

Factors Influencing Motorcycle Accidents in High Density Residential Area: A Case Study at Kampung Kuantan, Selangor

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ABSTRACT

Malaysia is currently facing major issue when it comes to road safety given that Malaysia is recorded to have the highest road fatalities among ASEAN countries. Alarming, over 50% of road fatalities involve motorcyclists, highlighting motorcycle as a high-risk form of transportation. While there are several research on road accident on highways, few studies were done when pertaining to road accident in residential areas. Thus, this study aims to determine the primary factors contributing to road accidents, especially those that occurred in high density residential area. Specifically, it will investigate the relationship between road condition, human factor and environment factor with the likelihood of accidents. To achieve the goals of this study, a quantitative research method was used in the form of questionnaires which were distributed to the motorcyclists residing in Kampung Kuantan, Selangor. The questionnaire was distributed using Google Forms where respondents were given the link through WhatsApp to access the form. Results from the survey were then analysed using a descriptive analysis and mean score method. Analysis results indicate that human factor, road condition and environment factors heavily influence the probability of an accident occurring, with road conditions having the highest mean score. Analysis results suggest that taking the 3E (Engineering, Education and Enforcement) approach can help to reduce road accident which in turn will also reduce fatalities. As such, it is important for the relevant authorities to perform proper maintenance of the roads and improve their urban road planning while also improving on the method of imparting proper road safety knowledge to the residents through road safety campaigns.

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1. Introduction

Globally, countries are struggling to reduce road accidents especially in developing countries where the World Health Organization (WHO) reported that road accidents have caused the deaths of 1.35 million people every year and leaving up to 50 million people with non-fatal injuries. Cambridge Dictionary defines an accident as any unexpected or unintended occurrence that often leads to property damage or personal injury. Based on the Road Transport Act 1987, road accidents are defined as accidents or incidents where damage is inflicted towards any person, property, vehicle, structure or animal that occur on any public road including but not limited to bridges, tunnels, side stops, multilevel/multi-storey roads, and toll plazas. Road accidents involve either motor vehicles, bicycles, rickshaws, pedestrians, and other types of vehicles. WHO defines road accidents as "violations or incidents that usually leads to injuries or fatalities that occur on public roads involving at least one vehicle." Thus, in the context of this study, road accidents refer to the unintended disasters that occur on public roads leading to injury or death or the destruction of property.

In many developing countries, including Malaysia, road use is dominated by two-wheeled vehicles such as motorcycles leading to motorcyclists having the highest risk of being involved in road accidents. In Malaysia, fatal accidents are very significant involving motorcyclists as indicated by the national statistics issued by Malaysian Institute of Road Safety Research (MIROS) where motorcyclists were reported to contribute up to 50% of road accidents fatalities from 2000 to 2014. Comparative to the global average, WHO (2016) reported that almost a quarter (24.1%) of road deaths in the world involves motorcyclists which indicates the severe lacking road safety awareness amongst the motorcyclists in Malaysia. Statistic data from the Head of Investigation and Traffic Enforcement Division of the Royal Malaysia Police (PDRM) as shown in Figure 1, reinforces the notion that motorcyclists face a significant road safety issue given the high fatality compared to the number of involvements in road accidents.



Figure 1: Vehicle types involved in accidents (Source: Head of Investigation and Traffic Enforcement Division (PDRM))

Road accidents will result in a great economic loss for the country since when an accident occurs, it will mostly be damaged to the roads, and this incurs high expenditure to the government for repairing the damages. Additionally, the disabilities or the loss of human lives leads to a loss in capable work forces who may be contributing to the development of the country. One of the problems that often highlighted in the traffic safety studies are that almost all small and large accidents causing fatalities occur in high density housing area. While there are several studies carried out on motorcycle accidents on the highways, there is a lack of reported studies have focused on accidents in residential areas. Hence this study focuses more on investigating the factors influencing motorcycle accidents in a high-density housing area by performing a survey on the residents of Kampung Kuantan, Selangor.

Previous studies highlighted several factors attributed to motorcycle accidents, such as road conditions, human factor, and environment (Austroads, 2006; Jaafar et al., 2003; Kulanthayan et al., 2000; Manan, 2014; Newstead et al., 2013; Sabey & Staughton, 1975; Suraji & Tjahjono, 2011). Human factor is likely to be the main factor that cause road accidents. It was the most quoted issue among various studies noting the severe lack of safety awareness among the riders which also include incompetence, negligence and impatience when riding a motorcycle (Chong et al., 2010; Jaafar et al., 2003; Kulanthayan et al., 2000; Sabey & Staughton, 1975; Sood, 1988). Coupled this issue with poor road conditions such as absence of road signs, poor road lighting at night, and confusing road layout can lead to road accidents (Manan, 2014). While situational, the environmental condition does contribute to the occurrence of road accident such as during heavy rain or foggy weather. However, it is argued that the weather only highlights the previous two factors rather than being the main cause as accident in a heavy rain occurs due to the vehicle operator being reckless or faulty road conditions (Julia, 1998; Manan, 2014).

2. Method

This study used a quantitative research methodology by performing a survey on the residents of Kampung Kuantan, Selangor. The survey involved the distribution of questionnaires made in Google Forms and distributed through WhatsApp to 150 residents of Kampung Kuantan.

Questionnaires were used to help in identifying the relationship between the variables, namely road, human and environment factors by dividing the questions into five sections, namely Part A, B, C, D and E, which will correspond to different variable. Part A contained questions related to respondent demographic, such as age, gender, occupation, marital status, and types of driving license. Part B contained questions related to vehicle condition, while Part C provided questions on human factor or behaviour associated with the village area. Part D comprised questions on road conditions at the village area.

Part E consisted of questions related to environment of the village area. Finally, Part F provided recommendations regarding the issues. The collected data will be in the form of a Likert scale with scores of 1 = Strongly disagree, 2 = Disagree, 3 = Neither agree nor disagree, 4 = Agree and 5 = Strongly agree. Respondent selected one of these number that they felt accurate in their perspective. The collected data was analysed using descriptive statistics which will create graphical oriented results to help making numbers visible for communication purposes. Additionally, a Cronbach alpha test was conducted to measure the reliability of the question provided through the Likert scale to ensure the questions presented were relevant to the variable in question where an alpha value greater than 0.6 indicates that the questions were reliable and relevant to the variable.

Next, a mean score was measured to determine the average performance of a group of respondents involved in this study. All answers related to the independent variables were analysed using this mean score. Specifically, the mean score was calculated by adding all the individual scores and dividing by total scores. The levels of agreement of respondents to a statement were measured based on five categories: (1) Strongly disagree, (2) Disagree (3) Neither agree nor disagree, (4) Agree, and (5) Strongly agree. A mean score is interpreted using Table 1.

Table 1: Mean score interpretation.

Mean Score	Interpretation	Level
1.00 until 2.33	Low	Poor
2.34 until 3.66	Medium	Average
3.67 until 5.00	High	Good

3. Results

Out of the 150 questionnaires distributed, 105 valid respondents were collected resulting in 70% response rate. It was found that 57 (54.3%) of respondents were males and 48 (45.7%) were female. Majority of the respondents involved in this study were Malay and aged between 31-40 years old. Most of the respondents owned motorcycle licenses. Table 2 summarises the demographic data of the respondents.

Table 2: Demographic data of respondents.

Demographic Profile	Category	No. of Sample (N = 105)	Percentage (%)
Gender	Male	57	54.3
	Female	48	45.7
Age	18 - 25	1	1
	26 - 30	32	30.4
	31 - 40	58	55.2
	41 - 50	9	8.6
	50 and above	5	4.8
Race	Malay	103	98.1
	Chinese	-	-
	Indian	-	-
	Others	2	1.9
Occupation	Government sector	71	67.6
	Private employee	19	18.1
	Self-employed	7	6.7
	Student	4	3.8
	Others	4	3.8
Marital status	Single	8	7.6
	Married	91	86.7
	Divorce/Single Parent	6	5.7
	Parent	-	-
Number of children	1	29	27.7
	2	41	39
	3	21	20
	More than 4	14	13.3
	Class of driving license	B	51
	B2	54	51.4

Based on Table 3, it was revealed that 64 respondents (61%) only owned one motorcycle, 33 respondents (31.4%) owned two motorcycles and the remaining 8 respondents (7.6%) owned three motorcycles. Majority owned motorcycle with an engine capacity less than 250 cc represented by 96 respondents (91.4%) and 63 respondents (60%) used motorcycle for going to work. Table 3 shows the questions related to the vehicle and motorcycle condition of the respondents.

Table 3: Question related to vehicle condition of respondent.

Question	Category	No. of Respondents (N = 105)	Percentage (%)
How many motorcycles do you own?	1	64	61.0
	2	33	31.4
	3	8	7.6
	More than 4	-	-
What is the capacity of your motorcycle engine (cc)?	Less than 250 cc	97	92.4
	Between 250 cc - 500 cc	11	10.5
	Greater than 500 cc	3	2.9
What is/are the reason/s you ride motorcycle? (Can tick more than one answer)	Going to work	63	60.0
	Pick/send child from/to school	36	34.3
	Go to the shop	36	34.3
	Recreational	20	19.0
	Run errands	14	13.3
	Others	40	38.1
How often do you ride your motorcycle?	Once a week	2	1.9
	Weekdays only	8	7.6
	Weekends only	9	8.6
	2 - 3 times per week	12	11.4
	Everyday	51	48.5
How often do you send your motorcycle for service?	Seldom	23	22.0
	According to service instruction	68	64.8
	Once a year	14	13.3
	Only if it broke down	18	17.1
Have you ever involved in road accident while riding your motorcycle within the pass one year?	Others	5	4.8
	Yes	30	28.6
	No	75	71.4

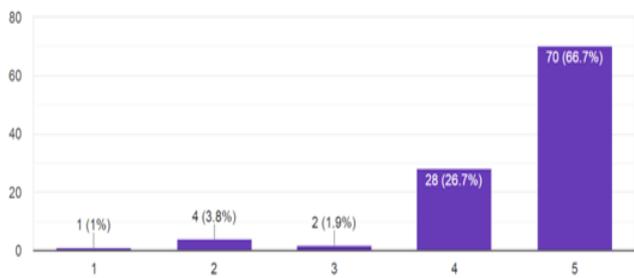


Figure 2: Graph on the opinion of recommended service instruction

Figure 2 depicts the percentage of responses related to the motorcycle service performed by the respondents according to the recommended service instruction. A total of 70 respondents (66.7%) agreed that the motorcycle should be serviced according to the recommended service instruction. It is important to service the motorcycle according to the recommended service instruction to ensure that the motorcycle can perform well and to increase the safety of the motorcyclists.

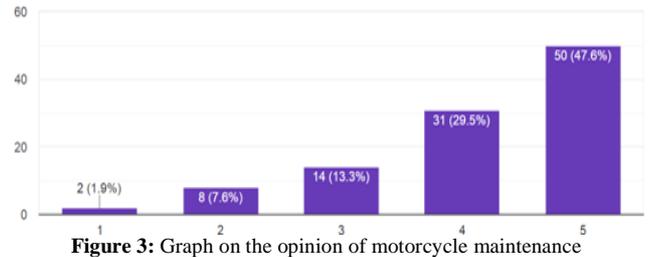


Figure 3: Graph on the opinion of motorcycle maintenance

Figure 3 illustrates the percentage of responses related to motorcycle services are not maintained periodically. A total of 50 respondents (47.6%) agreed to this statement that this could be one of the factors causing motorcycle accident, while only 2 respondents (2%) did not agree with the statement.

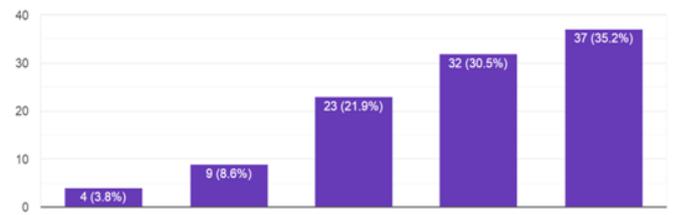


Figure 4: Graph on the perception that issue with motorcycle stability contribute to accidents

Based on Figure 4, a total of 37 respondents (35.2%) agreed while only 4 respondents (3.8%) did not agree that one of the main causes of road accidents involving motorcyclists was due to stability problem. The stability problem can be defined as a discomfort of a rider while the vehicle is in normal working condition.

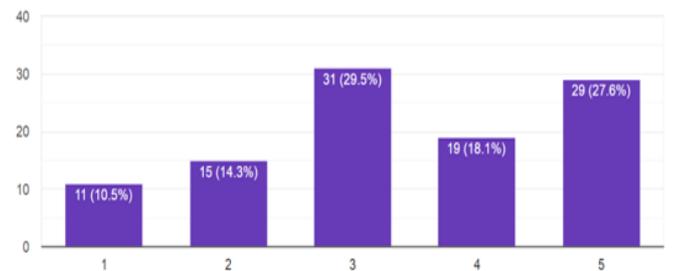


Figure 5: Graph on the perception of older motorcycles contribute to accidents

The percentage of the responses associated with the condition of old motorcycle that can be one of the contributors to road accidents (Figure 5). A total of 29 respondents (27.1%) agreed, while 31 respondents (29.5%) neither agreed nor disagreed. There were 11 respondents (10.5%) who did not agree.

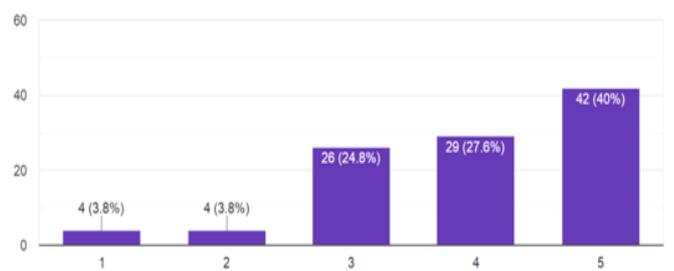


Figure 6: Graph on the opinion that higher powered motorcycles lead to accidents

Figure 6 depicts the percentage of responses associated with high-powered motorcycles are more vulnerable of fatal accidents. A total of 42 respondents (40%) agreed to this statement, 26 respondents (24.8%) neither agreed nor disagreed and only 4 respondents (3.8%) were not agreed.

Table 4: Cronbach alpha

Variable	No. of Item	Cronbach's Alpha
Human factor	4	0.64
Road condition factor	6	0.84
Environment factor	5	0.78

A Cronbach alpha test is performed on the variables to ensure the validity of the items in relation to the variable. As indicated in Table 4, the score of all the variables is above 0.6, which indicates that the items in the variables are relevant and shows high reliability.

The analysis for other variables was carried out through the interpretation of the score range and mean range as suggested by Ghafar (2003).

Table 5: Mean score analysis of human factor

Variables	Questions	Mean
Human factor	Inexperience drivers are likely to make unsafe moves on the road that could compromise the safety of other motorists and rear-end accidents resulting from following a vehicle too closely or an abrupt stop can result in serious injury or death to a motorcyclist.	4.65
	Fatigue can cause lack of concentration when riding a motorcycle.	4.62
	When tired/fatigued, I would be more likely to break a red light at a traffic light junction.	3.25
	When tired/fatigued, I will be more likely to ride at high speeds.	3.16
	Average	3.92

Table 5 shows that the question of “*Inexperience drivers are likely to make unsafe moves on the road that could compromise the safety of other motorists and rear-end accidents resulting from following a vehicle too closely or an abrupt stop can result in serious injury or death to a motorcyclist*” has the highest mean of 4.65 among other questions under the independent variable of human factor. The lowest mean of 3.16 was obtained by the question of “*When tired/fatigued, I will be more likely to ride at high speeds*” under the human factor. The average of all means of each question was 3.92 indicating good and the respondents agreed that this factor influenced the motorcycle accident in high density housing area.

Table 6: Mean score analysis of road condition factor

Variables	Questions	Mean
Road condition	Road cracks, potholes, debris and a lack of necessary signboards can increase the motorcycle rider’s chances of losing control of the vehicle.	4.68
	Dark areas and no streetlights are more likely to cause accidents at high density housing area.	4.66
	Rear-end accidents resulting from following a vehicle too closely or an abrupt stop near uneven road surfaces can result in serious injury or death to a motorcyclist.	4.65
	Uneven road conditions can lead to accidents in high density housing area.	4.65
	Correct positioning of traffic light is important in high density housing areas.	4.57
	Good lighting along the roads can prevent accidents in high density housing area.	4.56
	Average	4.62

Table 6 shows that the question of “*Road cracks, potholes, debris and lack of necessary signboards can increase the motorcycle rider’s chances of losing control of the vehicle*” has the highest mean of 4.68 among other questions under the independent variable of road condition factor. Meanwhile, the question of “*Good lighting along the roads can prevent accidents at high density housing area*” obtained the lowest mean of 4.56 under road condition factor. The average of all means of each question was 4.62 indicating good and the respondents agreed that this factor influenced motorcycle accidents in high density housing area.

Table 7: Mean score analysis on environmental factor

Variables	Questions	Mean
Environment factor	Children play or running around on the road without parental guidance are more exposed to the accident.	4.53
	Layered parking vehicles in high density housing area endanger other users and can cause accident.	4.27
	Bad weather (e.g. heavy rain, foggy, bright sun ray) can cause road accidents involving motorcycles.	4.26
	Flash floods and overflowing water can cause the risk of getting involved in an accident.	4.25
	Residents throw rubbish on the road in high density area can cause accidents.	4.07
	Average	4.27

Table 7 shows that the highest mean of 4.53 was recorded by the question of “*Children play or running around on the road without parental guidance are more exposed to the accident*” among other questions under the environment factor as an independent variable. The lowest mean was obtained by the question of “*Residents throw rubbish on the road in high density area can cause accidents*” of 4.07. The average of all means of each question was 4.27 indicating good and the respondents agreed that this factor influenced motorcycle accident in highly dense residential area.

Figure 7 shows the recommendations received from 105 respondents. About 22 respondents agreed to strengthen law enforcement and ensure that the roads are well maintained, while 21 respondents chose to perform awareness campaign among the motorcycle users. In addition, 15 respondents recommended to change the attitude of the riders to reduce the motorcycle accidents in high density housing area. It was also suggested by 14 respondents to encourage the use of public transport to reduce motorcycle accidents in the area as it is safer. Meanwhile, the remaining 10 respondents agreed that the vehicle maintenance can reduce motorcycle accidents as it is important to ensure that the motorcycles are in good condition.



Figure 7: Respondent recommendation

4. Discussion

The results from the analysis shows high mean values for all variables, with all having higher than 4.0 mean score, this indicates that these factors heavily contributed to motorcycle accidents in high density housing area with road condition having the highest mean score. Table 8 shows the interpretations of variable mean scores.

Table 8: Variable mean score.

Variable	Mean Score	Interpretation
Human factor	3.92	Good
Road condition factor	4.62	Good
Environment factor	4.27	Good

Results of this study is in contrary with Suraji et al. (2007) who stated that human factor is the main factor for traffic accident, while other factors give less significant impact on accidents however human factor still play a significant part in traffic accident. Taylor and Dorn (2005) explored the factors causing accidents and found that the most influential factor is rider fatigue. The road condition factor is in line with Austroads (2006) claiming that road accidents occur because of one or more of the following factors, namely human, vehicle, road and environment factors. Road condition includes road design and maintenance, construction work, weather condition and problems with signage and lighting. The environment factor is in agreement with Manan (2014) who emphasised that road environment influences the occurrence of traffic conflicts involving motorcycle entering from the access point and merging with the main road in Malaysia.

5. Conclusion and Recommendations

Most study concentrate on motorcycle accidents on the highway or city area, but the factors contribute to motorcycle accidents occurred around high-density residential areas have not been highlighted yet. Perhaps, it was given less concerned due to low fatalities rate, thus it was considered as unimportant to evaluate the factors that cause motorcycle accidents at high density residential areas. The findings from this study indicate that regardless, whether it is in busy city area, highway, expressway, trunk roads or within residential premises, road condition is the main contributor to traffic accidents followed by the environment factor and human factor respectively.

Fatigue was found to be the most influential factor, especially when the riders are approaching their home, they tend to speed and less attentive to the surroundings, hence more susceptible to be involved in an accident. The lack of maintenance of the road also one of the main reasons that can cause accidents around residential areas and unexpected actions such as children suddenly crossed the street out of nowhere and motorcyclist unaware of the situation may also cause a mishap around the residential areas.

Therefore, motorcyclist should be more alert when riding around the residential areas, and the city council should maintenance the streets and the road should be free of cracks, debris, potholes, and double/layered parked cars on the parking lots. The streetlight should be working well and sufficient, including signage and road bumps.

Motorcycle accidents can be reduced with the 3E (Engineering, Education, and Enforcement) approach. The steps that can be taken in the engineering approach are to provide a more comfortable environment for users such as widening and straightening narrow and winding roads, providing clear signage, providing pedestrian lanes and motorcycle lanes, organized intersections, and bright streetlights. The educational approach aims to make road users aware to always be prudent and disciplined while on the road through road safety campaigns. Meanwhile, the enforcement approach aims to change the behaviour and attitudes of road users. Law enforcement is a more effective method of changing human behaviour and habits compared to educational approach. This is evidenced by the decrease in accidents

and deaths every time the police launch *OPS Statik* within a certain period during the festive season. While the findings of the study are significant, further studies are still recommended to identify other factors influencing road accidents in high density area while also researching further into each individual factors presented.

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