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Fatigue and crashes: The case of freight transport in Colombia

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ABSTRACT

Truck drivers have been involved in a significant number of road fatalities in Colombia. To identify variables that could be associated with crashes in which truck drivers are involved, a logistic regression model was constructed. The model had as the response variable a dichotomous variable that included the presence or absence of a crash during a specific trip. As independent variables the model included information regarding a driver's work shift, with variables that could be associated with driver's fatigue. The model also included potential confounders related with road conditions. With the model, it was possible to determine the odds ratio of a crash in relation to several variables, adjusting for confounding. To collect the information about the trips included in the model, a survey among truck drivers was conducted. The results suggest strong associations between crashes (i.e., some of them statistically significant) with the number of stops made during the trip, and the average time of each stop. Survey analysis allowed us to identify the practices that contribute to generating fatigue and unhealthy conditions on the road among professional drivers. A review of national regulations confirmed the lack of legislation on this topic.

1. Introduction

Worldwide, road traffic crashes have risen in recent years, especially in developing countries (PIARC, 2003). Each year 110,000 people die in road crashes, and if the actual trend does not change, road crashes will become the fifth leading cause of injury death by 2030 (World Health Organization, 2011). In Colombia, fatalities from road crashes are the second leading cause of violent death (Instituto Nacional de Medicina Legal y Ciencias Forenses, 2010). In the country during 2010, there were approximately 170,000 road traffic crashes, of which ~5000 were fatal, and ~35,000 victims suffered injuries (Corporación Fondo de Prevención Vial CFPV and Uniandes, 2012). Data from the Ministry of Transportation shows that in 2010, freight transport vehicles were involved in 16% of the fatal crashes of that year, even though trucks account for only 3.5% of the motor vehicle fleet circulating in the country (Ministerio de Transporte, 2011).

Fatigue has been identified as a cause of road traffic crashes. Fatigue is a bodily response that has the potential to affect people's moods. It is produced by long-term efforts, which may affect work performance. It can manifest itself in slow or erroneous reactions, loss of vigilance and alertness, a decrease in performance, and failure to anticipate and avoid a crash (Ramirez Cavassa, 2000). The symptoms are reflected in physical, mental and emotional behaviour, generating impotence, somnolence, irritability, tension, sensory disturbance, tachycardia, headaches, sweating, and tremors (Ramirez Cavassa, 2000; University of Maryland Medical Center, 2011).

In the case of truck drivers, the driving time, resting time, and presence or absence of breaks during the trip are variables that have been associated with fatigue and the risk of a crash in previous studies. A study conducted by Baas et al. (2000) with a major survey of truck drivers in New Zealand, found that fatigue is involved in 5.1% of fatal road crashes. Pérez-Chada et al. (2005), presented results from a cross-sectional study in Argentina showing that truck drivers' mean hours of sleep during working days were 3.76, that 84.7% of work shifts were longer than 12 h, that 43.7% of drivers reported frequent sleepiness while driving, and concluded that the risk of a crash is associated with frequent snoring, daytime sleepiness, and reports of sleepiness at the wheel. Hakkanen and Summala (2001) studied truck drivers in Finland and concluded that before a crash a driver fell asleep in 2% of cases, 4% of the drivers were drowsy, and 51% of the drivers had made an error in attention, anticipation or estimation. From a study of lorry and bus drivers in northern Sweden, Van den Berg and Landstrom (2006) showed that 14% reported sleeping while driving, 8% reported head nodding, and 40% of hazard events occurred to drivers who reported less than 6 h of sleep before starting their shifts. In the United States,

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Table 1
International regulations.

European Union: CE561-2006	
Daily driving time	Max. 9 h. Twice a week max. 10 h.
Weekly driving time	Max. 56 h. Two consecutive weeks max. 90 h.
Daily rest	At least 11 h. (Option: Two rest times with durations of 9 h and 3 h.)
Reduced daily rest	Max. Three times/week daily rest could be between 9 and 11 h.
Weekly rest	45 h.
Reduced weekly rest	Min. 24 h and max. 45 h. Hours not taken must be replaced the following week.
Breaks	Option 1: Break of 45 min after driving for 4.5 h. Option 2: Two breaks with a duration of 30 min and 15 min minimum, in 4.5 hours of driving.
Australia: Road Traffic Regulations 1999	
Time windows (Periods) of work that determine regulations	Period 1: 5.5 h. Period 2: 24 h. Period 3: 336 h.
Driving time according with period	If Period 1: 5 h. If Period 2: 14 h. If Period 3: 144 h. For Period 3, driver should have at least 6 h working on duties outside the truck.
Breaks and rest time	If Period 1: One break of 30 min or two breaks of 15 min. Period 2: One break of 10 h (min. 6 h outside the truck). Period 3: Out of the 336 h, driver should rest 192 h (with a min. of two 24 h breaks outside the truck).
Canada: Commercial Vehicle Drivers' Hours Of Service regulations 1994	
Daily working time	Max. 14 h.
Daily driving time	Max. 13 h.
Weekly working time	Max. 70 h. Two consecutive weeks max. 120 h.
Daily rest	Min. 10 h. Option: split into short breaks.
Reduced daily rest	Min. 8 h.
Weekly rest	Min. 36 h.
United States of America: 49 CFR 395	
Daily working time	Max. 14 h.
Daily driving time	Max. 11 h. in a 14-h period.
Weekly working time	No motor carrier shall permit or require a driver of a property-carrying commercial motor vehicle to drive: "(1) Having been on duty 60 h in any period of 7 consecutive days if the employing motor carrier does not operate commercial motor vehicles every day of the week; or (2) Having been on duty 70 h in any period of 8 consecutive days if the employing motor carrier operates commercial motor vehicles every day of the week."
Daily rest	Min. 10 h.
Rest breaks	Min. 30 min in 8 h.
Weekly rest	"*After* June 30, 2013, any period of 7 consecutive days may end with the beginning of an off-duty period of 34 or more consecutive hours that includes two periods from 1 a.m. to 5 a.m. *After* June 30, 2013, any period of 8 consecutive days may end with the beginning of an off-duty period of 34 or more consecutive hours that includes two periods from 1 a.m. to 5 a.m. *After* June 30, 2013, a driver may not take an off-duty period allowed by this section to restart the calculation of 60 h in 7 consecutive days or 70 h in 8 consecutive days until 168 or more consecutive hours have passed since the beginning of the last such off-duty period. When a driver takes more than one off-duty period of 34 or more consecutive hours within a period of 168 consecutive hours, he or she must indicate in the Remarks section of the record of duty status which such off-duty period is being used to restart the calculation of 60 h in 7 consecutive days or 70 h in 8 consecutive days."

Source: Data from Department of Justice (1994), South Australia Regulations (1999), European Union (2006), National Archives and Records Administration (2012), Federal Authorities of the Swiss Confederation (2008, 2011), Department of Justice (2011).

Hanowski et al. (2008) collected data from 62 commercial-vehicle drivers who worked for three trucking companies, and found 58 critical events between the 10th and 11th hour of their work shifts. Furthermore, the mean sleeping time in this group was 6.28 h, and when drivers experienced a critical incident, they had slept for less than their average overall sleep quantity.

Several countries have implemented regulations regarding driving time and resting time, which are considered adequate strategies to reduce road traffic crashes. Jones et al. (2005) compared the labour and transportation laws of Australia, Canada, the United States of America, Switzerland, and the European Union. Table 1 shows that, despite some differences in terms of the hours allowed for driving and resting, legislation in several countries clearly regulates how much time a driver should both drive and rest, and is used as a strategy to reduce fatigue induced crashes.

The enforcement of the regulations shown in Table 1 is specified in detail in order to make them useful. The penalties for freight transport companies and drivers are severe. They include fines, immobilisation of the vehicle, and even imprisonment and temporary withdrawal of the driving license (Department of Justice, 1985; National Archives and Records Administration, 2012; National Transport Commission of Australia, 2008; Federal Authorities of the Swiss Confederation, 2008; Europeas, 2009).

Truck drivers are a highly exposed group because of the extended time they spend behind a wheel, and, as a result, are at high risk of being involved in road crashes. Specifically, the working conditions of truck drivers may increase the risk of a crash dramatically if the regulations do not include a road safety perspective. Unfortunately, in developing countries, this issue has not been properly addressed. This study analyses the association between drivers' fatigue and road crashes in Colombia as a way to promote regulations focused mainly on hours of service and rest periods.

2. Methods

To conduct this study, primary information regarding the truck drivers' characteristics and variables related to a reference road trip was collected using surveys among truck drivers. With this information, both single variable relative risk estimates and multivariate logistic regression models were used to determine the associations of several factors with the risk of a crash. Fig. 1 shows a flow chart of the steps developed for this study. A detailed description of each step is included below.