Who Violates Traffic Rules?

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Key Findings:

- Traffic rule violations contribute to crashes including fatal crashes;
- Drivers aged less than 18 years were 'at-risk' to exceed the speed limit/safe speed for conditions, drive aggressively/erratically, and disregard road signs;
- Drivers aged over 70 years were 'at-risk' to disregard traffic signals, and fail to yield the right-of-way;
- Drivers aged between 19 to 25 years were 'at-risk' of driving under the influence of alcohol and drugs;

Abstract

Traffic rule violations contribute to crashes including fatal crashes. This paper aims to investigate six different traffic rule violations and identify people who are 'at-risk' of committing violations and being involved in crashes. North Carolina crash data from 2010 to 2013 were analyzed. Drivers aged less than 18 years were 3.2 times more likely to exceed speed limits/safe speed for conditions, 2.4 times more likely to drive aggressively/erratically, and 2.7 times more likely to disregard the road and traffic signs compared to drivers aged between 26 to 40 years. Drivers aged over 70 years were 4.3 times more likely to fail to yield the right-of-way compared to drivers aged between 26 to 40 years. Drivers aged between 19 to 25 years were 1.4 times more likely to drive under the influence of alcohol or drugs and be involved in crashes. The results suggest that a diverse set of countermeasures may be needed to target drivers by age in order to reduce the number of traffic rule violations and eventually traffic fatalities.

Keywords

Traffic Violation, Crashes, Driver Age, Exceed Speed Limit, Driving Under the Influence

Introduction

Transportation officials set forward traffic rules to ensure smooth and safe travel for the public on roads. However, violation of those traffic rules is a major contributor to fatalities and injuries (Penmetsa, 2017). Motor vehicle crashes resulted in 40,200 fatalities during 2016 in the United States (National Highway Traffic Safety

Administration, 2017). According to NHTSA, drivers account for 94% of the traffic fatalities. Traffic violations such as driving under the influence of alcohol and speeding alone contributed to approximately 60% of the total fatalities in 2013 (NHTSA, 2014; 2015).

Traffic rule violations can be intentional or unintentional: in both cases, they are a threat to society. They not only put the traffic rule violators at risk, but also other road users (Penmetsa et al., 2017). According to Zhang et al. (2013) and Factor (2014), if drivers comply with the traffic rules, the number of fatalities may be significantly reduced. The objective of this study was to identify people who are 'at-risk' of committing traffic rule violations and eventually being involved in crashes.

Literature review

Older drivers are more likely to violate traffic rules at intersections compared to other drivers (Staplin et al., 1998; Braitman et al., 2007). These two studies found that older drivers accept unsafe gaps, perform unsafe lane changes, fail to detect the presence of other vehicle in the intersection, and, often fail to comply with stop signs.

Drivers younger than 18 years and older than 65 are more likely to be involved in crashes that occurred due to stop sign violations (Retting et al., 2003). Typical red light runners are male (Retting, 1999) and are aged between 18 to 25 years (Porter, 1999). Drivers aged 16 to 17 years are more likely to drive aggressively than those aged 18 to 20 years, who, in turn, are more likely to drive aggressively than those aged above 20 years (Paleti et al., 2010).

Penmetsa and Pulugurtha (2017a) investigated more than 20 traffic rule violations and risks associated with such harmful driving behaviors. Exceeding the speed limit was identified the riskiest traffic rule violation followed by driving under the influence of alcohol. Further, Penmetsa and Pulgurtha (2017b) ranked traffic rule violations based on several criteria such as frequency, crash severity, and cost. The top six traffic rule violations ranked in order were

(1) going the wrong way, (2) driving under the influence of alcohol, (3) operating vehicle erratically or aggressively, (4) failure to yield the right-of-way, (5) exceeding authorized speed limit, and (6) disregarding traffic signal. These six traffic rule violations from Penmetsa and Pulugurtha (2017b) were considered for the analysis in this study except going the wrong way. Going the wrong way is more of an unintentional error by drivers, which can be prevented by improved ramp designs, signage, striping, etc. (Moler, 2002). Hence, instead of analyzing wrong way driving crashes, disregarding road signs (the next ranked traffic rule violation from Penmetsa and Pulugurtha (2017b)) was considered for analysis.

Methodology

Crash data were obtained from the state of North Carolina in USA from 2010 to 2013. A total of 855,900 crashes occurred during those four years. In order to identify people who are likely to have committed a traffic rule violation at the time of the crash, those with a traffic violation record versus those without were compared. Six different data sets were prepared for six traffic rule violations of interest. For example, to examine 'disregarding road signs' traffic violation, a binary dependent variable was created ('1' if a driver involved in the crash disregarded road signs, '0' if a driver involved in the crash did not commit any traffic rule violation). Drivers' age was the independent variable: ≤18, 19-25, 26-40, 41-55, 56-70, >70 years.

Logistic regression was performed using Statistical Analysis Software (SAS Institute Inc., 2012). The driver's age group between 26-40 years was used as a reference for driver's age. The odds ratio was used to quantify the effect and is defined as the ratio of an event happening to an event not happening.

Results

Descriptive analysis results are presented in Table 1. During the 4-year study period, North Carolina drivers failed to yield the right-of-way over 74,000 times. Of the 74,046 drivers who failed to yield the right-of-way, 673 were killed in crashes. 'Exceeding speed limit or safe speed limit for conditions' had the highest number of driver deaths compared to any other traffic rule violation. 'Disregarding road signs' had the lowest frequency, but were related to more driver fatalities than 'disregarding traffic signals'.

Table 2 summarizes the computed odds ratios of committing the respective traffic rule violation at the time of the crash.

Drivers of age less than 18 were approximately three times more likely and drivers aged between 19 to 25 years were twice as likely to exceed the speed limits than drivers aged 26-40 years. Drivers aged 70 years were less likely to exceed speed limit compared to drivers in the reference age group.

Drivers of age less than 18 years were 3.7 times more likely and drivers aged 70 years or more were over four times likely to fail in yielding the right-of-way compared to drivers aged 26-40 years. Drivers between 56 and 70 were 1.4 times more likely to fail to yield the right-of-way.

In North Carolina, the legal drinking age limit is 21 years. Even then, a substantial number of drivers aged under 21 years were involved in crashes whilst driving under the influence of alcohol. Drivers aged between 19 to 25 years were 1.4 times more likely to have been under the influence than drivers aged 26-40 years

Drivers aged less than 18 years were 2.4 times more likely to drive aggressively, erratically, or recklessly compared to drivers aged 26-40 years. Drivers aged between 19 to 25 years were twice as likely to drive aggressively.

Road signs for this study include stop sign, yield sign and other road signs. Drivers less than 18 years were 2.7 times more likely and drivers aged over 70 years were 2.5 times more likely to disregard the road and traffic signs than drivers aged between 26 to 40 years.

Table 1. Frequency of traffic rule violations

Traffic rule violation	Frequency	Frequency of Drivers' Deaths
Exceeding Speed Limit/Safe Speed for Conditions	47,970	1,041
Failing to Yield the Right-of-Way	74,046	673
Driving Under the Influence of Alcohol or Drug	15,180	880
Driving Aggressively/ Erratically/Recklessly	16,419	760
Disregarding Road Signs	7,715	603
Disregarding Traffic Signals	13,810	548

Table 2. Odds ratios of committing different traffic rule violations

Driver Age (years)	Exceeding Speed Limit / Safe Speed for Conditions	Failing to Yield the Right-of-Way	Driving Under the Influence of Alcohol or Drug	Driving Aggressively/ Erratically/ Recklessly	Disregarding Road Signs	Disregarding Traffic Signals
<18	3.21	3.72	0.60	2.42	2.75	2.06
19-25	2.01	1.80	1.42	1.99	1.77	1.64
26-40(R)	1.00	1.00	1.00	1.00	1.00	1.00
41-55	0.61	0.91	0.70	0.58	0.80	0.87
56-70	0.45	1.42	0.41	0.46	0.95*	1.18
>70	0.43	4.35	0.16	0.68	2.51	3.07

R reference category

* variable not significant at a 95 % confidence interval

Discussion and Conclusions

This paper identified people who are 'at-risk' of committing violations at the time of the crash in terms of driver age. A total of six traffic rule violations were investigated in this study. In North Carolina, failing to yield the right-of-way was the most frequently violated traffic rule followed by exceeding the speed limit/safe speed for conditions. Exceeding the speed limit/safe speed for conditions had the highest number of driver deaths compared to any other traffic rule violation.

Overall, drivers less than 18 years were 'at-risk' of exceeding the speed limit/safe speed for conditions, driving aggressively/erratically, and disregarding road signs. Drivers over 70 years were 'at-risk' of disregarding traffic signals, and failing to yield the right-of-way. Drivers between 19 to 25 years old were 'at-risk' of driving under the influence of alcohol and drugs. The results from this study suggest that a diverse set of countermeasures may be needed to target drivers by age in order to reduce the number of traffic rule violations and eventually traffic fatalities.

Drivers with high risk perceptions are less likely to take risks such as driving under the influence of alcohol, running red lights, etc. Young drivers perceive traffic rule violations less risky compared to older drivers (Penmetsa et al., 2017) and hence they are willingly likely to violate traffic rules. Even though older drivers have high risk perceptions, they still are 'at-risk' of committing violations and being involved in crashes. Past research suggests that older drivers' involvement in crashes is more due to cognitive and visual impairment (Owsley et al., 1991; Owsley et al., 1998; Ross et al., 2009).

While engineering treatments are vital to improve safety on roads, educating drivers about potential risk of violating a traffic rule is equally important. Studies such as Elder et al. (2004), Tay (2004), Lewis et al. (2007) have shown the effectiveness of public campaigns on improving road safety. The findings from this research could help target such education efforts by age and traffic violation.

More effective enforcement and penalty system may also help drivers comply with traffic rules. The North Carolina Department of Motor Vehicles (DMV) awards 3 penalty points if drivers are convicted of driving above the speed limit and revokes the license if convicted of driving 15 mph above the speed limit. Even though the number of crashes and fatalities occurred due to exceeding speed limit is very high, the number of penalty points applied is less compared to other less serious traffic violations such as passing on hill/curve. Revision of the penalty fine amount and points for traffic violations based on risks of fatal crashes may be beneficial to improve road safety.

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