

Statistical Analysis of the Impact of Penalties in Driving: A Case Study

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Abstract

The purpose of research is to highlight the impact of penalties/punishing during driving in the demographics of Mehran UET, Jamshoro. The cross sectional research was conducted as per convenient sampling technique by adopting the Dr. Larson questionnaire. We have focused only one factor i.e. 'punishing while driving' in our paper. Data was analyzed in SPSS version 22 and statistical analysis about frequency distribution and mean \pm SD is presented. Later on detailed data analysis with number of groups was conducted about punishing in nature. There were some groups which had greater mean response on few questions whereas, at the same time, their mean response of some questions was recorded low. In some variables, young females and males were pointed to be punishing in nature and on other hand, middle aged male drivers were also indicated to punish in nature. Since, this research was conducted with lesser sample size that's why it is difficult to generalize the scenario. Irresponsible drivers can hurt/kill themselves & others therefore this type of behavioral research about driving should be conducted to cope with this problem. Low sample size and inclusion of only a few demographics were counted to be the major limitations of the present research.

Keywords

Driving, Penalties, Punishing, traffic, vehicles.

1. Introduction

Aggressive driving is incremental and widely observed among drivers with each passing day (Mizell 1997). Elements that are likely to increment risk of collision are contemplated effort to drive aggressively, impatient with hostility, anguished according to Tescan (Gilbert and Orleans 2011) or "no regard to safety or ill-intentioned" (AAA Foundation for Traffic Safety 2009). It is known as Road rage (Paleti, Eluru, and Bhat 2010), (Kalwar, Khan, et al. 2020), (Wan et al. 2019). Aggressive driving may be intentional to get an edge over opponent drivers, and during the course, it increment chances of violations and driving crossing the traffic speed (Goodwin et al. 2013). Chance of physical and mental injury surge with this behavior (Grey, Triggs, and Haworth 1989). Aggressive driving is far grave problem as compare to traffic jam. According to by Dula, C.S. it can cause physical and emotional injury. (Dula and Geller 2003). It is by-product of frustration (Lajunen and Parker 2001), (Abou-Zeid, Kaysi, and Al-naghi 2011), which may not be part and parcel in every situation but aggressive driving behavior is rather suggested by it (Berkowitz 1989). Personality is another major aspect linked up with aggressive driving (AAA Foundation for Traffic Safety 2009). The

expression of aggression was reported in one of the research as: anger i.e. speeding tailgating and connected to road safety negatively (SWOV Institute for Road Safety Research 2012). Physical and mental injury, property damage and above all mortality could be result of aggressive driving (Dula and Geller 2003). It was highlighted during the past several year by researchers (Deffenbacher et al. 2002). Lack of patience and anger nature can cause aggressive driving (Khaskheli et al. 2018); to include further, offender may be instigated by anger may hurt others (Abou-Zeid et al. 2011), (SWOV Institute for Road Safety Research 2012), (Deffenbacher et al. 2003), (Schafer 2015). Congested traffic does lead to anger which becomes another element of aggression (A. Hennessy and L. Wiesenthal 1999). When confronted by congestion, hostile nature and anonymity- driving anger is expressed (Deffenbacher et al. 2003). Drivers competing during driving is another major factor associated with aggressive driving and violates in traffic violations (Dula and Geller 2003). The behavior that could be a punishing one is conjunction to cause of accidents, and led by tailgating practice and drivers counteract each other (Chakrabarty and Riku 2013). Anger, aggressiveness are connected with traffic health issues, traffic violations and accidents (Deffenbacher et al. 2000), (Novaco et al. 1979). During a simulation that was an experiment resulted that driving with anger could result in damaging the judgement, control of impulse and judgement. (Schafer 2015). Other aspect associated with driving aggressively are reflected in literature. “a sort of belief that one possess remarkable driving skills”, being relatively young”, traffic congestion, but only if drivers do not expect it” etc. (Chakrabarty and Riku 2013). This research underlines profoundly and analyze driving behavior of the drivers of Mehran UET, Jamshoro. With profound details, analysis of punishing while driving is produced in the perspective of several demographics. This research highlights the influence of demographics on the punishing behavior of drivers while driving.

2. Literature review

Anger is harmful socially, physically and psychologically (Montoro et al. 2018), (Priyanka and Tigga 2015). Road rage was indicated as the cause of frustration and which was reported to be expressed (verbal/nonverbal) in the form of driving anger (Cayanus, Martin, and Weber 2005). Underwood et al investigated the factor having an impact on driving anger and at the same time, the consequences of driving anger were also highlighted; in this regard, drivers were asked to keep dairies to write the happening accidents and events of expression of anger feelings; and the dairies of 100 drivers were analyzed and 293 and 383 accidents and events of expression of anger feelings were reported respectively; for most of the cases, traffic congestion was heighthed as the cause of expression of anger (Underwood et al. 1999). Zang et al., 2019 conducted a research in which they investigated the relationship of driving anger and aberrant driving behavior with the risk of crash by testing and suggesting one mediated model. The impact of driving anger on the crash on the road was mediated by aberrant behaviors of driving. As an alternative to the overall scale scores, driving anger's subscales and aberrant behaviors of driving were used for the development of mediated model. Model validity was tested by using the online questionnaire consisted on variables of driving anger, aberrant driving and history of road crashes. The study was based on the 1974 responses of drivers of china. Results indicated the impact of driving anger fully mediated by aberrant behaviors on the risk of road crash. The results were useful to develop the countermeasures for the reduction of crashes of road traffic in China (Zhang et al. 2019). Useche et al., 2019 conducted their research in which they worked on the analysis of driving styles and trait driving anger among the professional drivers of Colombia. Driving anger scale (DAS-14) and Spanish version of multi-dimensional driving style inventory (MDSI) were used in the research based on 492 bus and taxi drivers of the city. Results of linear regression analysis indicated 3 factors of DAS-14 i.e. illegal driving, impeded progress by others and direct hostility by which the adaptive and maladaptive driving styles could be significantly predicted. DAS-14 was proved to be the reliable measurement tool for traits of driving anger in professional drivers (Useche et al. 2019). Saikalis et al., 2020 used electromyography (EMG) for the measurement of driving anger by using driving simulator while completing a navigation task. Traffic events (frustrating events) were used for the induction of anger in participants and at the same time, there was the pressure of time during which they had to follow the directions of navigation. Subjective self-report, facial EMG and DAS was used for the assessment of driving anger of participants. Higher facial EMG values of activation and subjective anger feelings were indicated by the results when participants experience frustrating events (Saikalis et al. 2020). Kalwar et al., 2020 carried out their research on 140 drivers (students and teachers) of Mehran University, Jamshoro. They analyzed the relationship among driving anger, driving impatience, driving competing and punishing while driving by using Pearson correlation. They also developed 16 hypothesis which were tested by using T-test and one way ANOVA. Results indicated that driving anger, impatience, competing and punishing were found to be the same across age, gender, driving experience and academic status. Moreover, positive (significant) correlation was found in among driving impatience and driving anger, competing and punishing (Kalwar, Khan, et al. 2020). Industries need to innovate their processes and machines on the advent of new technology in the market especially when there is the matter of line performance, cost and process efficiency (Kalwar and Khan 2020a, 2020b). Popusoi and Holman,

2016 examined the strategy of regulation of habitual emotion on the association between in the aggressive tendency and driving anger. This study was based on 114 drivers of Romania. Significant association among expressive suppression, cognitive reappraisal, experimental avoidance, aggression and driving anger was found. Restrain impact of expressive was found on the association between aggressive tendency and driving anger and it was suggested that those drivers who overturn their emotions habitually incline to respond in higher aggressive manner when they are in the prone to experience higher levels of driving anger (Oi and Holman 2016). Queue is the common occurrence in daily life (Kalwar et al. 2018; Kalwar, Mari, et al. 2020; Khaskheli et al. 2020). Priyanka and Tigga, 2015 analyzed the relationship between driving anger and mindfulness in young adults. The sample size was 100 (50 from boys and girls each); the participants were in between the age of 18-25 years. Driving anger scale and mindful attention awareness scale were used for the data collection. After the analysis of results it was revealed that driving anger was influenced by the mindfulness; moreover, impact of mindfulness on the driving anger was also reported in the context of gender (Priyanka and Tigga 2015).

3. Research gap

Punishing while driving is the rare topic in the available literature; most of the researchers have conducted their research and published papers on the subject of aggressive driving or driving aggressiveness. In contrast, this paper presents the detailed analysis of punishing while driving across gender, age and driving experience. The contribution of present research cannot be ignored because it provides the empirical evidence (from the students and teachers of the MUET, Jamshoro) on the subject.

4. Research methodology

It is the description of research methods which are used in research. Method includes, data collection and analysis techniques which are explained in detail in separate headings as under.

5.1 Data Collection

Mehran University of Engineering and Technology, Jamshoro was the research area where present cross sectional research was conducted by collecting the data as per convenient sampling technique by using the questionnaire adopted from Dr. Larson. The participants included the teachers and students of the University. Although there were four factors of driving in the questionnaire but only one factor i.e. punishing while driving was considered in the present research paper. Since, questionnaire is about the measurement of participants' thoughts this is because, measurement scale was needed to be defined. One of researcher in 1930s, gave the structured idea for the measurement of thoughts by initiating the scale i.e. likert scale in his research (Rensis 1932)

5.2 Data Analysis

Data was analyzed in the Statistical package for social sciences (SPSS) version 22 and data analysis included the frequency distribution and mean \pm SD of all the variables of the considered factor i.e. punishing while driving. Frequency distribution is used for the measurement of quantity of observation coming in each of the category (ManiKandan 2011). Other than frequency distribution, ANOVA was conducted for the comparison of means of demographic groups in various variables of competing while driving; ANOVA was conducted with 95% confidence interval and with 5% chance of error. In ANOVA, fundamentally, there is the need to two variables i.e. independent and dependent variables (Ostertagová and Ostertag 2013; Sawyer 2009). Before the conducting the analysis with ANOVA, normality of variables is ensured because it is the assumption of the test (Ostertagová and Ostertag 2013)(Blanca et al. 2017)(Ostertagova and Ostertag 2013). Skewnes and kurtosis are conducted to ensure the normality; symmetry of data and the normal curve is determined by the help of these two mentioned tests (Kim 2013).

5. Results

Results of the Analysis are split into four parts; 1) frequency distribution of all the variables of punishing driving along with their mean \pm SD; 2) calculation of skewness and kurtosis; 3) mean \pm SD of all the variables of punishing while driving across various demographics along with the ANOVA results; and 4) The comparison of frequency distribution of each of the response from each variable across demographics along with their mean \pm SD.

5.1 Frequency Distribution, Descriptive Statistics of Variables of Punishing While Driving Along With Results of ANOVA

As mentioned earlier, the frequency distribution of the responses of all the variables of punishing while driving was taken out along with the mean±SD of each variable. Table 1 presents the discussed analysis.

Table 1: Frequency distribution, mean ± SD of various variables punishing while driving

Variable	1 n (%)	2 n (%)	3 n (%)	4 n (%)	Total n (%)	Mean ± SD
I punish bad drivers.	15(10.71%)	67(47.86%)	38(27.14%)	20(14.29%)	140(100%)	2.45±0.86
I complain to passengers about other drivers	14(10.00%)	55(39.29%)	45(32.14%)	26(18.57%)	140(100%)	2.59±0.90
I misbehave with other drivers	30(21.43%)	35(25.00%)	36(25.71%)	39(27.86%)	140(100%)	2.60±1.11
I block cars trying to pass	47(33.57%)	54(38.57%)	27(19.29%)	12(8.57%)	140(100%)	2.03±0.93
I block cars trying to change lanes	36(25.71%)	45(32.14%)	35(25.00%)	24(17.14%)	140(100%)	2.34±1.04
I ride another car's tail	51(36.43%)	55(39.29%)	21(15.00%)	13(9.29%)	140(100%)	1.97±0.94
I apply brakes suddenly to punish tailgater	49(35.00%)	52(37.14%)	23(16.43%)	16(11.43%)	140(100%)	2.04±0.98
I use high beams of head lights to punish bad drivers	89(63.57%)	27(19.29%)	16(11.43%)	8(5.71%)	140(100%)	1.59±0.90

It can be seen in the table that mean±SD of question 3 i.e. 'I misbehave with other drivers' is the highest among all other variables; Total of 39(27.86%) respondents came up with the response of '4=strongly agree' and 36(25.71%) responded '3=agree' on the same question. If these quantities are summed up then around 53% of the participants agreed with the question.

5.2 Calculation of Skewness and Kurtosis

Skewness and kurtosis are used for the determination of symmetry of data and the normal curve respectively (Kim 2013). The values considered in the normal are expressed for skewness and kurtosis are between ±1 and ±3 respectively.

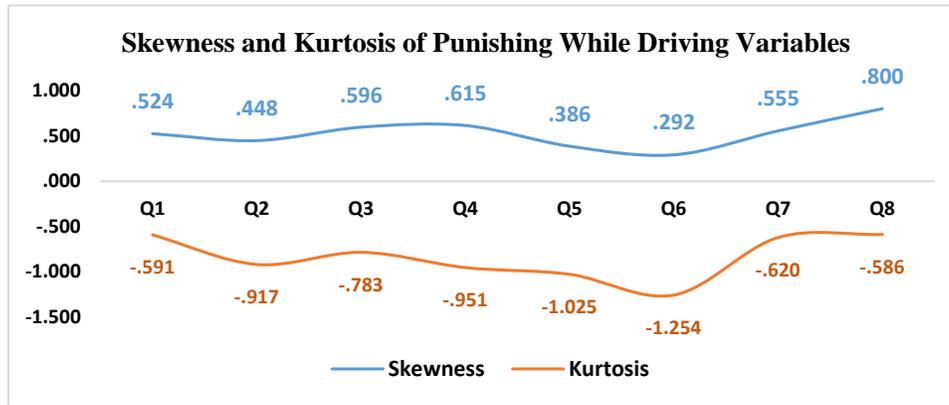


Figure 1. Calculated values of skewness and kurtosis for the various variables of punishing while driving

A look at the Figure 1 indicates that the values of skewness are between ±1 and the values of kurtosis are also in the normal range thus, the data of all the variables was revealed to be normal.

5.3 Mean and Standard Deviation of Variables across Gender and ANOVA Results

Since, the responses of participant belonging to either gender are certain to differ; in this regard, to highlight the difference, the mean±SD of each of the variable was calculated for male and female respondents separately. Table 2 presents the results of mean±SD of the variables across gender.

Table 2: Frequency distribution, mean \pm SD of various variables punishing while driving as per gender along with results of ANOVA

Variable	Mean \pm SD (Gender)		F	P-value
	Male	Female		
I punish bad drivers.	2.48 \pm 0.84	2.34 \pm 0.97	.547	.461
I complain to passengers about other drivers	2.61 \pm 0.91	2.52 \pm 0.91	.201	.655
I misbehave with other drivers	2.66 \pm 1.08	2.38 \pm 1.21	.151	.698
I block cars trying to pass	2.06 \pm 0.91	1.90 \pm 1.05	.370	.544
I block cars trying to change lanes	2.34 \pm 0.98	2.31 \pm 1.28	.165	.685
I ride another car's tail	1.98 \pm 0.93	1.93 \pm 1.00	.000	.991
I apply brakes suddenly to punish tailgater	2.07 \pm 0.91	1.93 \pm 1.25	.772	.381
I use high beams of head lights to punish bad drivers	1.64 \pm 0.92	1.41 \pm 0.82	1.856	.175

At the same time, the results of ANOVA are also presented in table for each of the variable. As it can be seen in the table that all the p-values from ANOVA are >0.05 thus, it was indicated that there was no significant difference in the punishing behavior of the respondents across gender.

5.4 Mean and Standard Deviation of Variables across Age and ANOVA Results

Same analysis as presented above in table 2 is presented under this heading. Mean \pm SD of the various variables of punishing while driving is calculated across the various age groups along with results of ANOVA which are presented in table 3.

Table 3: Frequency distribution, mean \pm SD of various variables punishing while driving as per various age groups along with results of ANOVA

Variable	Mean \pm SD (Age (Years))					F	P-value
	(18-22)	(23-27)	(28-32)	(33-37)	(38-42+)		
I punish bad drivers.	2.53 \pm 0.86	2.29 \pm 0.87	2.67 \pm 0.82	1.25 \pm 0.50	2.57 \pm 0.79	1.157	.333
I complain to passengers about other drivers	2.73 \pm 0.93	2.35 \pm 0.81	2.40 \pm 0.83	1.75 \pm 0.96	3.14 \pm 0.69	1.052	.383
I misbehave with other drivers	2.64 \pm 1.12	2.62 \pm 1.18	2.47 \pm 1.06	2.00 \pm 1.15	2.71 \pm 0.95	1.165	.329
I block cars trying to pass	2.13 \pm 0.97	1.88 \pm 0.91	1.87 \pm 0.83	1.50 \pm 1.00	2.29 \pm 0.76	.183	.947
I block cars trying to change lanes	2.51 \pm 1.14	2.24 \pm 0.99	1.80 \pm 0.56	1.75 \pm 0.96	2.29 \pm 0.49	2.537	.043
I ride another car's tail	1.96 \pm 1.02	2.03 \pm 0.90	1.87 \pm 0.52	1.50 \pm 1.00	2.29 \pm 0.95	2.772	.030
I apply brakes suddenly to punish tailgater	2.01 \pm 1.00	2.09 \pm 1.03	2.13 \pm 0.83	1.25 \pm 0.50	2.43 \pm 1.13	1.808	.131
I use high beams of head lights to punish bad drivers	1.46 \pm 0.87	1.82 \pm 1.06	1.60 \pm 0.63	1.50 \pm 1.00	2.00 \pm 0.82	.821	.514

Results of the ANOVA indicate that there is no significant difference in all the variables of punishing while driving across various age groups except two; the p-value for the question 5 and 6 was calculated to be <0.05 which clearly indicates that there was significant difference in the punishing behavior of the drivers while driving in the light of mentioned questions.

5.5 Mean and Standard Deviation of Variables across Driving Experience and ANOVA Results

As similar to the previous analysis, under this heading, mean \pm SD of the various variables of punishing while driving across the driving experience of the drivers along with the results of ANOVA test. Table 4 presents the above mentioned analysis i.e. the analysis of mean \pm SD of various variables of punishing while driving across driving experience.

Table 4: Frequency distribution, mean \pm SD of various variables punishing while driving as per various driving experience groups along with results of ANOVA

Variable	Mean \pm SD (Driving Experience (Years))			F	P-value
	(1-5)	(6-10)	(11-15)		
I punish bad drivers.	2.45 \pm 0.85	2.42 \pm 0.95	2.57 \pm 0.79	1.176	.297
I complain to passengers about other drivers	2.64 \pm 0.96	2.47 \pm 0.80	2.57 \pm 0.79	1.836	.033
I misbehave with other drivers	2.51 \pm 1.10	2.82 \pm 1.14	2.71 \pm 1.11	1.196	.281
I block cars trying to pass	2.16 \pm 0.89	1.68 \pm 0.96	2.14 \pm 1.07	1.355	.175
I block cars trying to change lanes	2.39 \pm 1.08	2.21 \pm 0.93	2.29 \pm 1.11	.846	.632
I ride another car's tail	2.08 \pm 0.97	1.61 \pm 0.75	2.43 \pm 0.98	1.149	.319
I apply brakes suddenly to punish tailgater	2.05 \pm 0.98	1.87 \pm 0.93	2.86 \pm 1.07	.941	.525
I use high beams of head lights to punish bad drivers	1.65 \pm 0.92	1.45 \pm 0.86	1.57 \pm 0.98	1.512	.106

Result of ANOVA indicates that there was no significant difference in all the variables of punishing behavior of participants while driving across drivers' driving experience except second variable i.e. 'I complain to passengers

about the other drivers'; the p-value for the mentioned question was calculated to be <0.05 which clearly indicated that there was significant difference in the response of participants against the mentioned question across demographics.

6. Discussion

Driver going through stress or are under pressure, probability of anger is more (Priyanka and Tigga 2015). Anger commences confrontational aggression and lead offender to harm another person (SWOV Institute for Road Safety Research 2012) (Deffenbacher et al. 2003). Traffic situation and personal factors leads to anger (SWOV Institute for Road Safety Research 2012) (Deffenbacher et al. 2003). Anger is harmful in every way i.e. physically, socially and psychologically (Priyanka and Tigga 2015). Anger is underlined as one of the fundamental bottleneck of aggressive driving that cause incident in which people are get killed by angry driver on the road that result of traffic dispute (Mizell 1997). Furthermore, the effect of anger are not limited to highway, but those are also part and parcel of their drivers' life (in family relations) after the travel (Deffenbacher et al. 2003). The outstanding cause of traffic violation was found to be the frustration among drivers which yield traffic congestion (Lajunen and Parker 2001) (Shinar 1998). A research by J. A. Vazquez conducted that based on 46 females and 52 males (Vazquez 2013). Moreover, the negative association between aggressive driving and age (Vazquez 2013) and negative association of anger and age reported as well (Sullman, Stephens, and Yong 2015) (Sullman, Stephens, and Yong 2014a). It was indicated that there was no significant difference in the punishing behavior (all variables) of the respondents across gender; because, p-values of ANOVA for all the variables were calculated to be >0.05 (see table 2); whereas, in the context of various age groups, the p-value for the question 5 ('I block cars trying to change lanes') and 6 ('I ride another car's tail') was calculated to be <0.05 which clearly indicates that there was significant difference in the punishing behavior of the drivers while driving in the light of mentioned questions. In the context of driving experience, the p-value for the question 'I complain to passengers about the other drivers' was calculated to be <0.05 variable i.e.; which clearly indicated that there was significant difference in the response of participants against the mentioned question across driving experience. Age was indicated to be strongly associated with the driving anger as reflected by traffic obstructions, lack courtesy, aggressive gestures (Sullman, Stephens, and Yong 2014b). During the course of the time, mean anger response of female drivers with less driving experience (1-5) was highest in all the variable, comparatively, the experience groups of both genders. The connection between the accident happened and events in which the feelings of anger are expressed by drivers has been reported (Underwood et al. 1999). It has been reported and indicated in several researches that education and driving psychology are interlinked and need by which peoples' driving habits can be improved widely. Additional aspects of driving are requisite to be taught to the drivers for the development of their character: there is also the need of research for the commencement of framework by which the drivers can evaluate themselves in terms of their own driving. Furthermore, it is required for drivers to acknowledge that driving is the social activity in coordinated interactions are required (James 2017).

7. Conclusion

After the deep and detailed data analysis, no group was concluded to be punishing in nature while driving. There were some groups which had the greater mean response on few questions whereas, at the same time, their mean response of some questions was recorded to be low. In the context of some variables, young females and males were pointed to be punishing in nature and at the other end, middle aged male drivers were also indicated to be punishing in nature. Since, this research was conducted with lesser sample size that's why it is difficult to generalize the scenario.

8. Future implications

The questionnaires for the present research were got filled from the students at canteens and from teachers at their offices but if they would have been got filled at the point when they expressed such feelings during their driving (punishing while driving), they would respond with the accurate and precise intensity. In this regard, for the extension of the present research it was suggested to collect the data at the point of expression of the feeling (punishing while driving).

9. Acknowledgement

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10. Conflict of interest

There were no conflicts of interest among the authors of the present research.

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