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Motor vehicle injuries among semi truck drivers and sleeper berth passengers

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ABSTRACT

Introduction: Injuries and fatalities due to large truck and other vehicle crashes have decreased over the last decade, but motor vehicle injuries remain a leading cause of death for both the working and general populations. The present study was undertaken to determine semi truck driver and sleeper berth passenger injury risk in a moving semi truck collision using a matched-pair cohort study. *Method:* Study data were obtained from the Kentucky Collision Report Analysis for Safer Highways (CRASH) electronic files for 2000–2010. A matched-pair cohort study was used to compare the odds of injury of both drivers and sleeper berth passengers within the same semi truck controlling for variables specific to the crash or the semi truck. The crude odds ratio of injury was estimated and a statistical model for a correlated outcome using generalized estimating equations was utilized. *Results:* In a moving semi truck collision, the odds for an injury were increased by 2.25 times for both semi truck drivers and sleeper berth passengers who did not use occupant safety restraints compared to semi truck drivers and sleeper berth passengers who used occupant safety restraints at the time of the collision. The driver seat or sleeper berth position in the vehicle was not a significant factor (p-value = 0.31) associated with a moving semi truck collision injury. *Conclusion:* Nonuse of occupant safety restraints by either drivers or sleeper berth passengers significantly increased the odds of an injury in a moving semi truck collision; semi truck seating position (driver's seat or sleeper berth) did not increase the odds for an injury in moving collisions. *Impact on Industry:* Trucking companies should include the mandatory use of occupant safety restraints by both semi truck drivers and sleeper berth passengers in their company safety policies.

1. Introduction

Although injuries and fatalities due to large truck and other vehicle crashes have decreased over the last ten years, motor vehicle injuries remain a leading cause of death in the US for both the working and general populations (Centers for Disease Control and Prevention [CDC], 2011; Federal Motor Carrier Safety Administration, Analysis Division [FMCSA], 2011; National Institute for Occupational Safety & Health [NIOSH], 2011). In 2009, there were 2,179 fatal combination truck (defined as a truck tractor pulling any number of trailers, a bobtail truck tractor not pulling any trailers, or a straight truck pulling at least one trailer) crashes in the US with 340 combination truck occupant fatalities; 289 drivers of large trucks were killed (FMCSA, 2011).

Semi truck drivers have a grueling timetable and drive extended hours behind the wheel. Some companies employ team drivers so that delivery schedules can be adhered to while accounting for hours of service rules. In a survey of long distance truck drivers, approximately 19.5% of drivers from Oregon and 8.5% of drivers from Pennsylvania shared truck driving (McCartt, Hellinga, & Solomon, 2008). Passengers in the semi truck sleeper berth accounted for 11 fatalities in 2009, 19 fatalities in 2008, and 19 fatalities in 2007 (National Highway Traffic Safety Administration, 2011a,b). Of the 49 sleeper berth passenger fatalities, 47 were not using an occupant safety restraint system and two victims had an unknown occupant safety restraint system use status.

The use of occupant safety restraints is associated with a decreased risk in injury severity in both passenger vehicle and commercial vehicle collisions (Bunn, Slavova, Struttmann, & Browning, 2005; Cummins, Koval, Cantu, & Spratt, 2008, 2011; Talmor, Legedza, & Nirula, 2010). Restraint usage may be lower among semi truck drivers compared to passenger vehicle occupants (Kim and Tremblay, 2004). In 2011, observed occupant safety restraint usage was 84% for occupants in passenger cars (NHTSA, 2011a,b). In a survey of commercial motor vehicle drivers, 74% were observed using an occupant safety restraint; the occupant safety restraint usage rate was 61% for other occupants in the commercial motor vehicle (FMCSA, 2009). Safety belt use among commercial vehicle drivers was higher in states with a primary seat belt law (78%). The use of occupant safety restraints by both semi truck drivers and sleeper berth passengers may, therefore, be important components of trucking company worker safety policies.

Funded by the National Institute for Occupational Safety and Health, state Fatality Assessment and Control Evaluation (FACE) programs investigate worker deaths in order to develop reports that contain feasible, practical injury prevention recommendations for worker safety training use by employers and workers. The Kentucky FACE program

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has targeted semi truck driver and passenger deaths for investigation since the year 2005 because of the high number of worker fatalities in the transportation industry and in semi trucks, in particular. From 2005 to 2010, 119 semi truck drivers, and 13 semi truck passengers have died in collisions on Kentucky roadways (Kentucky Injury Prevention and Research Center). Of the 13 semi truck passengers who died, 2 were in the sleeper berth. Of the 132 total deaths, 20 fatality reports have been produced and disseminated to employers.

Due to the high number of semi truck driver and passenger fatalities in Kentucky, and the percentage of semi truck team drivers on the road, the present study was undertaken to determine if passengers in the sleeper berth were at a higher risk of injury in a semi truck collision compared to semi truck drivers using a matched-pair cohort study.

2. Method

2.1. Study data

Data for the study were obtained from the Kentucky Collision Report Analysis for Safer Highways (CRASH) electronic files for 2000–2010 from the Kentucky State Police Records Section which contained all reported crashes on public roadways in Kentucky. The electronic file received contained all motor vehicle collision information but excluded some personal identifiers. This study is part of the broad spectrum of the Kentucky Occupational Safety and Health Surveillance program which is approved by the University of Kentucky Institutional Review Board.

2.2. Case selection criteria

Selection of the cases for the study was determined in the following order:

1. Semi truck with sleeper berth (identified by unit type = "21," "22," "23," or "24" or National Crime Information Center [NCIC] type = "SE")
2. Presence of passenger in sleeper berth at the time of collision (position in vehicle = "11[sleeper compartment]")
3. Age of semi truck drivers ≥ 21 years of age and age of passengers ≥ 21 years of age
4. Moving semi truck collisions (Semi truck not in "parked" position at the time of collision)

Semi trucks with the pre-collision action recorded as "parked" were excluded from the analysis. The presence of the passenger in the sleeper berth was determined based on the "passenger position" variable. Using the selection criteria above, 708 semi trucks involved in collisions (containing both the driver and a passenger in the sleeper berth) were included in the final analysis.

2.3. Study design and analysis

A matched-pair cohort study was used to assess the association of occupant position and injury outcome in semi truck collisions. By matching drivers and sleeper berth passengers in the same semi truck, the effect of potential confounders specific to the crash or common for the occupants was controlled for. We used the odds ratio as a measure of the relationship between the injury outcome and the exposure variable (position in the vehicle). To further adjust the odds ratio for personal level confounders, a statistical model for correlated binary outcomes using the method of generalized estimating equations (GEE) (Liang & Zeger, 1986) was utilized. The GEE are used previously in the analysis of motor vehicle crash data (Hutchings, Knight, & Reading, 2003; Olsen, Cook, Keenan, & Olson, 2010). Our data have a clustered structure (each matched pair is a cluster) and observations from the same cluster (vehicle) tend to be more alike than observations from different clusters. The response variable modeled was *injured*, and coded as "1" when the police officer at the collision scene recorded that the occupant sustained fatal, incapacitating, or nonincapacitating injury, and coded as "0" otherwise (no injury or possible injury). The exposure variable of interest was the occupant position coded as "1" for an occupant in the sleeper berth at the time of the collision, and "0" for an occupant in the driver's position. Age, gender, occupant safety restraint use, and vehicle area of first contact in the collision were considered potential confounders not involved in the matching, and were included as explanatory variables in the statistical model. The analysis was performed with SAS® version 9.2, utilizing PROC GENMOD with binomial distribution and logit link function (Allison, 1999; Stokes, Davis, & Koch, 2000). The GEE method was invoked by the REPEATED statement in PROC GENMOD where the SUBJECT was the vehicle number, identifying the matched driver-passenger pair. There was no multicollinearity issue with the explanatory variables (the variance inflation factors were below 3.3). Two-way interaction terms were included in the model but then dropped as none of the interaction terms were significant.

3. Results

3.1. Kentucky semi truck collisions by occupant characteristics

Almost one-third of the semi truck drivers were between the ages of 35–44 years, and another one-third were between 21–34 years of age (Table 1). Passengers in the sleeper berth tended to be younger (35% who were 21–34 years of age compared to 29% who were 35–44 years of age). Semi truck drivers were older (14% who were 55 years old or older) compared to the percentage of sleeper berth passengers who were older (11% who were 55 years of age and older). A higher percentage of the semi truck drivers were male (84%) when compared to sleeper berth passengers (75%).

Table 1
Kentucky Semi Truck Collisions by Occupant Characteristics, 2000–2010.

Occupant Characteristics	Drivers N (%)	Sleeper Berth Passengers N (%)
Age (years)		
21–34	220 (31.1)	246 (34.7)
35–44	224 (31.6)	202 (28.5)
45–54	162 (22.9)	182 (25.7)
55–64	84 (11.9)	67 (9.5)
65+	18 (2.5)	11 (1.6)
Gender		
Male	592 (83.6)	529 (74.7)
Female	116 (16.4)	168 (23.7)
Missing	0 (0)	11 (1.5)
Occupant Safety Restraint Use		
Used	682 (96.3)	101 (14.3)
Not Used	20 (2.8)	602 (85.0)
Missing	6 (0.8)	5 (0.7)
Injury Severity		
Fatal	4 (0.6)	9 (1.3)
Incapacitating	12 (1.7)	11 (1.5)
Non-incapacitating	25 (3.5)	36 (5.1)
Possible injury	27 (3.8)	34 (4.8)
None	640 (90.4)	618 (87.3)
Injury Location		
Head/Face	13 (1.8)	12 (1.7)
Neck/Back	14 (2.0)	24 (3.4)
Chest/Abdomen/Pelvis	8 (1.1)	8 (1.1)
Arms/Hands/Legs/Feet	15 (2.1)	22 (3.1)
Multiple	18 (2.5)	24 (3.4)
Missing (indicates no injury or no possible injury)	640 (90.4)	618 (87.3)
Ejection from Vehicle		
Not ejected	701 (99.0)	695 (98.2)
Ejected	4 (0.6)	7 (1.0)
Missing	3 (0.4)	6 (0.8)
Trapped		
Not trapped	691 (97.6)	686 (96.9)
Trapped	14 (2.0)	18 (2.5)
Missing	3 (0.4)	4 (0.6)