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# Traffic crashes probability: A socioeconomic and educational approach

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ABSTRACT

While it has been acknowledged in the literature the need to apply comprehensive approaches to identifying specific measures in order to improve road safety, only few reports have found how integrate the socioeconomic and educational characteristics of population into the road safety analysis. This paper assumes the probability of a road user to get involved in traffic crash in order to represent the performance measure of the road safety in a such specific region. The logical analysis of a field survey involving different road users, reveals that specific socioeconomic and educational characteristics influence the probability of a road user to get involved in a traffic crash. The outputs from this research can be helpful to define public policies on road safety for users of each transport mode.



## 1. Introduction

The motivation of this research derives from the need to explore causes of traffic contretemps coming from general perspective, as a function of different infrastructure users, in order to provide data for transport safety community in which socioeconomic and educational aspects must be considered when developing road safety policies exist.

Worldwide, traffic crashes are leading cause of death of people between 15 and 19 years old (Sivak, 2002). In the case of Mexico, it has been estimated that between 70% and 90% of traffic crashes are result of driveŕs poor traffic behavior, further recognizing human errors and driveŕs offenses to traffic rules as the most common traffic crashes causes (García, Acosta, & Vázquez, 2010). For Mexicós federal highways, has been reported that 72.9% of road contretemps could be attributed to driver-related factors (IMT, 2013). For the State of Queretaro, in which Queretaro city is located, 93% of traffic crashes have been attributed to driverś poor traffic behavior (CONAPRA, 2010).

In relation with the performance of any road safety system, Ker et al. (2005) and Mackay and Tiwari (2001) mentioned that human errors should be minimized in order to significantly improve road safety.

In case of drivers, traffic safety policies recently implemented have been focused on improving their traffic behavior (Mirzaei, et al; 2014), specifically to promote a better attitude when using roads (Wang et al., 2010; Martinov-Cvejin, Jakovljevic, Nalcic, Grujic, & Ac-Nikolic, 1993; Teoh, Soh, Heng, Heng, & Cheah, 2004). However, Mirzaei et al. (2014) reported that while many drivers show a safe traffic attitude, there are specific circumstances that induce a poor traffic performance from some of these road users. Consequently, the authors urge about the need to clarify such circumstances, including any potential cultural aspect. For the different groups of road users, Factor, Mahalel, and Yair (2007 and 2008) proposed a

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theoretical model to analyze the influence that some social and cultural characteristics of these groups have on traffic safety, reporting that road safety depends on cultural and social features, including lifestyles and attitudes.

On the basis of field surveys that were carried out through questionnaires given to road users, Twisk, Commandeur, Vlakveld, Shope, and Kok (2015) link some characteristics of the target population on the level of risk behavior observed on roads, including their social attitudes, knowledge of the traffic rules and age. Unfortunately, those mentioned authors from their analyses get exclude the cyclists and the pedestrians. For the different modes of transportation, Moeinaddini, Asadi-Shekari, Sultan, and Shah (2015) reported that when contretemps analysis was carried out in urban areas, only few studies have examined the effect of the transportation mode chosen by the user.

Few authors have included some socioeconomic characteristics of the population when analyzing road safety (Zaidel, 1992; Huguenin, 2005; Factor et al., 2007, 2008). In particular, Moeinaddini et al. (2015) explicitly suggest the consideration of the mandatory mode of transport when analyzing road safety. Recently, Obregón-Biosca, Betanzo-Quezada, Romero-Navarrete, and Ríos-Nuñez (2018) reported the relationship between the level of population's and road safety.

It is the purpose of this paper to describe the methodological aspects and main results, associated to a study that was carried out in the City of Santiago de Querétaro (México), concerning an estimation of the probability for a transport infrastructure user to get involved in a traffic mishap, as a function of the mode of transport and some socioeconomic and educational characteristics of the surveyed population.

## 2. Background

This section analyses the findings reported in the literature about of some socioeconomic and educational factors that have great influence in road safety.

When analyzing the number of road contretemps as a function of a given country economic level, Xu, Wang (2014) conclude that road useŕs income is a determining factor for road safety. According to its 2013 Global Status report on road safety, such conclusion is also reached by the World Health Organization, as low- and middle- income countries showing higher traffic mortality rates, when compared with high-income economies. Other authors also reported such mentioned cause – effect relationship, including Shinar (1993), Braver (2003), Zambon and Hasselberg (2006) and Factor, Mahalel, and Yair (2008). In general, these authors argue that a low per capita income is a determining factor for traffic crashes.

Results reported by Shinar, Schechtman, and Compton (2001) suggest a characteristic relationship between driveŕs income and the obedience of speed limits, with the low income drivers showing the greater reluctance to respect such speed restrictions. A similar behavioral pattern was reported by Shin, Hong, and Waldron (1999), whose findings reveals that in the case of students, the socioeconomic status gets correlated with the probability of using seatbelts.

The effect of driver age on road safety has been analyzed in the literature. Xu et al. (2014) report an inverse correlation between the driveŕs age and the probability of being involved in a traffic crash, which is explained by the authors as the result of the experience and a greater driver caution when he or she becomes older. DeJoy (1992), Gabany, Plummer, and Grigg (1997) and Factor et al. (2008) identify driveŕs age as a critical factor influencing the occurrence of traffic crashes. According to these authors, young drivers overestimate their driving ability, inducing a distorted assessment of the level of risk involved when performing critical driving actions. According to Wosiack-da-Silva et al. (2012), driver age is also a significant influential factor in the case of motorcycling.

On the basis of a user-reported study, Shinar et al. (2001) tried to clarify the potential relationship between driveŕs demographic/economic features and probability of being involved in a traffic crash. The studied reports showed that male operators exhibit less safe driving than female drivers. Unsafe driving associated to male drivers has also been described by several Yagil (1998). Particularly, these drivers have been found as less respectful to speed and other traffic restrictions signals (Ferguson, Williams, Chapline, Reinfurt, & De Leonardis, 2001; Taubman, Mikulincer, & Gillath, 2004), such drivers tend to drive comparatively faster, and to disturb other road users more frequently compared to female drivers (Evans, 2004; Boyle, Dienstfrey, & Sothoron, 1998).

Factor et al. (2008) conclude that probability of being present in traffic crashes is higher for men than women, and for young drivers than old drivers. Furthermore, their logistic regression analysis showed a strong inverse correlation between socioeconomic-educational status and traffic crash probability, i.e. a driver combining a high education level and a high socioeconomic status, will have the minimum probability of being involved in a traffic crash.

The inverse correlation between the general education level and the probability of being involved in traffic crashes has also been reported by Shinar (1993). Braver (2003), on the other hand, combined the educational level characteristic of the driver with other socioeconomic factors such as occupation, income, type of housing, kind of neighborhood and the sociocultural environment, finding the lower the education level the greater is the probability of being involved in a traffic crash. Hemenway and Solnick (1993) attribute such situation to a greater respect to traffic regulations that higher education drivers tend to have. Logistic regression models reported by Shell, Newman, Córdova-Cazar, and Heese (2015) revealed this same trend regarding the effect of driver education on the probability of being involved in a traffic crash.

As far as the future needs for statistical analysis of socioeconomic factors and road safety, Wang et al. (2010), Iversen and Rundmo (2004), Ali, Haidar, Ali, and Maryam (2011) and Moradi, Motevalian, Mirkoohi, Mckay, and Rahimi-Movaghar (2012) suggest the inclusion of variables such like driver knowledge of traffic regulations, recommended practices and his or her