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Exploring crash characteristics and injury outcomes among older truck drivers: An analysis of truck-involved crash data in the United States

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ABSTRACT

Road freight transportation represents a long-standing public health and transportation safety problem in the United States. Despite the United States' aging population, and predictions of an aging road freight transportation workforce, there is little information about the unique safety issues faced by older truck drivers, whether they pose an increased safety risk or how to inform the development of new evidence-based preventive strategies. This study represents the starting point for addressing these issues by exploring differences in crash characteristics and injury outcomes in older and middle aged driver groups. Two sets of data in the United States (i.e., Fatality Analysis Reporting System and the National Automotive Sampling System General Estimates System) were used to analyze trends and compare truck drivers aged 60 years and older to their younger counterparts (i.e., 27–50 year olds). The results of this study both support and refute previous research. No differences were identified in crash outcomes and characteristics between older and middle aged truck drivers, representing a departure from previous research conducted with non-professional drivers. Furthermore, older drivers were found to display some safer driver behaviors (i.e., safety belt and alcohol use) compared with middle aged drivers. The results support the need for future research in this area and countermeasures that leverage the knowledge and experience of older truck drivers in managing safety in the transportation industry.

1. Introduction

Road freight transportation represents a long-standing public health and transportation safety problem in the United States (U.S.). In 2014, there were an estimated 438,000 large truck-involved crashes in the U.S., resulting in 3903 people killed and approximately 111,000 injured (National Highway Traffic Safety Administration, NHTSA, 2016a). These figures are likely to increase, given a steadily increasing demand for both freight services and the requisite truck drivers (Short, 2014). One group of truck drivers found to be over-represented in fatal crashes is comprised of drivers aged 60 years and older (Duke et al., 2010). Previous research has shown that the risk of a highway fatality involving heavy vehicles increases commensurate with drivers' age and that drivers aged 65 years and older are 4.3 times greater risk of being killed in crash compared with drivers aged 15–19 years (Chen et al., 2014). This trend is unlikely to change given the proportion of truck drivers aged 65 years and over almost doubled from 2.8% in 2003 to 5.4% in 2008.

The Federal Motor Carrier Safety Administration (FMCSA, 2017) does not specify a maximum age limit for drivers and there is currently no performance-based testing of commercial motor vehicle (CMV) drivers over a certain age. Most CMV drivers are required to meet the medical standards of the FMCSA (i.e., Department of Transportation examination) which involves an assessment of the CMV drivers' capability to perform all driving and non-driving work-related tasks. As discussed in a current study conducted by the FMCSA, the Age Discrimination in Employment Act of 1967 precludes employers from excluding older drivers from the workforce on the basis of safety concerns. Removing older drivers from the workforce is not necessarily the solution to this problem, nor is there research to support this approach. In fact, research has identified that 'fitness-to-drive' should be based on drivers' functional performance rather than their age (Koppel and Charlton, 2013; Langford and Koppel, 2006). Thus, it is important to understand the unique challenges facing older drivers so that targeted interventions can be identified.

With the exception of a few studies (Campbell, 1991; Duke et al., 2010), there is little information on risk factors that may contribute to crashes among older truck drivers. While there are many individual differences in the aging process, even relatively healthy older adults are likely to experience some level of functional decline in sensory,

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cognitive and physical abilities (Waller, 1991). These declines in functional abilities can include: a decline in visual acuity and/or contrast sensitivity; visual field loss; reduced dark adaptation and glare recovery; decline in auditory sensitivity and discrimination; reductions in motion sensitivity; a decline in attentional abilities; slowed cognitive processing speed; reduced long-term memory retrieval; loss of strength, stamina, and flexibility; postural control and gait changes; and slowed reaction time (Eby et al., 2009). Of relevance to older truck drivers is how declines in these abilities relate to the safe operation of a vehicle on the road and whether these skill degradations put them at increased risk of crash-related injury or death. The need for urgent attention was highlighted by a recent report by the American Transportation Research Institute (Short, 2014) that pointed to the aging employee base of the trucking industry, and projected significant growth in the percentage of trucking employees in the age ranges of 55–64 years and 65 years and older.

Further, there is little information about the unique safety issues faced by older truck drivers and existing preventive strategies to address these issues, or how to inform the development of new evidence-based preventive strategies. This study represents the starting point for addressing this issue by describing trends in truck crash data to identify risk factors that contribute to crashes among older truck drivers. Two sets of data in the U.S. were analysed to identify differences in crash outcomes and characteristics in middle and older aged truck drivers. The crash analyses addressed the following questions:

1. What is the distribution of crashes by severity type, and are older truck drivers more highly represented in fatal and non-fatal crashes compared with middle aged truck drivers?
2. What is the distribution of crashes by type of vehicle, and are older truck driver more highly represented in some vehicle categories compared with middle aged truck drivers?
3. What types of crashes are older truck drivers involved in and how do they differ from middle aged truck drivers?
4. What environmental characteristics are associated with crashes involving older truck drivers and how do they differ from those involving middle aged truck drivers?
5. What types of risk-increasing factors performed by older truck drivers contribute to crashes, and how do those actions differ from those of middle aged truck drivers?

2. Methods

2.1. Data sources

Data were combined from two crash databases maintained by NHTSA: (1) the Fatality Analysis Reporting System (FARS) (NHTSA, 2016a); and, (2) the National Automotive Sampling System General Estimates System (GES) (NHTSA, 2016b). FARS was established in 1975 and is a census of all fatal motor vehicle crashes within the U.S. and Puerto Rico. To be included in FARS, crashes must involve a motor vehicle traveling on a public roadway and must result in the death of a vehicle occupant or non-occupant within 30 days of the crash. FARS data are compiled by analysts in each state from state records, and investigators at the crash scene. The database includes information at the crash, vehicle, and person levels. GES was established in 1988 and is a nationally-representative probability sample of all police-reported crashes. To be included in GES, crashes must have a police crash report, involve at least one motor vehicle traveling on a roadway, and result in property damage, injury, or death. GES is a stratified, hierarchical sample with an associated case weight (the inverse of the selection probability) used to estimate population totals. FARS and GES data on crashes occurring from 2010 to 2012 were combined to create the dataset used for this analysis. FARS was used to obtain fatal crash data and GES was used to obtain non-fatal crashes. Combined in this way, FARS and GES provide the best estimate of the U.S. national crash experience.

Table 1
Truck type by driver age.

Truck type	Truck driver age	
	27–59	60 +
Medium SUT	25.8%	20.7%
Heavy SUT	18.4%	20.7%
Bobtail	1.5%	2.5%
Tractor-semitrailer	42.0%	46.7%
Double/Triple	1.4%	1.1%
Oher	10.9%	8.3%
Total	100.0%	100.0%

2.2. Vehicles

Crashes included in the analysis were limited to those of the tractor-semitrailer combination. The argument for doing this was to control for differences in operations (i.e., core business activity) and crash risk exposure. Combination trucks, which are overwhelmingly tractor-semitrailers, average about 62,000 vehicle miles traveled (VMT) per year, significantly more than the annual average of single-unit trucks (SUTs) (estimated at 13,000 miles/year). In addition, truck configurations differ in the distribution of travel by road type. For example, in 2015 the estimated VMT for combination units was 27.9% on interstate rural roads compared with 8.8% VMT for SUTs (FHWA, 2015).

To further support this argument, an analysis was conducted on the FARS and GES data to explore truck configuration and driver age (see Table 1). The analysis found a significant relationship between truck driver age and truck type, χ^2 (5) = 20.36, p < .05. In particular, the data indicated that older truck drivers and middle aged truck drivers (42.0%) were more likely to use tractor-semitrailers than any other truck type. Thus, all data generated in this research paper are restricted to crashes for tractor-semitrailers and middle aged and older age groups.

2.3. Drivers

Middle aged and older truck drivers were included in the analysis to allow comparison between age groups. Drivers were assigned to the following age groups: 27–59 years, and 60 years and older. The 27–59 year old age group was considered to represent 'middle-aged truck drivers' and the 60 years and older age group was considered the 'older truck driver' group.

2.4. Data analysis

SAS was used to compute chi-square statistics on a combined dataset consisting of the FARS and GES datasets. SAS was capable of interpreting the sampling structure of the GES dataset. Case weights for the GES records are simply the inverse of their selection probabilities. The case weight of all records in FARS was set to 1 to reflect the fact that FARS is a census file. All the FARS cases were then assigned their own sampling unit and stratum. Chi-square statistics were used to compare differences across older and middle aged groups on key variables.

3. Results

Results have been divided into four sections. The first section characterizes the age of truck drivers by injury severity. The second section describes the age of truck drivers by type of crash. Rollover crashes are also characterized by the driver's age, given that this type of crash significantly increases the probability of truck driver fatality. The third section characterizes the age of crash-involved truck driver by environmental conditions, including lighting condition, roadway alignment, and roadway surface condition. The final section