taking behavior, decrease alertness, and cause confusion. This could lead to a traumatic work-related injury.

Purpose of the capstone

Given the statistics stated above, it would not be surprising if people in the workforce were also abusing alcohol and drugs. They could present to work under the influence or consume these substances while at work, and this use and abuse could contribute to traumatic work injuries and fatalities. Therefore, in light of this concern, the primary objective of this study was to determine

if workers who experienced traumatic work injuries were at an increased risk of more severe injuries when drugs (prescription and/or illicit) or alcohol were consumed prior to the injury. A secondary objective was to determine if there was an association between drug or alcohol use prior to a traumatic work injury and a specific mechanism of injury: being struck by or against an object, a fall, or injured as an occupant in a motor vehicle. It was hypothesized that workers who consumed drugs or alcohol prior to a traumatic work injury would have more severe injuries than those who did not. Falls were thought to be the cause of injury most likely to be associated with drug and alcohol use prior to the injury.

Importance of the study

This research would add significant value to public health practice, because it would alert stakeholders in the workplace of the potentially negative consequences of drug and alcohol use, and they may take more proactive steps to effectively decrease its use. Employers and employees might take steps to decrease substance use if there was evidence of an increased risk of more severe work injuries or a specific mechanism of injury with drug or alcohol use or abuse. Employers might increase the frequency of random drug and alcohol testing to try and decrease an employee's use of these substances in order to keep their workers safe. Employees might be more mindful of the potential impact that drugs and alcohol can have on their risk of a severe work injury or a specific mechanism of a work injury and decrease their use of these substances. Finally, employees could initiate conversations with their medical providers regarding the effect that a drug they have been prescribed could have on their ability to function on the job. In turn, medical providers could start to question the impact the medications they prescribe may have on their patients' risk for a work-related injury, and they might change their prescribing habits.

LITERATURE REVIEW

The purpose of this literature review was to summarize what has already been discovered regarding the following: information on work-related injuries in the United States and Kentucky; drug and alcohol use in the workplace; research on drug use, alcohol use, and work injuries; using the Injury Severity Score to measure injury severity; research on drugs, alcohol, and injury severity; and alcohol and drug testing and its impact on a work-related injury. Resources collected from federal websites, websites, books, and published journal articles. PubMed, EBSCOhost, and Medline (EBSCOhost) were used to find scholarly research in the areas of interest stated above. Key words and phrases used to obtain these sources included workplace, work-related injuries, work injuries, drug testing, drug use, drug, severe work injuries, alcohol use, injury severity score, ISS, AIS, abbreviated injury scale, Kentucky, occupational industry, industry, occupation, United States, substance use, and substance abuse.

Information on work-related injuries in the United States and Kentucky

There were 5,147 work-related fatalities in the United States in 2017. This was a decrease from the 5,190 workers killed in 2016 (U.S. Bureau of Labor Statistics, 2018c). Transportation accidents caused the most fatalities and led to 2,077 deaths (40%). The second highest cause of fatal injuries were falls, trips, and slips and led to 887 deaths (17%). Contact with objects and equipment was the third highest cause of fatal injuries which led to 695 deaths (13.5%) (U.S. Bureau of Labor Statistics, 2018c). In terms of a worker's occupation and fatal injuries, transportation and material moving occupation and construction and extraction occupation were involved in 47% of the fatalities. These were the occupations with the highest risk of fatal injuries. Other notable characteristics of workers who had the highest rates of fatal injuries in 2017 were the following: men, Caucasian, Hispanic or Latino ethnicity, and aged 65 or older (U.S. Bureau of Labor Statistics, 2018c).

In terms of nonfatal work-related injuries in the United States, there were 2.8 millon in 2017, at a rate of 2.8 cases per 100 full-time equivalent workers (U.S. Bureau of Labor Statistics, 2018a). Agriculture, forestry, fishing, and hunting industry had the highest injury rate at 5 per 100 full-time equivalent workers. It was followed by state and local government; education and health services; natural resources and mining; manufacturing; and construction industries. Their injury rates were 4.6, 3.8, 3.6, 3.5, and 3.1 per 100 full-time equivalent workers respectively (U.S. Bureau of Labor Statistics, 2018d).

Kentucky was 24th overall in the rate of fatal work injuries and illness in 2017 as compared to the rest of the United States. Its injury rate was 3.8 per 100,000 full-time equivalent workers. The industry with the highest fatality rate in Kentucky was agriculture, forestry, fishing and hunting. The rate was 34.4 per 100,000 full-time equivalent workers. It was followed by the transportation and utilities industry at 9.7 per 100,000 full-time equivalent workers, and the construction industry at 8.2 per 100,000 full-time equivalent workers (U.S. Bureau of Labor Statistics, 2018b).

In terms of nonfatal occupational injures in industry in Kentucky in 2017, the total incidence rate of recordable cases was 3.3 per 100 full-time equivalent workers. Arts, entertainment, and recreation had the highest incident injury rate of an industry at 10.2 per 100 full-time equivalent workers, followed by hospitals at 9.9 per 100 full-time equivalent workers, and animal production and aquaculture at 9.2 per full-time equivalent workers (U.S. Bureau of Labor Statistics, 2019).

Alcohol and drug use in the workplace

Substance use has been seen in workers who have had a work injury, and the problem is not a recent one. Lewis and Cooper (1989) wanted to determine whether drugs and alcohol were present in the most severe work-related injuries that could occur in Harris County, Texas: fatal

injuries. They looked at 207 deaths that occurred at work between 1984 and 1985. Of those deaths, 196 had an autopsy, and of those 173 had blood alcohol levels tested and 172 had drug tests. Blood alcohol levels were detectable in 23 (13.3%) of the individuals and 12 (7%) had drugs present. Only one of the positive drug cases was positive for an illicit drug. They also determined that prescription drugs were the drugs most frequently found on positive drug tests (Lewis & Cooper, 1989).

Lipscomb, Dement, and Rodriguez-Acosta (2000) looked at death records of North Carolina construction workers on and off the job from 1988 to 1994. They found that in 5% of injuries that were work-related and not fatal, workers were under the influence of alcohol (Lipscomb, Dement, & Rodriguez-Acosta, 2000).

Pertaining to alcohol use, drug use, and work-related injuries in Kentucky, Bunn, Slavova, & Bernard (2014) analyzed the Kentucky Trauma Registry data from 2008 to 2012 and found of the 1,670 work-related injury cases, 19% of those cases had taken drugs. Two hundred and sixty-two cases (14%) had taken prescription drugs and 85 cases (5%) had used prescription or illicit drugs illegally. Fifteen cases were found to have alcohol over the legal limit and 19 cases only had trace amounts of alcohol. The natural resources and mining; construction; and transportation and public utility industries were found to be the industries with the highest percentage of positive drug screens at 80%, 76%, and 76% respectively (Bunn, Slavova, & Bernard, 2014).

More recently, the U.S. Bureau of Labor Statistics reported that for all workers in the United States, the use of nonmedicinal drugs or alcohol during work caused 217 unintentional fatal overdoses in 2017. This was an increase of 25% compared to 2016. Surprisingly, each year since 2013 has seen a 25% increase of unintentional overdoses in the workplace compared to the previous year (U.S. Bureau of Labor Statistics, 2018c). According to the most recent data,

published in 2015, from the Substance Abuse and Mental Health Services Administration, the top five industries from 2008 to 2012 with the heaviest past month alcohol use among workers aged 18 to 64 years were as follows: mining; construction; accommodations and food services; arts, entertainment, and recreation; and utilities. The rates were 17.5%, 16.5%, 11.8%, 11.5%, and 10.3% respectively. The top five industries for illicit drug use for workers aged 18 to 64 years during the same time period were as follows: accommodations and food services; arts, entertainment, and recreation; management; information; and construction. The rates were 19.1%, 13.7 %, 12.1%, 11.7%, and 11.6% respectively (Bush & Lipari, 2015).

Research on drug use, alcohol use, and work injuries

There has been some research to determine if an association exists between work injuries and substance use. Stallones and Xiang (2003) looked at farm residents to see if there was an association between work injuries and alcohol consumption. The study design was a prospective cohort that was followed from 1993 to 1995. Injuries and alcohol consumption were self-reported which might have introduced recall bias. Statistically significant findings and results were that farm residents who consumed alcoholic beverages had a higher injury rate than those who did not. People who consumed 1 to 2 alcoholic beverages per day had an injury rate of 3.02 per 10,000 person-days of observation. Those who consumed 3 or more alcoholic beverages per day had an injury rate of 3.62 per 10,000 person-days of observation. People who abstained from alcohol had 1.94 injuries per 10,000 person-days of observation (Stallones & Xiang, 2003).

The findings of an increased risk of a work-related injury with alcohol use was consistent in other studies. Soares, Gelmini, Brandao, & Silva (2018) used the Brazil National Health Survey of 2013 and found that workers who had consumed alcohol were 4.6 times more likely to have a work injury than workers that had no alcohol (Soares, Gelmini, Brandao, & Silva, 2018). Wang et

al. (2010) surveyed 2,050 agricultural workers in China and asked about their use of alcohol and the occurrence of a work-related injury within a 12-month period. Workers who consumed alcohol in the past month were 77% more likely to have a work injury during the 12-month period. The ones that consumed distilled spirits were 89% more likely to have a work injury during that period. Finally, workers that had episodes of intoxication were 112% more likely to have a work injury during that 12-month period (Wang et al., 2010). All results reported from the Soares and Wang studies were statistically significant.

Now that more states in the United States are legalizing the use of marijuana, Anderson, Rees, & Tekin (2018) looked specifically at the effect of legalizing marijuana on workplace fatalities. They looked at workplace fatalities in all 50 states from 1992 to 2015. Surprisingly, they found a statistically significant decrease of 19.5% (incident rate ratio of 0.805) in the number of expected workplace fatalities in workers aged 25 to 44 years. A greater reduction of 33.7% (incident rate ratio of 0.663) in the number of expected workplace fatalities in workers aged 25 to 44 years was seen 5 years after laws legalizing marijuana went into effect (Anderson, Rees, & Tekin, 2018).

Using the Injury Severity Score to measure injury severity

All of this information showed that the use of drugs and alcohol among workers exists and has an impact on work injuries. However, none of the studies discussed thus far measured injury severity when drugs and alcohol were used. For the purposes of this capstone, the Injury Severity Score (ISS) was determined to be the best measure of injury severity. The ISS score is calculated based on the Abbreviated Injury Scale (AIS) score. The AIS score is an anatomic based scoring system that ranks 9 body regions on a six-point scale in terms of severity. A score of 1 corresponds to minor, 2 is moderate, 3 is serious, 4 is severe, 5 is critical, and 6 is maximal severity and not

currently able to be treated. Each of the scores in the 9 body regions are used to determine an overall severity score (Champion, 2012a).

ISS is calculated using the highest AIS score from the three areas of the body that are most severely injured (Copes et al, 1988). There are 6 body regions from the AIS score that are used to compute the ISS score: head or neck; face; chest; abdominal area or contents within the pelvic area; extremities or pelvic girdle; and a general or external category (Baker, O'Neill, Haddon, & Long, 1974). The score ranges from 1 to 75. ISS of 1-9 are considered an injury of minor severity, 10-15 are injuries of moderate severity, 16-24 are injuries of moderate/severe severity, 25-74 injuries are severe/critical severity, and a score of 75 (the maximum score for ISS) are for an injury that is not considered survivable (Champion, 2012b). If a person has an AIS score of 6 (the highest AIS individual body region score) for one or more injuries, then their ISS score is automatically a 75. If the patient has AIS scores of 5 or lower, then only the highest AIS body regions are considered. The 3 highest AIS scores from different body regions are squared, added together, and this results in the ISS (Copes et al., 1988).

The ISS was found to be a better measure of mortality than just using the AIS score. The elderly population are known to have a worse prognosis than those who are younger even with similar injuries. When the elderly population obtained mild injuries, they had a higher risk of mortality than young people with the same injuries if the ISS was used. However, if AIS score was used, there was not a difference in morality between the groups for mild injuries (Baker et al., 1974).

An ISS score can also predict survivability with treatment. A score of below 50 showed increased survivability with a prompt diagnosis and treatment after an injury, because people with this score were still alive an hour after an injury. Therefore, there was time for interventions to be

done to increase survival. Even ISS scores above 50 survived if provided with prompt diagnosis and treatment. People with ISS score of less than 10 die rarely (Baker et al., 1974).

A limitation of the Injury Severity Score is that any problems associated with the Abbreviated Injury Scale will be present in the ISS as it uses this scale in its calculation. Also, it is not recommended to be used to triage patients, it does not predict the severity of a penetrating injury well, and if there are several serious injuries that only involve one region of the body, it underestimates the severity of the person's injury. Osler and colleagues developed an alternative to the ISS score called the New Injury Severity score. It attempts to resolve the limitation of using the 3 highest AIS scores from the 3 most severely injured body regions by using the 3 highest AIS scores from any body region. However, this score is not widely used (Champion, 2012b).

Strengths of the ISS score is that it is anatomy-based, it includes multiple injuries in the 3 areas of the body most affected to determine the severity of injury, it corresponds to the likelihood of survival from the injuries, and using it in addition to a trauma score (Trauma and Injury Severity Score) can improve its predictive value for survival (Champion, 2012b).

Research on drugs, alcohol, and injury severity

There have been studies that have used the ISS to determine if there was an association between drug and alcohol abuse in all injuries and specifically in work-related injuries. Foster and Dissanaike (2014) designed a retrospective cohort study to look at the use of alcohol prior to a work-related injury and the severity of the injury sustained at a Level I academic trauma center. The cohort was from the period of January 1, 2007 to January 1, 2012. Out of 823 patients, 319 were tested for the presence of alcohol after an injury. They found that patients with a positive blood alcohol test had a lower injury severity score (8.5) than those who were negative (11), but results were not statistically significant. They also found that there were no deaths among the

individuals positive for alcohol, but there were 11 individuals that were negative for alcohol that died (Foster & Dissanaike, 2014).

Valdez et al. (2016) designed a retrospective review study of adults that were injured and admitted to an urban trauma center to assess whether or not there was an association between injury severity and alcohol. The ISS was used to assess degree of injury severity. All injuries were analyzed in this study and not just work-related injuries. With a sample size of 1,397 patients, a statistically significant negative association was found between rib fractures, a hemothorax and/or pneumothorax, and the blood alcohol level (BAL) of the injured individual. They found a positive association between a concussion, soft tissue injury, and the BAL of the injured individual. A person who had experienced a fall from a standing position had a negative association between ISS and BAL, and bike collisions had a positive association with ISS and BAL. However, when they looked at all mechanisms of injury, they were unable to find a statistically significant association between BAL and ISS (Valdez et al., 2016).

Khashaba et al. (2017) performed a case-control study at Mansoura Emergency Hospital in Egypt to look at cannabis use in construction workers and injury severity in non-fatal work-related injuries. They found a statistically significant difference in the injury severity scores between 24 users of cannabis prior to a work injury and 16 people who had not used prior to the work injury. Workers that had used cannabis had a significantly higher ISS than ones who had not. Both had a median ISS score of 3 with the scores ranging from 0 to 25 in users and 0 to 9 in non-users (Khashaba, El-Helaly, El-Gilany, Motawei, & Foda, 2017). This study does not absolutely contradict the findings in the study done by Anderson et al. It is possible to have a more severe work injury with marijuana use but to die at a decreased rate due to that work injury. However, it

would be very unlikely to have a more severe injury rate than another group and die at a decreased rate from that injury.

One study that looked at injury severity and illicit drug use but did not specifically use ISS was one performed by Vitale and van de Mheen (2005). They did a literature review involving 11 emergency room studies. All injuries and the use of illicit drugs prior to the injury were analyzed. The result was no association between injury severity and illicit drug use. However, they defined injury severity in terms of violent injury caused by crime (more severe) versus accidental injury (less severe) (Vitale & Mheen, 2005).

Alcohol and drug testing and its impact on work-related injuries

An increase in the frequency of alcohol and drug testing was proposed to decrease work-related injuries if a positive association was found between work-related injuries and injury severity and mechanism of injury in this capstone. The researcher wanted to determine if this was a reasonable proposal based on the evidence currently available. Gerber and Yacoubian (2002) reported that drug testing in the construction industry led to a 51% decrease in injury incident rates within the first 2 years of the start of testing (Gerber & Yacoubian, 2002).

Schofield, Alexander, Gerberich, & Ryan (2013) looked at the Workers' Compensation claims of 1,360 construction companies. When they analyzed the risk of injury in the presence or absence of drug testing programs at the companies, they found that the companies with drug testing programs had a lower relative risk of injuries. For companies that had pre-employment and post-accident drug testing, their relative risk was 0.85. The ones that had pre-employment, post-accident, random, and suspicion testing had a relative risk of 0.97. However, neither result was statistically significant (Schofield, Alexander, Gerberich, & Ryan, 2013).

Ozminkowski et al. (2003) also showed that drug testing decreased work injuries. They looked at the medical expenditures of a large manufacturing firm between 1996 to 1999 to determine the impact of drug testing on those expenditures and injury rates. Multiple regression analyses of a pooled cross-sectional time-series data set was used and found that medical expenditures were decreased when 42% of employees were drug tested during a calendar year. If the rate of testing was doubled, they found that the odds of having an injury on the job decreased by over 50%. However, since the company already had a really low injury rate, the benefit of this testing was very minimal (Ozminkowski et al., 2003).

Miller, Zaloshnja, & Spicer (2006) also found a decrease in medical expenditures and injury rates with drug testing. They looked specifically at workplace substance abuse prevention programs that included federally mandated random alcohol and drug testing. They used time-series analysis and found almost a one-third decrease in injury rate, which saved the employer $48 million in the year 1999. In terms of employer injury costs per employee, this translated to $1,850 saved per employee (Miller, Zaloshnja, & Spicer, 2006).

However, not all studies showed that drug and alcohol testing in the workplace was an effective means to decrease work-related injuries. Cashman et al. (2009) did a review of approximately 6000 randomized controlled trials, cluster-randomized control trials, controlled clinical trials, controlled before and after studies, and interrupted time-series studies to determine if mandatory alcohol and drug screening, mandatory random drug test screen, and random for-cause alcohol screening could help prevent injuries in occupational drivers. They found 2 studies that they used in their literature review and they were interrupted time-series studies. One study showed that for mandatory and for-cause alcohol testing that there was a significant decrease in injuries immediately after the testing. However, this decrease was not seen long-term. One study

showed that there was a significant decrease in injuries immediately after mandatory random drug testing went into effect while the other study did not show a significant difference. Both studies did show a long-term decrease in injuries after mandatory random drug testing. However, the authors concluded that there was not enough evidence to recommend for or against alcohol and drug testing to prevent injuries of occupational drivers "as a sole, effective, long-term solution" (Cashman, Ruotsalainen, Greiner, Beirne, & Verbeek, 2009).

Pidd and Roche (2014) attempted to determine whether or not drug testing in the workplace was effective as a safety strategy. They conducted a systematic qualitative review study that included 23 studies, but only one was found to have a strong data analysis. That study showed decreased fatal accidents in the transport industry when random alcohol testing was instituted. However, they concluded that more research needed to be done to determine whether or not drug testing improved workplace safety (Pidd & Roche, 2014).

Cunradi et al. (2005) looked at post-crash and random alcohol and drug testing results in the transit industry from 1995 to 2000 to determine the impact of alcohol and drug testing on crashes. The found a modest decrease in the population attributable risk percentage of alcohol and drug use contributing to crashes, with the greatest decrease occurring in the first year of the intervention and no substantial change seen in the subsequent years (Cunradi, Ragland, Greiner, Klein, & Fisher, 2005).

Summary of Literature Review

The literature review showed that some workers are using drugs and alcohol prior to a work-related injury, and their use may impact the risk of having a work-related injury. The use of alcohol showed a statistically significant increased risk of a work injury in a couple of studies. However, whether or not alcohol has an impact on injury severity was questionable. One study showed a

decreased risk of a severe injury with alcohol use prior to a work injury, but this result was not statistically significant. Another study showed no association with injury severity and alcohol use prior to work-related and not work-related injuries (all injuries). This result was also not statistically significant.

Cannabis use prior to a work injury showed a decreased risk of fatalities but increased risk of injury severity. These results were from 2 different studies and both findings were a statistically significant. No association between illicit drug use prior to all injuries and injury severity was found in one study, but they defined injury severity not in terms of ISS but accidental versus violent injury. However, there were no studies that have previously looked at the impact drug and alcohol use prior to a work-related injury has on the severity of the injury. In terms of the secondary objective of this capstone, no studies have specifically looked to see if there is an association between drug and alcohol use and the mechanism of a work-related injury. Although, Valdez et al. (2016) did look at the mechanism of injury and whether or not it was associated with ISS and BAL, they did not look at drug use. Finally, implementing alcohol and drug testing in the workplace was found to initially decrease work-related injuries associated with their use. However, whether or not the testing showed a benefit long-term to decrease these injuries was questionable.

METHODOLOGY

Research Methodology

Due to the use of alcohol and drugs by workers and evidence from previous studies that they play a role in work-related injuries, I hypothesized that drug (prescription and/or illicit drugs) and alcohol use prior to a work-related injury was associated with more severe injuries and falls as the mechanism of injury when compared to work-related injuries that did not involve drug or alcohol use. This was important to determine, because showing a positive association between drug and

alcohol use, injury severity, and mechanism of injury could increase employer, employee, and medical provider awareness of the negative effects these substances have in the workplace. It could facilitate alcohol and drug use policy and practice changes. As a result, the primary objective of this study was to determine if workers who experienced traumatic work injuries in Kentucky were at an increased risk of more severe injuries when drugs (prescription and/or illicit) or alcohol were consumed prior to the injury. A secondary objective was to determine if there was an increased risk of drug (prescription and/or illicit) or alcohol use given a specific mechanism of injury: being struck by or against an object, a fall, or injured as an occupant in a motor vehicle. The null hypothesis of the primary objective was that there would be no increase in the severity of a work-related injury when drugs or alcohol were used prior to the injury. The null hypothesis of the secondary objective was that there would be no association between the mechanism of injury (struck by or against an object, injured by a fall, or injured as an occupant in a motor vehicle) and the use of drugs or alcohol prior to a work injury.

Participants

To study these objectives, a retrospective, facility-based, case review study was performed to examine work-related traumatic injuries from 2013 to 2017, and the study was approved by the Institutional Review Board at the University of Kentucky. Data were obtained from the Kentucky Trauma Registry records for years 2013 to 2017. It is a registry to which Level I to Level IV trauma centers in the state report traumatic injuries. All data was already collected by the registry, so this was a secondary data analysis. The initial criteria for inclusion in the study was the individual had to have suffered a work-related injury and had to be 18 years or older at the time of the injury. Two thousand, two hundred and fifty-eight individuals met these criteria. Not all cases had been tested for drug use and/or alcohol in the registry. It was determined that 530 of these individuals

had been tested for drugs and 462 had been tested for alcohol use. Since the specific aim of the study was to evaluate the impact drug or alcohol use may have on work-related injuries, this study used a sample size of 530 that met these criteria. Within this group, the ages ranged from 18 to 84 years of age, and four age categories were formed. Those categories were as follows: 18 to 24, 25 to 34, 35 to 44, and 45 to 84. The highest percentage of individuals were in the 45 and over category (46.79%), while the lowest percentage was 18 to 24 years (9.81%). The categories were formed based on assumed risk in the severity of their injury based on age.

Procedures/Instrumentation

The method used to determine whether or not a person had used drugs (prescription and/or illicit) or alcohol before the injury was further investigated, and the researcher reached out to the University of Kentucky Trauma Registrar who oversaw the collection and reporting of the data. The registry reports a drug use indicator variable for the trauma registry injuries, and splits the use into 4 categories. The categories are: 1) not tested; 2) negative for drug use that was confirmed by a test; 3) positive for a prescription drug; and 4) positive for an illegal drug. Anyone who was not tested for drugs was not included in this study. Given the timing of the drug test, a prescription drug might have been given to the individual after the work injury by medical providers and prior to the test administration. Therefore, the data available for each individual was carefully evaluated. In addition to the drug use indicator variable, the medication code, medication location code, and toxicology results were reviewed, and two categories were formed: 1) drug use prior to the work-related injury and 2) no drug use prior to the work-related injury. If a person was positive on drug testing for a prescription drug and no documentation was available to indicate that the person was given the drug in the field or at the hospital, that person was determined to have taken the drug prior to the injury. If the medication location code or medication code indicated that a particular

medication was given to the individual after the work-related injury and the toxicology screen showed no other drugs that were not given after the injury, then they were placed in the "no drug use prior to the work-related injury" category. The toxicology results of individuals who tested negative for drug use were confirmed by review of the toxicology results. Based on the toxicology results, the cases were placed in the appropriate group. If any illegal drugs were present on toxicology screen, the individual was automatically placed in the "drug use prior to the work-related injury" category.

The alcohol use indicator variable was also evaluated for each individual. The categories reported by the registry were the following: 1) not tested; 2) not positive for alcohol and confirmed by test; 3) positive for trace amounts of alcohol in the blood; and 4) positive for blood alcohol content above the legal limit. The legal limit in Kentucky is less than 0.08%. Individuals who were not tested were not included in the analysis, but they were included in the study because 68 people were tested for drugs but not for alcohol. Two categories for alcohol use were used in this study: 1) no alcohol use prior to the work injury confirmed on blood alcohol test and 2) people who either tested positive for trace amounts of alcohol or were over the legal limit of alcohol prior to the work injury.

Next, it was determined that the locally calculated Injury Severity Score would be the best measure of injury severity given the data available that was reported by the registry. Based on the information on the categories of mild, moderate, and severe injuries that Champion (2012) reported and since this study had a small sample size, two categories of injury severity were formed: 1) mild and 2) moderate/severe. Mild severity injuries were ones with injury severity scores that were less than or equal to 9. Moderate to severe injuries were ones that had scores greater than or equal to 10.

In terms of the mechanism of injury, there were two data variables used by the trauma registry. They were the cause code and the cause final. According to the trauma registrar, the cause code was determined on admission to the trauma center and the cause final was reported on discharge. For this reason, the cause final was a better representation of what caused the injury. Both variables were reviewed for all subjects and the top three causes of injury that best fit were "struck by or against an object", a "fall", or being an "occupant in a motor vehicle accident". The cause final variable of each individual was reviewed to determine if the cause of injury could fit any of the categories and was coded based on this evaluation. If it was unclear whether or not a cause could fit into these categories based on the cause final variable, then the cause code was examined. For example, the cause final code for a person was "suffocation" and the cause code was "struck by or against". It was determined that an injury in which someone was struck by or against something could lead to suffocation as the final cause of the injury. Therefore, this individual was placed in the "struck by or against and object" category. All injuries that did not fit into the top three categories were coded as other.

Next, the occupations and industries to which the subjects belonged were evaluated. In the occupation category, the top three occupations reported in this data set were construction and extraction; transportation and material moving; and production. All occupations that did not fit into these categories but did have an occupation listed were coded as other. Individuals that did not have an occupation listed were not used in the final analysis with respect to substance use association with their occupation. The same logic was applied to determine the industries that were evaluated. The top two industries that were reported were construction industry and the transportation and public utilities industry. The third and fourth highest industries reported were agriculture, forestry and fishing industry and the natural resource and mining industry. Since

individually they had small sample sizes, the third and fourth highest industries reported were combined to make a third category. All industries that did not fit into these categories but did have an industry listed were coded as other. Individuals that did not have an industry listed were not used in the final analysis with respect to substance use association with their industries. Of note, all coding was done using the Statistical Analysis System (SAS) program (Version 9.4; SAS Institute Inc., 2013).

Data Analysis

After the data were organized into a format for analysis, it was determined that odds ratios would be the best measure of whether or not there was an increased risk of moderate/severe injuries when a worker had consumed prescription and/or illicit drugs or alcohol prior to a work injury. Odds ratios of moderate/severe injuries compared to mild injuries if the person had taken drugs or alcohol were determined. The exposure was determined to be whether or not the person had consumed drugs or alcohol prior to the work injury, and the outcome was moderate/ severe injuries versus mild injuries. Other variables that were examined to determine if they might have an effect on injury severity were the following: age, ethnicity, gender, occupation, industry, and race. Using the variables found to significantly impact ones' severity of injury, a logistic regression was performed on those variables, in addition to the alcohol and drug use indicator variables, to determine if the odds of a moderate/severe work injury changed when the other variables were controlled for. Logistic regression was performed using the SAS program (Version 9.4; SAS Institute Inc., 2013). The odds ratios along with the confidence intervals were determined using the OpenEpi program (Dean, Sullivan, & Soe, 2013). Of note, each variable for race, occupation, and industry were compared to all other variables in that category and they acted as the referent group for the calculation.

The secondary objective was to determine if there was an association between drug or alcohol use given a specific mechanism of injury: being struck by or against an object, a fall, or injured as an occupant in a motor vehicle. Odds ratios were determined based on the exposure as drug or alcohol use in addition to age, ethnicity, gender, occupation, industry, and race. The outcome was the mechanism of the work-related injury. Of note, each variable for age, race, occupation, and industry were compared to all other variables in that category and they acted as the referent group for the calculation.

Summary of Methodology

In summary, the researcher used odds ratios to determine if there was an increased risk of moderate/severe work-related injuries when the use of alcohol or drugs (prescription and/or illicit) occurred prior to the injury. Logistic regression was used to control for the effects of a variable on the outcome of another variable if any variables were found to statistically significantly affect the severity of a work-related injury. Then, odds ratios were used to determine if there was an association between a particular mechanism of injury when alcohol or drugs were used prior to a work-related injury. Logistic regression was not used in this case, because the outcome of interest (mechanism of injury) was not dichotomous.

RESULTS AND DISCUSSION

Data Analysis Results

The sample population within the Kentucky Trauma Registry was mostly within the age category of 45 to 84 years (46.79%), Caucasian (92.06%), non-Hispanic or Latino (92.56%), male (92.45%), worked in the production occupation (27%), and worked in the construction industry (22.93%). Within the sample population, 30.19% of the workers had used drugs (prescription and/or illicit drugs) and 4.76% had used alcohol (trace amounts or over the legal limit) prior to the

traumatic work-related injury. Overall, this sample population had more moderate/severe work-related trauma injuries (77.14%) than mild injuries (22.86%). The high severity of injuries in the population was thought to be due to the age distribution of the sample population. Previous research has shown that the same injury in a young person will be more severe in an older person. Another theory was that it could have been due to the initial inclusion criteria for this sample. The entire sample had been tested for drug use. The reason that they may have been tested was because they presented with more moderate/severe injuries. The mechanism of injury was mostly falls (36.23%). These results can be viewed in Table 1 in the Appendix section. Comparing the demographics in this study to the Kentucky work injury statistics reported by the U.S. Bureau of Labor Statistics, the industry and occupation with the highest severity in work-related injuries in this study did not correlate with the occupations with the most severe (fatal) injuries in the United States: transportation and material moving occupation and construction and extraction occupation. In this study, the other occupation category had the most percentage of severe injuries (80.58%), followed by construction and extraction occupation (79.01%) and transportation and material moving occupation (77.19%). If the other occupation category was divided into the specific occupation categories, then this distribution is likely the same as the U.S. population. The construction and extraction occupation and transportation and material moving occupation were the top 2 occupations with the most fatalities in the U.S. and have the highest percentage of moderate/severe injuries in this study. Also, agriculture, forestry, fishing and hunting industry was the industry associated with the most severe (fatal) injuries in Kentucky. It was not the industry with the most severe injuries in this study. That industry was transportation and public industry. However, this industry had the highest percentage of fatalities in the United States.

When demographic characteristics for work-related injuries in the United States to this study, the sample population in this study having more non-Hispanic workers was not representative of the U.S. population. The fact that the sample population was mostly men, Caucasian, and in the older age range was representative of the U.S. population work-related injuries. Based on some of the discrepancies between the U.S. workers, Kentucky workers, and the sample population of this capstone noted above, the results of this study may not be generalizable to all work-related injuries in the United States or Kentucky.

This research showed that there was not a statistically significant increase in work-related injuries when alcohol or drugs (prescription and illicit) were used by the worker prior to the injury (see Table 2 and 3). Even though not a significant finding, alcohol use prior to an injury was found to be protective. A person was 55% less likely to have a moderate/severe work injury when the variable of drug use, age, and gender were controlled for. Alcohol as a protective factor against injury was a trend observed by Foster et al. (2014), and their results were also not statistically significant.

The effects of drug use prior to a work injury on injury severity was also not statistically significant, but there was a 20% increased risk of moderate/severe injuries when drugs were used. The variables of alcohol use, gender, and age were controlled for.

Gender and age was found to significantly affect injury severity. This result was expected. Men were 134% more likely to have a moderate/severe injury compared to women. There was an increased risk of a moderate/severe work injury with increasing age. Compared to the 18 to 24 age category, workers aged 25 to 34 and 35 to 44 were approximately 2 times more likely to have a moderate/severe work injury. Workers aged 45 to 84 were 2.6 times more likely to have a moderate/severe injury when compared to the age category of 18 to 24 (see Table 3). This

demonstrates the known correlation of an increased risk of a more severe injury with advancing age.

In terms of the secondary objective of this capstone, there was not a statistically significant association between the use of alcohol or drugs prior to a work injury and the mechanism of the injury. However, the results were interesting. When looking at falls and being struck by/against an object as the mechanism of the injury, the use of drugs and alcohol had opposite effects on the risk of that injury type. For instance, alcohol use increased the risk of a fall by 84%, and drug use decreased fall risk by 33%. In the case of the risk of being struck by/against an object, alcohol use decreased the risk by 48% and drug use increased the risk by 34%. The effect of drug and alcohol use on the risk of being injured as an occupant in a motor vehicle both increased the risk by 3% and 22% respectively (see Table 5, 6, and 7).

These findings of alcohol and drug use prior to a work-related injury having opposing effects, when the mechanism of injury was a fall or being struck by or against an object, was very interesting. It is known that alcohol and drug use affect individuals differently due to a variety of factors. Therefore, consuming alcohol and drugs does not automatically mean that one will be impaired and at an increased risk of a certain mechanism of injury.

Other findings seen that were not a focus of this study was a statistically significant association with some occupations and industries given a specific mechanism of injury. Given struck by/against as the cause of injury, workers in the transportation and material moving occupation were 74% less likely and the production occupation was 76% more likely to have this type of injury when each were compared to all other occupations. Given the nature of the duties in these occupations, these findings were expected. Given the same cause of injury, workers in the construction industry and the transportation and public utilities industry were 63% and 77%

(respectively) less likely to have this type of injury when each were compared to all other industries. The combination of agriculture, forestry, and fishing industry and the natural resource and mining industry were 218% more likely to have this type of injury when compared to all other industries (see Table 5). These findings were not completely expected. In the construction industry, it would seem that one would be at an increased risk of being struck by/against and object, but that was not observed.

Given a fall injury, a worker was 304% more likely to have been in a construction and extraction occupation and 96% less likely to have been in the transportation and material moving occupation when each were compared to all other occupations. Due to working above ground in some cases, an increased risk of a fall as an injury in construction was not unexpected. Also, being in an occupation in which one is within a vehicle also would not be expected to cause an increased risk of falls. Industry findings for this cause of injury were also expected. Construction industry had an increased risk of 754% of being injured by a fall when compared to all other industries. The risk of a fall was decreased in the transportation and public utilities industry and the agriculture, forestry, fishing, natural resource, and mining industries by 87% and 58% respectively when each were compared to all other industries (see Table 6).

For occupant motor vehicle injuries, transportation and material moving occupation and the transportation and public utilities industry had an increased risk of this injury, approximately 31 times and 18 times respectively when each were compared to all other occupations and industries. This was not unexpected. It was observed that all occupations that did not involve transportation and material moving occupation and transportation and public utilities industry were less likely to experience an occupant motor vehicle injury. The elevated relative risk of this injury occurring in transportation associated jobs compared to all other jobs was an expected finding.

Fall injuries were the only injuries in which being of the Hispanic or Latino ethnicity was a significant risk factor (286%). This was an expected finding. The construction industry is the industry where the highest number of Hispanics are employed (27.3%) and many are new immigrants (The Construction Chart Book, 2010 & U.S. Bureau of Labor Statistics, 2015). The construction and extraction occupation is the third highest occupation of Hispanic employment and 32.3% are employed in this occupation (U.S. Bureau of Labor Statistics, 2015). Since the construction industry had a significant association with falls, it is not unexpected that since a large proportion of Hispanics are employed in these jobs, then they would have a higher risk of a fall injury. Also, especially in the construction industry where a lot of Hispanics are new immigrants, the ability to perform one's job according to OSHA standards or understand instructions when one is new to a country and may not speak the language would increase one's risk of injury.

Hispanics were 86% less likely to be involved in occupant motor vehicle work injuries. The reason for this finding could not be determined. While they are employed in the transportation industries and occupations, data on whether or not they were the ones driving vehicles could not be determined. If they were less likely to have positions that required driving, then this would be an expected finding.

Results Summary

In summary, there was not a statistically significant increase in severity of work-related injuries when alcohol or drugs (prescription and/or illicit) were used by the worker prior to the injury. In addition, there was not a statistically significant association between the use of alcohol or drugs (prescription and/or illicit) prior to a work injury and the mechanism of the injury: struck by/against an object, falls, or an occupant in a motor vehicle accident.

CONCLUSION AND RECOMMENDATIONS

Implications and recommendations

This study was an important contribution to the public health field as it raised the question of the effects that alcohol and drug use can have on the worker, in particular how it affects injury severity and mechanism of injury. Further research should be done to determine if the findings of this study are consistent in similar studies. In particular, if there is a similar risk of severe injuries with the use of alcohol or drugs and if a similar mechanism of injury in different occupations and industries occur when drugs and alcohol were used prior to the injury. Using a larger sample size might replicate the findings of this study and be statistically significant. A better designed study, such as a retrospective case-control study, could also increase the evidence that the findings of this study are valid ones if those results are similar. One could look at workers matched by the demographic characteristics of age, gender, race, ethnicity, and industries. Cases would be workers that had a traumatic work-related injury and controls would be ones that did not during a specified period of time. Then, one would determine whether or not the cases and controls had the exposures of interest: 1) drugs; 2) alcohol; 3) drugs and alcohol; or 4) no substance use. Finally, one could determine the risk the exposure had on the outcome of a traumatic work-related injury. The data for this retrospective case-control study could come from the Kentucky Trauma Registry Data, pooled from the United States Trauma Data Registry, or Workers' Compensation Data.

Out of the workers that had traumatic work injuries in Kentucky from 2013 to 2017, only 23% were tested for drugs and 20% were tested for alcohol. Not being tested and being positive for a substance could have an adverse effect in a variety of ways. The employee might have a substance use disorder that is not identified. As a consequence, injury to self or others may result in situations involving the impaired individual. This could have been prevented if the substance use disorder was identified and treated. If a medical provider does not know that an employee has

drugs or alcohol in their system and gives the person opioids or benzodiazepines, this could cause the employee to overdose. This could lead to the death of the employee, a lawsuit against the medical provider for malpractice, and the loss of the medical provider's medical license. If there were more workers tested after a traumatic work injury, an increased risk of moderate/severe injuries and specific mechanisms of injury may have been seen if drugs or alcohol were used prior to an injury. This could have led to policy changes by the employer to decrease drug and alcohol use amongst their employees. Therefore, it is recommended that all workers who have a traumatic work injury should be tested for drugs and alcohol if it is feasible.

Limitations

There are some limitations with this study. Since the researcher had access to the Kentucky Trauma Registry data from 2013-2017, Kentucky workers would be the population of interest. Therefore, there may be a lack of generalizability to the United States workforce. In addition, not all traumatic work injuries in the state of Kentucky may have been reported. A worker with a work-related traumatic injury might not have been sent or transferred to one of the facilities that reported to the registry, so the data on this person would not be captured. The addition of these cases to the study could have changed the results. In the case of alcohol and drug exposure and how it affects injury severity, this would have been a nondifferential misclassification of the exposure and could have resulted in no statistically significant difference seen in the results even though one existed. In the case of the alcohol and drug exposure and how it affects the mechanism of injury, it might have lessened the exposure's association with the outcome even if an association existed. Therefore, a nondifferential misclassification bias could have led to the results of this study in relation to alcohol and drug use prior to a work injury not being significantly associated with injury severity or mechanism of injury.

There may be issues with the reliability of the results. The number of reporting centers to the Kentucky Trauma Registry increased from 21 in 2013 to 26 in 2017. As a result, fewer cases were captured in older years. Therefore, if this study was repeated in the future with data from several years from all reporting centers, the results may not be replicable. There was no way to control for this issue.

Of the 2,258 people who were reported to have traumatic work-related injuries in Kentucky from 2013 to 2017, only 530 had been drug tested and 462 were tested for alcohol. The way that these individuals were selected by the medical professionals to have this type of testing may have been biased on a variety of factors including, but not limited to, race, occupation, industry, general appearance, age, gender, and socioeconomic status. This could indicate a bias in the way that these individuals were selected for substance use testing and any results gathered from the study not be representative of Kentucky's workforce. This could not be controlled for by the researcher in this study.

Another limitation is in the use of the Injury Severity Score as the measure of injury severity. If a person had multiple injuries to the same body region, then the ISS underestimates the injury severity. As a result, there could have been more moderate/severe injuries that occurred and was not analyzed as such in this study, because the overall ISS score was used. This would have created a differential misclassification bias, and could have biased the results of this study more towards the null hypothesis.

Instrument Bias could have occurred if the blood alcohol and drugs tests used to test for the presence of each substance were not valid. This would have been highly unlikely in trauma centers due to regular quality checks and maintenance on equipment.

Only 13 categories of drugs were tested by the Kentucky Trauma Registry Data and reported on the toxicology screen. Some participants could have been positive for drugs that were not captured on the toxicology screen. This would have caused those individuals to be incorrectly classified as "no drug use prior to the work-related injury". This could have also biased the results more towards the null hypotheses.

Finally, people who either tested positive for trace amounts of alcohol or were over the legal limit of alcohol prior to the work injury were placed into the same category and compared to people who had not consumed alcohol. People who consumed only trace amounts of alcohol might not have been impaired by it. Future studies may consider placing people who had consumed trace amounts of alcohol in the "no alcohol use prior to the work injury" category. This would be based on assumed risk in impairment due to alcohol use.

Summary

In summary, this study was used to determine if there was an increased risk of moderate/severe work injuries if alcohol and drugs were used prior to the work injury, and if an association existed regarding the use of these substances and the mechanism of injury. More research should be performed with a larger sample size and better study design to increase strength of the evidence of any results that are found in this type of study. A change in practice of employers, employees, and medical providers based on the results of only this study would not be recommended at this time.

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APPENDIX

Table 1: Characteristics of Kentucky Work-Related Trauma Registry Cases, 2013 to 2017

Characteristic	Frequency	Percentage
Age Category (years)		
18-24	52	9.81
25-34	123	23.21
35-44	107	20.19
45-84	248	46.79
Alcohol Use Indicator		
No Alcohol Prior to Injury	440	95.24
Alcohol Prior to Injury	22	4.76
Missing	68	
Cause of Injury		
Other	39	7.36
Struck by/against	159	30
Fall	192	36.23
Motor Vehicle (Occupant)	140	26.42
Drug Use Indicator		
No Drugs Prior to Injury	370	69.81
Drugs Prior to Injury	160	30.19
Ethnicity		
Hispanic or Latino	38	7.44
Not Hispanic or Latino	473	92.56
Missing	19	
Gender		
Men	490	92.45
Women	40	7.55
Injury Severity Score		
Mild	120	22.86
Moderate/Severe	405	77.14
Missing	5	
Occupation		

Construction and Extraction	84	24.93
Transportation and Material Moving	57	16.91
Production	91	27
Other	105	31.16
Missing	193	
Occupation Industry		
Construction	108	22.93
Transportation and Public Utilities	69	14.65
Agriculture, Forestry, Fishing, Natural Resource and Mining	135	28.66
Other	159	33.76
Missing	59	
Race		
Other	21	3.97
Black or African American	21	3.97
White	487	92.06
Missing	1	

Table 2: Odds Ratios for a Moderate to Severe Injury

Variable	N	Moderate/ Severe Injury (%)	OR	CI
Age				
18-24 (ref)	52	61.54	1.0	ref
25-34	121	77.69	2.17	(1.06, 4.40)*
35-44	107	77.64	2.04	(0.99, 4.20)
45-84	245	80.41	2.56	(1.33, 4.86)*
Missing	5			
Alcohol Use Indicator				
No Alcohol Prior to Injury(ref)	437	78.49	1.0	ref
Alcohol Prior to Injury	21	66.67	0.55	(0.22, 1.49)
Missing	72			
Drug Use Indicator				
No Drugs Prior to Injury (ref)	366	76.78	1.0	ref
Drugs Prior to Injury	159	77.99	1.07	(0.69, 1.69)
Missing	5			
Ethnicity				
Hispanic or Latino	38	81.58	1.34	(0.60,3.38)
Not Hispanic or Latino (ref)	468	76.71	1.0	ref
Missing	24			
Gender				
Male	486	78.19	2.00	(0.98, 3.98)
Female (ref)	39	64.10	1.0	ref
Missing	5			
Occupation				
Construction and Extraction	81	79.01	1.11	(0.61, 2.08)
Transportation and Material Moving	57	77.19	0.97	(0.49, 1.97)
Production	91	73.63	0.73	(0.42, 1.30)
Other	103	80.58	1.28	(0.72, 2.31)
Missing	198			

Industry				
Construction	105	80.95	1.31	(0.77, 2.30)
Transportation and Public Utilities	69	84.06	1.63	(0.84, 3.38)
Agriculture, Forestry, Fishing, Natural Resource and Mining	133	72.18	0.67	(0.42, 1.07)
Other	159	76.73	0.94	(0.60, 1.49)
Missing	64			
Race				
Other	20	75.00	0.89	(0.33, 2.78)
Black or African American	21	80.95	1.27	(0.44, 4.49)
White	483	77.02	0.94	(0.41, 1.99)
Missing	6			

N=number in sample ref=referent group
CI= 95% Confidence Intervals OR=Odds Ratio
*CI significant at 95% level

NOTE: Each variable for race, occupation, and industry were compared to all other variables in that category and that acted as the referent group for the calculation.

Table 3: Adjusted Odds Ratio for Injury Severity

Variable	Adjusted OR	CI
Age		
18-24(ref)	1.0	ref
25-34	2.34	(1.08, 5.05)*
35-44	2.32	(1.05, 5.12)*
45-84	2.64	(1.32, 5.28)*
Alcohol Use Indicator		
No Alcohol Prior to Injury(ref)	1.0	ref
Alcohol Prior to Injury	0.45	(0.17, 1.18)
Drug Use Indicator		
No Drugs Prior to Injury (ref)	1.0	ref
Drugs Prior to Injury	1.20	(0.72, 2.00)
Gender		
Male	2.34	(1.07, 5.12)*
Female (ref)	1.0	ref

ref=referent group CI= 95% Confidence Intervals
OR=Odds Ratio *CI significant at 95% level

Table 4: Kentucky Work-Related Trauma Registry Cases by Injury Cause, 2013 to 2017

Variable	Struck By/Against (N)	Fall (N)	Occupant MV (N)	Other (N)
Age				
18-24	17	12	17	6
25-34	39	44	25	15
35-44	34	35	29	9
45-84	69	101	69	9
Alcohol Use Indicator				
No Alcohol Prior to Injury	131	155	122	32
Alcohol Prior to Injury	4	11	7	0
Missing	68			
Drug Use Indicator				
No Drugs Prior to Injury	104	144	97	25
Drugs Prior to Injury	55	48	43	14
Ethnicity				
Hispanic or Latino	7	25	2	4
Not Hispanic or Latino	149	157	133	34
Missing	19			
Gender				
Male	147	177	130	36
Female	12	15	10	3
Occupation				
Construction and Extraction	21	53	6	4
Transportation and Material Moving	6	2	48	1
Production	33	33	15	10
Other	33	40	20	12
Missing	193			
Industry				
Construction	17	81	4	6
Transportation and Public Utilities	7	6	54	2
Agriculture, Forestry, Fishing, Natural Resource and Mining	64	32	28	11
Other	50	56	35	18

Missing	59			
Race				
Other	4	12	2	3
Black or African American	8	6	7	0
White	147	173	131	36
Missing	1			

MV=Motor Vehicle N= number in sample

Table 5: Odds Ratios for Injuries in Which a Person was Stuck by or Against an Object Compared to All Other Injury Causes

Variable	Struck By (%)	OR	CI
Age			
18-24	32.69	1.15	(0.61, 2.11)
25-34	31.71	1.11	(0.71, 1.71)
35-44	31.78	1.11	(0.70, 1.75)
45-84	27.82	0.82	(0.56, 1.20)
Alcohol Use Indicator			
No Alcohol Prior to Injury(ref)	29.77	1.0	ref
Alcohol Prior to Injury	18.18	0.52	(0.15, 1.50)
Drug Use Indicator			
No Drugs Prior to Injury (ref)	28.11	1.0	ref
Drugs Prior to Injury	34.38	1.34	(0.90, 1.99)
Ethnicity			
Hispanic or Latino	18.42	0.49	(0.20, 1.10)
Not Hispanic or Latino (ref)	31.50	1.0	ref
Gender			
Male	30.00	1.0	(0.50, 2.09)
Female (ref)	30.00	1.0	ref
Occupation			
Construction and Extraction	25.00	0.84	(0.47, 1.47)
Transportation and Material Moving	10.53	0.26	(0.10, 0.60)*
Production	36.26	1.76	(1.04, 2.95)*
Other	31.43	1.31	(0.79, 2.18)
Industry			
Construction	15.74	0.37	(0.21, 0.65)*
Transportation and Public Utilities	10.14	0.23	(0.01, 0.50)*
Agriculture, Forestry, Fishing, Natural Resource and Mining	47.41	3.18	(2.08, 4.88)*
Other	31.45	1.17	(0.77, 1.77)
Race			
Other	19.05	0.54	(0.15, 1.54)

Black or African American	38.10	1.45	(0.56, 3.58)
White	30.18	1.08	(0.55, 2.25)

ref=referent group CI= 95% Confidence Intervals
OR=Odds Ratio *CI significant at 95% level

NOTE: Each specific variable for age, race, occupation, and industry were compared to all other variables in that category (the referent group).

Table 6: Odds Ratios for Fall Injuries Compared to All Other Injury Causes

Variable	Fall (%)	OR	CI
Age			
18-24	23.08	0.50	(0.25, 0.96)*
25-34	35.77	0.97	(0.64, 1.48)
35-44	32.71	0.82	(0.52, 1.29)
45-84	40.73	1.44	(1.01, 2.06)*
Alcohol Use Indicator			
No Alcohol Prior to Injury(ref)	35.23	1.0	ref
Alcohol Prior to Injury	50.00	1.84	(0.76, 4.43)
Drug Use Indicator			
No Drugs Prior to Injury (ref)	38.92	1.0	ref
Drugs Prior to Injury	30.00	0.67	(0.45, 1.0)
Ethnicity			
Hispanic or Latino	65.79	3.86	(1.94, 7.97)*
Not Hispanic or Latino	33.19	1.0	ref
Gender			
Male	36.12	0.94	(0.49, 1.88)
Female	37.50	1.0	ref
Occupation			
Construction and Extraction	63.10	4.04	(2.41, 6.85)*
Transportation and Material Moving	3.51	0.04	(0.01, 0.16)*
Production	36.26	0.91	(0.55, 1.49)
Other	38.10	1.01	(0.62, 1.62)
Industry			
Construction	75.00	8.54	(5.24, 14.19)*
Transportation and Public Utilities	8.70	0.13	(0.05, 0.30)*
Agriculture, Forestry, Fishing, Natural Resource and Mining	23.70	0.42	(0.26, 0.66)*
Other	35.22	0.88	(0.59, 1.31)
Race			
Other	57.14	2.45	(1.00, 6.15)
Black or African American	28.57	0.70	(0.25, 1.80)

White	35.52	0.74	(0.39, 1.41)

ref=referent group CI= 95% Confidence Intervals
OR=Odds Ratio *CI significant at 95% level

NOTE: Each specific variable for age, race, occupation, and industry were compared to all other variables in that category (the referent group).

Table 7: Odds Ratios for Occupant Motor Vehicle Injuries Compared to All Other Injury Causes

Variable	MV (%)	OR	CI
Age			
18-24	32.69	1.40	(0.74, 2.57)
25-34	20.33	0.65	(0.39, 1.05)
35-44	27.10	1.05	(0.64, 1.68)
45-84	27.82	1.15	(0.78, 1.69)
Alcohol Use Indicator			
No Alcohol Prior to Injury	27.23	1.0	ref
Alcohol Prior to Injury	31.82	1.22	(0.45,3.02)
Drug Use Indicator			
No Drugs Prior to Injury	26.22	1.0	ref
Drugs Prior to Injury	26.88	1.03	(0.68, 1.57)
Ethnicity			
Hispanic or Latino	5.26	0.14	(0.02,0.51)*
Not Hispanic or Latino	28.12	1.0	ref
Gender			
Male	26.53	1.08	(0.52, 2.38)
Female	25.00	1.0	ref
Occupation			
Construction and Extraction	7.14	0.16	(0.06, 0.36)*
Transportation and Material Moving	84.21	30.59	(14.34, 70.7)*
Production	16.48	0.46	(0.24, 0.84)*
Other	19.05	0.56	(0.31, 0.97)*
Industry			
Construction	3.70	0.08	(0.02, 0.21)*
Transportation and Public Utilities	78.26	17.84	(9.65, 34.40)*
Agriculture, Forestry, Fishing, Natural Resource and Mining	20.74	0.68	(0.42, 1.10)
Other	22.01	0.74	(0.47, 1.16)
Race			
Other	9.52	0.28	(0.04, 1.07)

Black or African American	33.33	1.41	(0.52, 3.54)
White	26.90	1.35	(0.64, 3.05)

ref=referent group CI= 95% Confidence Intervals
OR=Odds Ratio *CI significant at 95% level
MV= motor vehicle

NOTE: Each specific variable for age, race, occupation, and industry were compared to all other variables in that category (the referent group).

ACKNOWLEDGEMENTS

I would like to thank the members of my committee for their guidance and support with this project. Dr. Bunn allowed me to access the Kentucky Registry Trauma Data, helped me to develop research questions, and provided guidance regarding the statistical analysis and capstone document. Dr. Browning was helpful with determining the type of analysis to use to answer my research questions given the data to which I had access. He also provided input with the capstone document. Dr. Prince and Dr. Spengler challenged me to find ways to improve the health of the worker. Dr. Spengler also provided input with the capstone document. I would also like to thank Ms. Trish Cooper, the University of Kentucky Trauma Registrar. She was instrumental to understanding the Kentucky Registry Trauma Data. Finally, and most importantly, I would like to thank my family (Barrington, Sandra, Stephen, Travis, and Jackson) for their support and sacrifice to allow me to pursue my dreams. Of note, no financial or material support was received as a result of this project.

BIOGRAPHICAL SKETCH

Keisha L. McFarlane was raised in Jacksonville, Florida. She obtained a Bachelor of Science degree in Biology and Chemistry from Barry University in 2004, and a Doctorate of Medicine degree from the Medical College of Wisconsin in 2009. She was a physician in the military until 2017, when she was honorable discharged and started in the Occupational Medicine residency program at the University of Kentucky. At that time, she also started in the Master in Public Health in Environmental Health program at the University of Kentucky. She will graduate from both programs in 2019 and will obtain a position as an Occupational Medicine physician.