

## FACTORS AFFECTING MOTORCYCLIST ACCIDENT: PSYCHOLOGICAL, ENVIRONMENTAL AND VEHICLE FACTORS

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### Abstract

The highest contributor to road accidents and fatality in Malaysia involves motorcyclists. Recognizing this fact, identifying the issues that cause motorcyclists' accidents is essential for the government to develop appropriate road safety strategies to address the problem. Factors associated with motorcyclist accidents are generally related to motorcyclist riding behavior, road engineering and environments, and vehicle factors. Possible reasons that caused motorcyclist fatalities are riding above the speed limit, breaking traffic lights, following other vehicles closely, and the negligence of riders. This paper aims to identify the main factors affecting fatal accidents among motorcyclists from the perspectives of 146 road transport officers' ranking from the high to low order. Respondents involved in this study are staff and officers who serve in the Malaysian Road Transport Department. This study adopted the Theory of Planned Behavior (1985) and other factors influencing motorcyclists' attitudes and behaviors. Using Microsoft Excel, frequency analysis was used to rank all factors associated with motorcyclist accidents in the questionnaire survey. Findings show that psychological factors were the main factors affecting motorcyclist accidents.

**Keywords:** Motorcyclists, Fatal Accident, Road, Frequency Analysis, Psychological Factors.

### Introduction

The number of road accident cases and fatality cases in Malaysia is highest compared to neighboring countries in the ASEAN region (Idris et al., 2019). More than 1.35 million human lives were recorded died each year due to road traffic crashes making it the 8th leading cause of death globally (WHO, 2018). Overall, 16,920 motorcycle fatalities crash cases were recorded as a substantial cause of death in Malaysia (PDRM, 2019). Touahmia (2018) states that road traffic accidents are increasingly recognized as one of the most significant public health issues, incurring heavy losses of human resources and severe socioeconomic costs worldwide. Every day, thousands of people were killed and injured on roadways across the world. The World Health Organization (WHO) estimated that over 1.25 million deaths and 50 million injuries occur worldwide due to road crashes each year. Statistics anticipate road transport accidents to be the third among fifteen more frequent causes of death by 2020. The indicator becomes more significant if compared to a developed country. Road accidents are a phenomenon that the government should give serious attention.

The high rate of road accidents indicates an increase in road accident cases each year in Malaysia. The number of accidents, especially fatal ones, was based on the Royal Police Department Malaysia (PDRM) and Road Transport Department (JPJ) statistical reports. These statistics give every road user a serious picture to prioritize safety and awareness to reduce the accident rate. In recent years, increases in scooter and motorcycle sales have caused a corresponding increase in deaths and serious injuries

caused to their riders, following a period of relative decline (Ishak & Rahim, 2020). Scooters have seen a 16% rise in sales between 2002–2003; recent licensing data for larger motorcycles (above 500cc engine capacity) shows that the stakeholders consider around half of all registered motorcycles, so this pattern seems set to continue (Arévalo-Támara et al., 2020). Ishak & Rahim (2020) also claimed that for the past eleven (11) years, 4,940,345 road accident crashes have resulted in 67,304 deaths. Simultaneously, the overall motorcycle fatality accidents were worrying, with 41,979 or 62.3% the most dominant group exposed to road traffic crashes. The researchers predicted the pattern to remain the same in this decade. Due to the number of car occupants, motorcyclists and pedestrians are the riskier user groups to expose to fatality accidents on Malaysian roadways.

Motorcycle accidents have somewhat different characteristics compared to other transport and road users (Haque et al., 2009). In particular, stakeholders include 'right of way' accidents, accidents involving loss of control on bends, and accidents caused by motorcyclists using the more frequent overtaking and passing opportunities that this choice of transport affords them. There are THREE (3) factors affecting fatality accidents among motorcyclists adapted in this research from the Theory of Planned Behavior 1985 by Ajzen (1991), namely psychological factors, environmental factors, and vehicle factors. This research paper will recommend ranking factors affecting fatal accidents among motorcyclists from 146 road transport officers' points of view, from high to low order.

## Literature Review

This research adopted the Theory of Planned Behavior (1985) by Ajzen (1991) and other factors that influence motorcyclists' attitudes and behaviors to explain the relationship between psychological factors, environmental factors, and vehicle factors affecting fatal accidents among motorcyclists. The theoretical framework used in this research was illustrated in Figure 1 as follows:

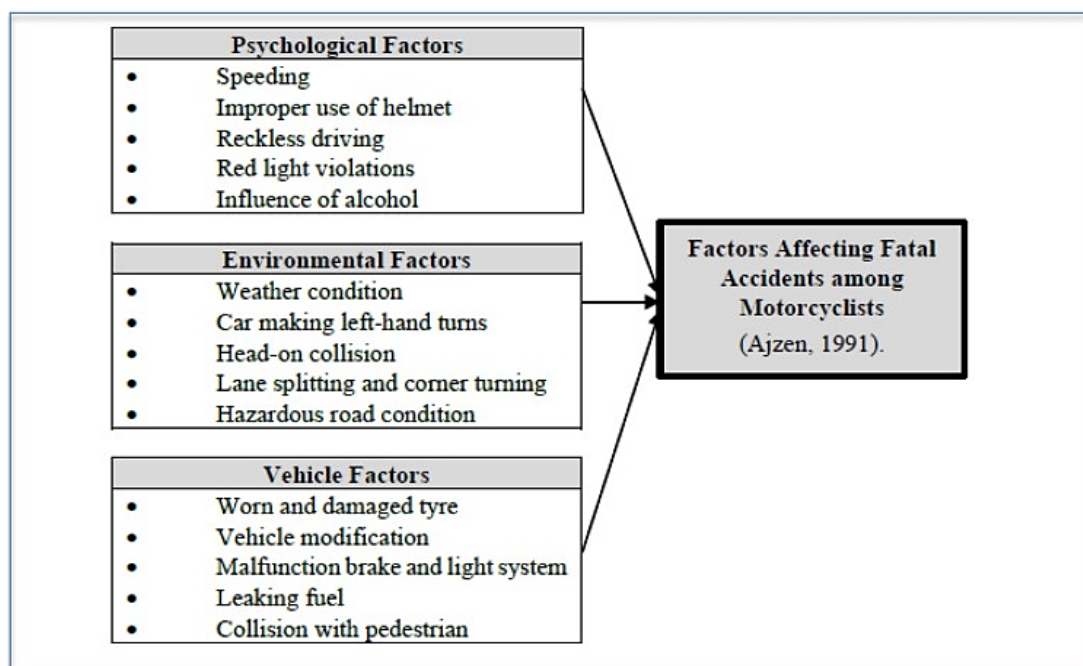


Figure 1: Theoretical Framework for Factors Affecting Fatal Accidents among Motorcyclists

### *Psychological Factors*

According to data collected from Guangdong Province of China, psychological factors offer insights into risk factors related to personal characteristics such as speeding, reckless driving and red light violations resulting in severe injuries to the motorcyclists (Zhang et al., 2021). In some cases, motorcyclists' attitudes, such as riding near-crash liabilities, happen between a motorcycle and other

transport types such as cars, lorry, bicycles, buses, vans, and four-by-four vehicles. However, only some cases of motorcycle fatalities occurring on roads are due to riding without a driving license and driving under the influence of alcohol (Trung et al., 2020).

Factors such as gender also affect the psychological factors affecting motorcyclists' accidents. Helmet non-use and red running offenses usually increase among female riders, riders wearing industrial uniforms, carrying passengers, riding during the weekend, off-peak hours, clear weather, multi-lane roads, and some T-junctions (Rusli & Salam, 2020).

Research finding from Goh & Leong (2020), reveals that there are positive effect and significant positive relationship between risky behavior and motorcyclists' behavior. The research stated that older motorcyclists ranging between 36 to 55 years old are less likely to take part in riding behavior while riding on the road than young motorcyclists ranging between 16 to 35 years old.

From the research findings, psychological factors are very significant to severe injuries and fatal accidents among motorcyclists. Other than that, lack of awareness among motorcyclists affected the riding behavior positively towards road safety plays an essential role in improving road safety awareness among riders (Alvisyahri et al., 2020).

### ***Environmental Factors***

Environmental is one of the factors that affect motorcyclist's injury severities. Research by Waseem et al., 2019 found that the probability of fatality or severe injuries increases for vehicle crashes that involve young and middle-aged riders ranging between 25 to 45 years old. Meanwhile, riders' awareness about frequently recorded accidents occurring on roads with a speed limit of 70 km/hr or higher with fixed objects such as heavy vehicles is not at the desired level (Haque et al., 2009).

According to Arévalo et al., 2020, road environmental factors during dry and heavy rain weather conditions also impact motorcycle accidents. There are three (3) types of high accident frequency associated with weather conditions: early morning hours or late afternoon, or early evening hours. These accident frequencies will depend on road segments and divided streets related to motorcycle accidents with a posted speed limit of less than 50km/hr.

Researchers also stated that road engineering and infrastructure factors such as curves and collision with roadside objects and road furniture serious attention (Santos & Dias, 2020). The effects of various factors, including horizontal curves, speeds, and helmet use, require motor skills and balance identified as essential mechanical protection, leading to motorcyclists being more prone to severe injuries (Maistros et al., 2014). Flat terrain also has a higher crash frequency than rolling or mountainous terrain (Arévalo-Támara et al., 2020). Furthermore, common road engineering and infrastructure problems such as hazardous road conditions such as oily, sandy, potholes and unsafe roadways were reported factors affecting motorcycle accidents.

### ***Vehicle Factors***

Fatalities in road accidents involving motorcyclists become crucial issues that the government needs to address with the collaboration of all stakeholders. Researchers' statistical analysis reported that motorcyclist's faults such as riding a motorcycle in the median lane, motorcycle modification up to higher engine capacity, and riding a motorcycle with a pillion passengers increased the likelihood of at-fault crashes on roadways (Arévalo-Támara et al., 2020). Motorcyclists become more vulnerable during nighttime on roadways. The presence of surveillance cameras significantly reduced the not-at-fault crash involvement at roadway intersections during day and night.

Other than that, vehicle modification factors, malfunction of motorcycle brake and light system, worn and damaged motorcycle tyre, wet-road surface, leaking fuel from others vehicle and collision with a pedestrian was found to increase the likelihood of at-fault crashes at non-intersection with the effect of a crash involving pedestrians higher at night (Haque et al., 2009). As cases recorded by Royal Police Department (PDRM) recorded, motorcyclists are more likely to be victims in multi-vehicle crashes at all locations. It does not matter young or old, male or female motorcyclists, negligence of all road users

will cause fatal accidents and someone will be at-fault in crashes. From the research findings, vehicle factors are very significant to severe injuries and fatal accidents among motorcyclists.

## Methodology

Using a quantitative data collection method, an online survey questionnaire was designed to identify the main factors affecting fatal accidents among motorcyclists from the perspectives of road transport officers'.

### *Target Respondents and Sampling Design*

The target respondents for this research were based on a purposive sampling frame provided by Road Transport Department (JPJ) lists which consist of approximately 300 road transport department officers' in Melacca state. These officers had grade positions of KP19 – KP28; AB19 – AB28, KP29 – KP40; AB29 - AB40; KP41 – KP48 and KP49 – KP54. Using Raosoft sample size calculator of 5% margin error and 95% confidence level, the sample size required for this study is 143 respondents. The equation of sample size is given as follows:

$$\begin{aligned} \text{Equations : } x &= Z(c/100)2r(100-r) && (1) \\ n &= N x / ((N-1)E^2 + x) && (2) \\ E &= \text{Sqrt}[(N - n)x/n(N-1)] && (3) \end{aligned}$$

Where N is the population size, r is the fraction of responses the study is interested in, and Z(c/100) is the critical value for the confidence level c.

This study received 146 usable and completed questionnaires during the data collection period. The data achieved 50% of the total respondents. This research is not experimental, the frequency analysis is used to rank nominal level type of data (Yes and No question) (Kaur & Kumar, 2015).

### *Questionnaire Design*

Questionnaires often seem logical and user friendly to collect information from people (Leedy & Ormrod, 2005). The questionnaire design for this research was divided into TWO (2) sections. Part A of the questionnaire survey was requested the demographic profiles of respondents. Part B was focused on ranking the main factors affecting the motorcyclist's accidents. The respondents were asked to determine the agreement level on the statement related to psychological factors, environmental factors and vehicle factors that affects motorcyclist fatalities accidents based on their working experience. Close-ended questions can be answered by a simple "yes" and "no" by the respondents conducted through the online survey, which is the best and fast way to answer the research questions and purposes. The flow of research methodology for this research is illustrated in Figure 2.

## Data Collection

### *Factors Selected for the Theoretical Framework*

By adopting the Theory of Planned Behavior (1985) and other factors that influence motorcyclist attitudes and behaviors, this study began with the collection of literature reviews for the theoretical framework constructs related to the motorcyclist's fatalities accidents. At this stage, identification of similarities and differences among the decisive concepts, variables, elements and factors in motorcyclist's road safety area was done within the past five (5) years back literature (Taylor & Procter, 2008).

### *Online Questionnaire Survey*

A quantitative research approach was carried out based on the purposive sampling of 146 respondents. The primary data was gathered among the road transport officers' from 16 state namely, Johor, Kedah, Kelantan, Kuala Lumpur, Labuan, Melaka, Negeri Sembilan, Pahang, Perak, Perlis, Pulau Pinang, Putrajaya, Sabah, Sarawak, Selangor and Terengganu. Before the distribution of the online questionnaire survey, the researcher conducted a pilot study to proofread the variables in the questionnaire among ten 10 respondents consisting of road transport department officers having grade

position KP19 – KP28; AB19 – AB28, KP29 – KP40; AB29 - AB40; KP41 – KP48 and KP49 – KP54 randomly.

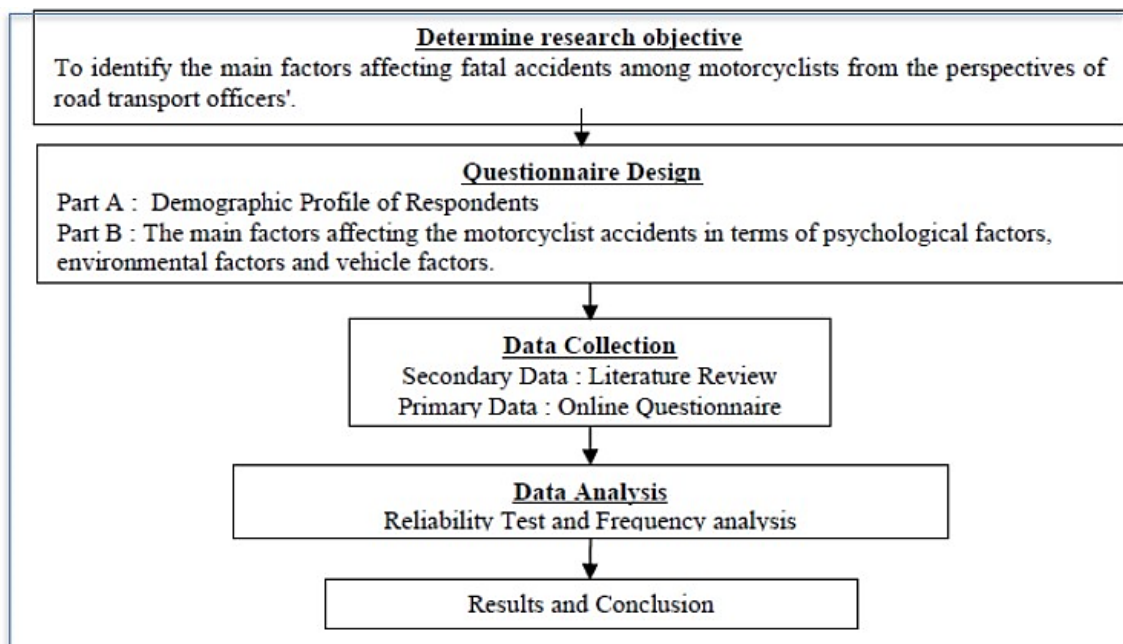


Figure 2: Flow Chart of Research Methodology.

## Data Analysis

### *Reliability Test*

Reliability test was commonly used in the descriptive, statistical and psychometric analysis. Reliability indicates the results' consistency when data or experiments are replicated under the same condition (Rani et al., 2020). This research applied a reliability test to ensure good questions quality and the reliability of this research are good and adequate. Table 1 shows the values of Cronbach's alpha obtained for three (3) factors affecting motorcyclist accidents, namely psychological, environmental and vehicle factors. The value tabulated indicates that the three variables have an adequate internal consistency level, which shows that this research is reliable.

Table 1: Reliability Test (Cronbach's Alpha Value)

<b>Independent Variables</b>	<b>Cronbach's Alpha</b>
Psychological Factors	0.733
Environmental Factors	0.794
Vehicle Factors	0.789

Note:

1. Coefficients of reliability should be in the range of 0 to 1, where "0" means too many errors, and "1" indicates no error.
2. Alpha values higher than 0.8 indicate that the variables test are high in internal consistency
3. Alpha values of a minimum of 0.7 indicate that the variables test are adequate in internal consistency

### *Frequency Analysis*

Data collected from the online questionnaire were organised and analysed using Microsoft Excel. According to Theofilatos & Yannis, (2014), data patterns can be observed using descriptive, frequency and a combination of the categorical analysis. At this stage, factors affecting motorcyclist accidents in terms of percentages value were ranked from high to low order.

## Results and Discussion

### Demographic Profile of Respondents

The demographic profiles of respondents are demonstrated in Figure 3. Figure 3 shows that the majority (66%) of respondents for this study are male officers. The remaining 34% of female respondents responded to this survey.

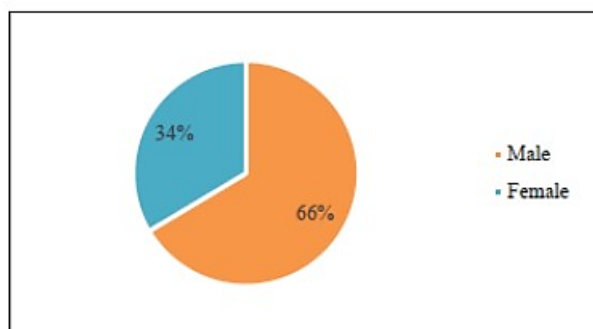


Figure 3 Respondent's Gender.

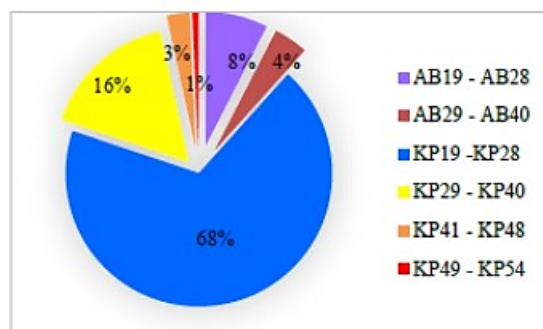


Figure 4 Respondent's Grade Position.

The pie chart in Figure 4 shows that 68% of respondents are road transport officers having a grade position of KP19 – KP28. Most of them are officers from the Driving Licensing Division of the Road Transport Department in Malaysia. These officers were mainly involved in conducting enforcement operations, preparing records and reports of operations and prosecutions, engaging with prosecutions witnesses' cases and other related work directed by superiors from time to time.

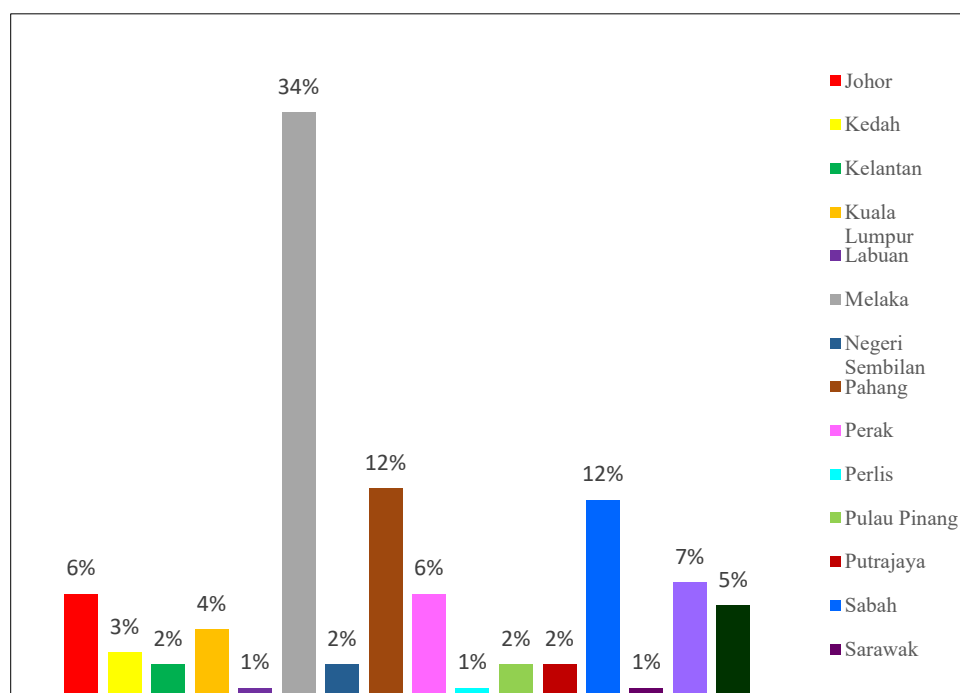


Figure 5 Respondent's Working State Department.

Next, Figure 5 shows the percentage distribution of respondents working state department. From the results, the majority of the respondents (34%) worked in the Melacca state department. The following section discusses respondents' feedback based on the frequency analysis of each motorcyclist's fatal accident factors.

***Respondents' Feedback on the Main Factors Affecting Motorcyclist Accidents in terms of Psychological, Environmental and Vehicle Factors***

Data tabulated in Table 2 were analysed using frequency percentages gathered from road transport department officers' points of view.

Table 2. High to Low Order Ranking of Respondents' Feedback on the Main Factors Affecting Motorcyclist Accidents

<b>Psychological Factors</b>	<b>Frequency (%)</b>	<b>Rank</b>
Reckless driving	99	1
Red light violations	98	2
Influence of alcohol	84	11
Improper use of helmet	83	12
Speeding	79	14
<b>Environmental Factors</b>	<b>Frequency (%)</b>	<b>Rank</b>
Car making left-hand turns	97	3
Hazardous road condition	94	5
Lane splitting and corner turning	95	6
Weather condition	91	8
Head-on collision	82	13
<b>Vehicle Factors</b>	<b>Frequency (%)</b>	<b>Rank</b>
Malfunction brake and light system	96	4
Worn and damaged tyre	92	7
Collision with pedestrian	90	9
Vehicle modification	87	10
Leaking fuel	72	15

The respondent's feedback listed in Table 2 was ranked from high to low order. The top five (5) factors perceived by the respondents are reckless driving (99%); red light violations (98%); car making left-hand turns (97%); malfunction brake and light system (96%) and hazardous road conditions (94%) were the main factors that affect fatal accidents among motorcyclists. These findings show that psychological factors were the main factors affecting motorcyclist accidents.

**Conclusion**

This study identified and ranked the main factors affecting fatal motorcyclist accidents based on 146 respondents' opinions and experiences from the Driving Licensing Division, Road Transport Department officers in Malaysia. Reckless driving and red light violation are the highest-ranking respondents' feedback on the main factors affecting motorcyclist accidents. It is essential to educate the public, especially the motorcycle rider, that psychological, environmental and vehicle factors may influence the likelihood of both crash and injury severity. This paper is limited to the road safety research area focusing on motorcycle accident factors based on descriptive analysis using a quantitative questionnaire survey. This paper's findings can help road safety officers and public awareness of motorcycle fatal accident factors.

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