Transportation Research Part F 38 (2016) 22–28

Contents lists available at ScienceDirect

Transportation Research Part F

journal homepage: www.elsevier.com/locate/trf

Comparison of contributing factors in hit-and-run crashes with distracted and non-distracted drivers

Arash M. Roshandeh [a,*], Bei Zhou [b], Ali Behnood [a]

[a] Lyles School of Civil Engineering, Purdue University, 550 Stadium Mall, West Lafayette, IN 47907-2051, USA
[b] School of Highway, Chang'an University, Xi'an 710064, PR China

ARTICLE INFO

Article history:
Received 6 October 2014
Received in revised form 30 November 2015
Accepted 24 December 2015

Keywords:
Hit-and-run
Distraction
Logistic regression model
Traffic safety

ABSTRACT

Among different types of crashes, hit-and-run is driver's failure to stop after a vehicle crash. There are many accidents where drivers could actually be at fault or totally innocent, and leaving the scene would turn an innocent driver into a criminal. The current paper aims to contribute to the literature by exploring the association of different variables pertaining to the condition of infrastructure, environment, driver, population of the area, and crash severity and type with hit-and-run crashes. The analysis is performed for two data sets: (i) crashes where the driver was distracted; and (ii) crashes where driver was not distracted. Hit-and-run crash data with corresponding factors are police-reported data for crashes within Cook County, Illinois, occurring between 2004 and 2012. A logistic regression model assessed 43 variables within 16 categories for statistically significant association with hit-and-run crashes, for drivers with and without distraction. For both driver distraction statuses, 17 variables were associated with a significant increased probability of a hit-and-run crash and 10 variables were associated with a significant decreased probability. Additionally, it was found that crashes on curve level and curve hillcrest road alignment types were associated with increased likelihood of a hit-and-run crash when the driver was distracted and decreased likelihood when the driver was not distracted. Variables related to hit-and-run crashes vary depending on driver's distraction status. When comparing likelihood to flee the scene after a crash, non-distracted drivers are 27% less likely to do so compared to distracted drivers.

1. Introduction

Hit-and-run crash is defined as a collision where driver of the striking vehicle flees the scene without aiding the victim or offering information. Still according to many law enforcement officers, this type of offence is growing and affects individuals from different age, gender, and social status causing death or permanent injury. Hit-and-run crashes increase the risk for the victim since flight often results in delays in emergency medical services (Tay, Rifaat, & Chin, 2008). There are many accidents where drivers could actually be at fault or totally innocent, and leaving the scene would turn an innocent driver into a criminal. Nonetheless, if driver is impaired with alcohol, using cell phone, or smoking he/she might leave the crash location to hide his/her illegal act.

* Corresponding author.
E-mail addresses: aroshand@purdue.edu (A.M. Roshandeh), bzhou3@chd.edu.cn (B. Zhou), abehnood@purdue.edu (A. Behnood).

http://dx.doi.org/10.1016/j.trf.2015.12.016
1369-8478/

Solnick and Hemenway (1995) pointed out that drivers mostly run in urban areas, during weekends and also at night. Tay et al. (2008) performed a study in Singapore and found that hit-and-run crashes would happen more likely on bridges and close to shopping centers and are less likely to occur if crash type is either right turn or U-turn maneuver on undivided roads. Additionally, Tay, Barua, and Kattan (2009) applied a logistic regression model to determine contributing factors on hit-and run crashes in California. Their study showed that speed limit, traffic control device, lighting condition, and roadway alignment are some of the main parameters in roadway design which could potentially minimize hit-and-run crashes. Results of another study by Tay, Kattan, and Sun (2010) indicated that likelihood of hit-and-run crashes is higher in weekend compared to weekdays. In terms of driver related factors, female drivers aged at 55 or above showed the greatest likelihood to flee after a crash. MacLeod, Griswold, Arnold, and Ragland (2012) used data on single pedestrian-vehicle fatal crashes and found that probability of hit-and-run crashes is higher in the morning, bad lighting conditions, during weekend, and more importantly if driver was impaired with alcohol. Aidoo, Gyimah, and Ackaah (2013) employed a binary logit model and conducted a study in Ghana to determine factors related to the pedestrian hit-and-run accidents. Analysis results revealed that the probability of leaving the crash scene increases under fatality, bad weather, and roadways without median. Recently, with data collected from Guangdong Province in China, Zhang et al. (2014) applied a logistic regression analysis and found that the probability of hit-and-run crashes would increase if it was a pedestrian related crash, driver was male and without a valid driving license or auto insurance.

Getting involved in any secondary task such as using cell phone would increase the crash occurrence and potential hit-and-run. According to the reported data by National Highway Traffic Safety Administration approximately 5870 people died and almost 500,000 individuals were injured in crashes caused by driver's distraction in year 2008 (Ascone, Lindsey, & Varghese, 2009). Although, Platten, Milicic, Schwalm, and Krems (2013) showed that drivers reduce their secondary task like cell phone usage or talking to passengers when approaching critical driving situations, but still the most common drivers' distraction factor is using a cell phone (Amado & Ulupınar, 2005; Ghazizadeh & Boyle, 2009; Holland & Rathod, 2013; Reimer, Mehler, Coughlin, Roy, & Dusek, 2011; Reimer, Mehler, & Donmez, 2014; Waddell & Wiener, 2014; Zhou, Wu, Patrick Rau, & Zhang, 2009). Beck, Yan, and Wang (2007) investigated drivers' behavior when using cell phone while driving and found that cell phone using motorists were more likely to run a stop sign or red light. Behnood, Roshandeh, and Mannering (2014) applied a latent class multinomial logit model to determine factors affecting driver's crash severity level and found that distraction due to electronic devices would increase the likelihood of no-injury crashed more than minor-injury and severe-injury.

As demonstrated in literature, distraction is one of the main factors causing severe crashes. The current paper aims to contribute to the literature by exploring the association of different factors with hit-and-run crashes. The analysis is performed for two driver conditions: (i) crashes where the driver was distracted; and (ii) crashes where driver was not distracted. In the present study, driver's distraction is defined if it is: (i) due to operating an electronic communication device (e.g., cell phone); (ii) from other electronic devices (e.g., navigation device, DVD player), (iii) from outside of the vehicle (e.g., dangerous overtaking); and (iv) from inside of the vehicle (e.g., chatting with passengers).

2. Data collection and processing

Using a dataset with more variables would enable decision makers (e.g., state and local legislators or engineers at Department of Transportation) to get a better view in terms of possible factors connected to hit-and-run crashes and consequently apply the right treatment at the right time and right location to reduce the likelihood of crash occurrence. In the current study, hit-and-run crash data with corresponding factors are police-reported data for crashes within Cook County, Illinois, occurring between 2004 and 2012. In order to study the association of various factors with hit-and-run crashes, the large dataset was first divided into two parts: (i) crashes where the driver was distracted; and (ii) crashes where the driver was not distracted. Therefore, two different data sets were used to perform the analysis, each with 53,220 observations. In this paper, 43 variables are selected for modeling purposes. These variables are categorised into 16 parts including day of week, population of area, crash type, crash severity, class of traffic-way, national highway system, traffic control device, road surface condition, crash location, light conditions, weather conditions, alcohol usage, intersection related, number of lanes, alignment, and median type. Detailed description of each category and the frequency of hit-and-run crashes corresponding to each variable is presented in Table 1.

3. Methodology

In the current study, logistic regression model is applied to perform the analysis. This is due to the fact that dependent variable in this study (hit-and-run or non-hit-and-run) is a binary variable. As adopted by most of previous studies in this field, logistic regression models are able to predict the probability of hit-and-run crashes as a function of chosen independent variables (Tay et al., 2008, 2009, 2010; Zhang et al., 2014). In the context of this study, the logit is the natural logarithm of the likelihood ratio, that the dependent variable (hit-and-run or non-hit-and-run) is 1, such that (Washington, Karlaftis, & Mannering, 2011)