

A Study of the Impact of Human Factors on Speeding Traffic Accidents

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Abstract: Speeding is one of the major factors contributing in traffic accident and causes fatality and injury. However, the choice of driving speed always depending on the human factor. Thus, the main purpose of this study is to investigate the relationship between speeding and traffic accident. Besides, it also aims to determine the human factors which will lead a driver to speeding and collect the opinions from the respondents about the effective speed control actions. The data collected from 384 respondents via questionnaire were descriptive and inferential analyzed by using SPSS software. The findings of this study showed the relationship between speeding and the rate of traffic accident, the most probability human factor cause traffic accident. This study was also expected to has a contribution to the speed management in future study.

Keywords: Speeding, Traffic Accident, Human Factor, Internal Factor, External Factor

1. Introduction

In this era of technological advancement, transportation becomes an important tool in our daily life. However, the development of transportation tools also increases the traffic volume on the roads and hence increasing the rate of the traffic accidents. Traffic accidents represent a major problem facing many countries around the world [1]. According to the World Health Organization (2020), road traffic crashes result in the deaths of approximately 1.35 million people around the world each year and leave between 20 and 50 million people with non-fatal injuries. The victims of a traffic accident are not only the driver but also other road users such as pedestrians, cyclists, motorcyclists and their passengers.

Traffic accidents are a worldwide issue with numerous negative impacts. Road accident casualties might have long-term effects or outcome of injuries regarding disability, impairment and handicap [2]. The people that experience the disability will lead to problems like continuation in their job may not be possible or the need to spend more time in completing their job. Apart from the physical injuries, traffic accident also may cause the financial losses [3]. For instance, the people involved in traffic accidents will experience the financial loss such as repair of vehicles, past lost income on medical expenses, travel expenses and hire vehicles. Besides, insurance companies outplay and interest on the compensation

claim and legal fee has also to be included as financial loss. Furthermore, the road accident also had a huge negative impact on the environment [4]. The occurrence of a traffic accident will emit harmful chemicals such as fluid and gas leak when a car accident occurs. The harmful chemical will then harm the wildlife or poison the neighboring plants or grass. The oil from wrecked vehicles will spill into the river and cause the death of aquatic life. The most important is that the car accident will also damage the roads. Since car accidents sometimes can be so traumatic and massive, and hence will damage the road.

The driver is a significant role which lead to a traffic accident, especially drivers' behaviors such as speeding [5]. However, there is both internal factor and external factor which can influence a driver to driver over the speed limit. The external factors are the factors such as vehicle occupancy while the internal factors are factors such as personality, attitudes, and emotion [6]. Along with this, the driver's gender, nationality, age, driving experience, and previous crash history also may affect their choice of speed [7]. For example, a driver's responding time will significantly longer than usual when he is drunk [8]. In the same way, another study found that the drivers tend to be more impatient and reckless after drunk drinking, which affects their driving performance. [9]. Besides, a hurry or emergency situation was also the primary factor leading a driver to speeding [10]. The gender, age and the occupation also play as the important role for the speeding behavior of a driver [7]. Apart from that, the choice of speed has a direct relationship with the presence of a passenger [11]. This study stated that a passenger will persuade the driver to accelerate on the straight-way and decelerate on the curve way.

Vehicle speed is a primary factor in the terms of road traffic safety [10,11]. The speeding actions not only increase the likelihood to collision, so does the severity of accidents. Several variables should be taken into account to determine the relationship between speed and traffic accident. When a vehicle is accelerating, the distance for the driver to respond will be much longer to allow the vehicle to stop in order to avoid collide on the obstacle. In short, the probability of the driver to restore the control of his vehicles will significantly decreases due to the reduced reaction time.

2. Methodology

The methodology section includes the site selection, sample sizing, design of questionnaire and data analysis.

2.1 Site Selection

The study area which selected is Selangor. This is because Selangor has the largest population among the states in Malaysia which is up to 6.57 million. This actively demonstrates that Selangor has a very high demand in transportation. Thus, one of the major roads in Klang called Jalan Haji Sirat was chosen as the study site. It is categorized as state road which have only one lane in each direction. The increasing in the number vehicles on the single lane will cause the drivers tends to drive in a higher speed to overtake other vehicles and increase the traffic collision risk. Thus, researcher will carry out a questionnaire survey among the 384 respondents in Klang.

2.2 Sample Sizing

In questionnaire survey, the first stage is the sample size determination. For this study, the sampling area of this study is focus on the residents in Klang, Selangor. The population of Klang is approximately 880 thousand. Based on the Krejcie and Morgan's sample size determination table (1970), the sample size for the population of 1000000 or above is 384. Therefore, 384 respondents who owns a driving license in Klang were invited to answer the designed questionnaire.

2.3 Design of Questionnaire

For the purpose of this study, questionnaire method was used for collecting the data. This is because questionnaire is an effective method to conduct the postal survey [12]. The questionnaire was designed in an online software called Google Form and the questions were set by referring the previous study [6]. The questionnaire was designed via an online website called Google Form and mainly divided

into three sections. The first section covers the respondents' demography and their driving habits. The exact purpose of this section is to investigate the relationship between the driving speed and the rate to involve in a traffic accident. Then, the second section covers some situation that will make a driver to drive over the speed limit. The purpose is to gauge the levels of agreement of the respondents towards the factors that will lead a driver to speeding. Additionally, the third section covers the actions that will make a driver to travel within the speed limit. The purpose is to gauge the levels of agreement of the respondents towards the actions that will stop a driver from speeding.

2.4 Data Analysis

This phase was mainly to organize the data collected for analyzing purposes by using SPSS software. The data analysis method includes descriptive analysis and inferential analysis. For descriptive analysis, the measures are mainly based on the mean and the standard deviation. From the descriptive analysis, researcher can more understand about the behavior of the data collected. While the inferential analysis in this study comprises with correlation test and Mann-Whitney U-test. The correlation test is to determine the strength of the relationship between speeding and traffic accident by refer to the correlation coefficient while the Mann-Whitney U-test is to determine whether the respondents are normally distributed or not.

3. Results and Discussion

The results and discussion section presents data and analysis of the study based on the data collected from 384 respondents via questionnaire.

3.1 Relationship Between Speeding and Traffic Accident

In this analysis, the question "What is your preferred driving speeds?" and "Have you been involved as a driver in any road accident due to excessive speeding in past 5 years?" represent the speeding and the rate of traffic accident respectively. Table 1 shows the crosstabs analysis for two categorical variables which are the preferred driving speed of the respondents (Variable A) and the involvement of the respondents in the traffic accident due to excessive speed (Variable B). There are 4 possible values for the variable A and 2 possible values for variable B. The null hypothesis is that there is no relationship between speeding and the rate of traffic accident.

Table 1: The Crosstabulation Table (Involvement in traffic accident due to excessive speed*Preferred driving speed)

			What are your preferred driving speeds? (Variable A)			
			below 60km/h	60 - 80 km/h	81 - 100 km/h	above 100km/h
Have you been involved as a driver in any road accident due to excessive speeding in past 5 years? (Variable B)	Yes	Count	0	14	50	62
		Expected Count	4.3	27.2	56.1	38.4
	No	Count	13	69	121	55
		Expected Count	8.7	55.8	114.9	78.6
Total	Count	13	83	171	117	
	Expected Count	13.0	83.0	171.0	117.0	

Table 2: The Chi-Square Tests Table for The Relationship Between Speeding and The Rate of Traffic Accident

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	38.52 ^a	3	<.001
Likelihood Ratio	42.25	3	<.001
Linear-by-Linear Association	36.99	1	<.001
N of Valid Cases	384		

a. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.27.

Table 2 shows the observed count and expected count between the two variables. The observed count represents the observed frequency derived from the data collected while the expected count represents the predicted frequency based on the null hypothesis. In table 4.9, the Pearson Chi-Square which represents the value of the chi-square statistic is 38.52 while the p-value for 2-sided significance is smaller than 0.001. In this case, the p-value is smaller than the standard alpha value (0.05). Hence, it is required to reject the null hypothesis that asserts the two variables are independent of each other.

3.2 Human Factors Lead to Speeding

As showed in Table 3, the relationship between gender of the respondents and their agreement level towards the human factors which lead to speeding was tested using Mann-Whitney U test. The Mann-Whitney U results showed that there is a slightly different between the male group (n = 205) and female group (n = 179). For variable A, the mean rank of the female group is higher than male group. This represents that female group has a higher agreement toward variable A because the agreement level is ascending from value 1 to 5. A statistically significant difference was found with $U = 17800$ and $p > 0.05$. The result for variable A indicates that the female group more agree to variable A compared to male group, that is statistically significant.

Table 3: Mann-Whitney U test between gender of respondents and their agreement level towards the human factors which lead a driver to speeding

Ranks

Variables	Gender	N	Mean Rank	Sum of Ranks
Driver starts to drive over the speed limit when he/she do not know the speed limits of the road. (A)	Female	179	195.56	35005.00
	Male	205	189.83	38915.00
	Total	384		
Driver starts to drive over the speed limit when he/she is in a hurry situation. (B)	Female	179	198.29	35493.50
	Male	205	187.45	38426.50
	Total	384		
	Female	179	190.06	34020.50

Driver starts to drive over the speed limit when other road users start speeding. (C)	Male	205	194.63	39899.50
	Total	384		
Driver starts to drive over the speed limit when he/she want to overtake the vehicle in front of him/her due to impatient. (D)	Female	179	151.73	27160.00
	Male	205	228.10	46760.00
	Total	384		
Driver starts to drive over the speed limit because he/she feels excited when travel in a high speed. (E)	Female	179	151.73	27160.00
	Male	205	228.10	46760.00
	Total	384		
Driver starts to drive over the speed limit when he/she was persuaded by the passengers. (F)	Female	179	178.62	31973.00
	Male	205	204.62	41947.00
	Total	384		

Table 3: Mann-Whitney U test between gender of respondents and their agreement level towards the human factors which lead a driver to speeding (cont)

Test Statistics ^a						
Variables	A	B	C.	D.	E	F
Mann-Whitney U	17800.00	17311.50	17910.50	11050.00	11050.00	15863.00
Wilcoxon W	38915.00	38426.50	34020.50	27160.00	27160.00	31973.00
Z	-0.52	-1.02	-0.42	-6.97	-7.17	-2.39
Asymp. Sig. (2-tailed)	0.60	0.31	0.68	<0.001	<0.001	0.02

a. Grouping Variable: Gender

3.3 Effective Way to Reduce the Speeding Problems Among Vehicles

The table 4 demonstrates the relationship between gender of the respondents and their agreement level towards the speeding control method along with the Mann-Whitney U test. The Mann-Whitney U results showed that there is a slightly different between the male group (n = 205) and female group (n = 179). For variable A, the mean rank of the male group is higher than female group. This represents that male group has a higher agreement toward variable A because the agreement level is ascending from value 1 to 5. A statistically significant difference was found with $U = 17879.50$ and $p > 0.05$. The result for variable A indicates that the male group more agree to variable A compared to female group, that is statistically significant.

Table 4: Mann-Whitney U test between gender of respondents and their agreement level towards the speeding control method

Ranks				
Variables	Gender	N	Mean	Sum of
			Rank	Ranks
Penalty or fines on speeding offenders. (A)	Female	179	189.89	33989.50
	Male	205	194.78	39930.50
	Total	384		
More road safety campaigns. (B)	Female	179	199.97	35794.50

	Male	205	185.98	38125.50
	Total	384		
More road humps or other traffic calming devices to slow down the traffic. (C)	Female	179	221.34	39619.50
	Male	205	167.32	34300.50
	Total	384		
More use of automatic speed cameras by JPJ. (D)	Female	179	188.70	33777.50
	Male	205	195.82	40142.50
	Total	384		
Greater enforcement of speed limits by the polices or enforcement officers. (E)	Female	179	169.44	30329.50
	Male	205	212.64	43590.50
	Total	384		

Table 4: Mann-Whitney U test between gender of respondents and their agreement level towards the speeding control method (cont)

Test Statistics ^a					
Variables	A	B	C	D	E
Mann-Whitney U	17879.50	17010.50	13185.50	17667.50	14219.50
Wilcoxon W	33989.50	38125.50	34300.50	33777.50	30329.50
Z	-0.45	-1.275	-4.91	-0.65	-4.01
Asymp. Sig. (2-tailed)	0.65	0.20	<0.001	0.52	<0.001

a. Grouping Variable: Gender

3.4 Discussion Regarding the Study Objectives 1

Based on the chi-square test, the null hypothesis is rejected and it has to accept the alternative hypothesis that asserts there is a relationship between speeding and the rate of traffic accident. This means that the higher the preferred driving speed of the respondents, the higher the probability of the respondent to be involved in the speeding traffic accident. This may due to when the driving speed increases, the reaction time of the driver become much lesser than normal speed. Hence, the risk for a collision between the vehicle and other obstacles on the road to happen also increases. In contrast, the lower the driving speed of a driver, it has also lower probability to be involved in a speeding traffic accident.

3.5 Discussion Regarding the Study Objectives 2

Based on the descriptive analysis, the human factor which get the highest level of agreement from the 384 respondents is the driver starts to drive over the speed limit when he/she is in a hurry situation. This may due to mostly of the respondents had ever face this situation. A hurry situation may occur when a driver is late to workplace, a student is late to school, a lorry driver meets the deadline to send the cargoes, a driver is sending an emergency patient to hospital or others. Plus, Jalan Haji Sirat is a single lane road. This increases the probability of the respondents to increase their speed to overtake other vehicle so that they can reach their destination in a shorter time.

The second highest rating human factor is the driver was persuaded by his passengers. From the evidence by previous study, the speed choice of a driver will be influenced by the presence of passengers. For example, if the passengers are children, the driver will travel at a lower speed. In contrast, if the passengers are adults, the driver might be travel at higher speed due to situation in the vehicle.

The third highest rating human factor causes speeding chose by respondents is the driver starts to drive over speed limit when others drivers start speeding. The driver felt provocation when other

vehicles around him start speeding and cause the driver to increase his speed and ignore the speed limit. Apart of that, a driver also might in the race with other vehicles in speeding.

The fourth highest rating human factor causes speeding is the driver feels excited when travel in a high speed. This may due to the psychological of the driver. For example, some drivers feel relax when driving at high speed after a whole day of high-pressure working time. The high-speed driving might be a pressure releasing way for them.

Then, the next human factor is a driver increase the speed to overtake other vehicles due to impatient. Some drivers will feel annoyed with the low-speed vehicles in front of them and tends to increase their speed to overtake the vehicles before them but ignore the speed limit.

The least rating for the human factor led to speeding is the driver do not know the speed limits of the road. This is because all driver gets their driving license after undergoes an oral test. The oral test includes the understanding of the road sign. While in Malaysia, the speed limit has indicated on the road sign on every road. Therefore, the respondents thinks that the drivers are impossible do not know the speed limits of the road.

3.6 Discussion Regarding the Study Objectives 3

It is necessary to gauge the agreement level from the respondents toward each speed management method before making the suggestion. The speed management methods are mainly divided into five categories which are speed enforcement and regulation, public education, engineering treatments, speed-limiting technology and speed management by related officers.

From the descriptive analysis, the respondents think that speed management by officers is the most efficient method. For example, traffic police or traffic enforcement officers can have more monitoring on the traffic situation and ensure the traffic flow is smooth. This may due to most of the road users will having the sense of fear when saw the traffic police or traffic enforcement officers on the road. Hence, they will drive within the speed limit if the road situation is in the monitoring of the officers.

The second highest rating speed management method is penalty or fines on the speeding offenders. The department of traffic can introduce a lower speed limit on the traffic accident hotspots. They also can implicate higher penalties or fines on the speed limit offenders. The speed limit sign should be also located on a road where the speed limit starts. In addition, they can introduce the low-speed zones at the accident hotspot to advice the road users reduce their speed at the particular area.

Then followed by the more use of automatic speed cameras by JPJ. This method is widely used in many countries. In Malaysia, AES speed camera is used to control the vehicle speed. Most of the respondents think that the vehicle will control their speed at the zone when there is an AES camera. Thus, the camera can be installed in more locations so that the vehicles will follow the speed limit.

However, the least respondents agree that traffic calming devices and road safety campaigns are effective to control the speed of the vehicles. This may due to they think that the devices like speed humps or chicanes will influence the traffic flow but it is undeniable this method is efficient in some areas such as school area and hospital area. Also, the people were busy working from Monday to Friday and even some of them will work overtime in Saturday. Hence, it will increase the level of tiredness if they need to attend the extra event like road safety campaign.

4. Conclusion

From the data analysis, it can be concluded that there is a relationship between speeding and the rate of traffic accident. The higher the preferred driving speed by the driver, the higher the risk for him to be involved in a traffic collision. Besides, there are many human factors that can cause a driver to drive over the speed limit. Based on the data collected, the major and minor factors which lead to speeding are driver is in a hurry situation and driver is unaware with the speed limit. Therefore, a complete speed management system must be achieved to reduce the speeding issue in order to reduce the rate of traffic accident. The respondents have the highest agreement toward the greater enforcement of speed limits by the polices or enforcement officers is the most effective method to stop the speeding compared to other actions. In contrast, they think that road humps or other traffic calming devices is not effective to reduce the speeding among vehicles.

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