# ANALYSIS OF MOTORCYCLE TRAFFIC ACCIDENT BASED ON THE RIDER'S CHARACTERISTICS IN KUPANG, EAST NUSA TENGGARA

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***Abstract**: Awareness about driving safety is still lacking among motorcycle users. As the provincial capital of East Nusa Tenggara (NTT), Kupang city accounts for the largest number of accidents in NTT with 70% of the total accidents involving motorcycles. It is important to measure the extent to which riding characteristics affects and causes road accidents since humans as the riders are the main factor in traffic accidents. A questionnaire was distributed to the motorcyclists. The data collected from 212 respondents was analysed with the multivariate logistic regression method. The analysis result states that the motorcycle mileage and the motorbike ownership hold the most influence on the incidence of motorcycle road accidents, where the further the motorcycle riders travel, the higher the probability of them to get involved in a road accident. Meanwhile the more units of motorcycle owned, the lower the probability of them to get involved in a road accident.*

**Keywords:** *Motorcycle, probability, riders' characteristics, traffic accidents*

## INTRODUCTION

Motorcycle is one of the most common and popular transportation modes used in Indonesia. The number of motorcycles continues to increase in line with the increasing population and income of the community, especially the lower middle-income group [1]. According to the Indonesian State Intelligence Agency (BIN RI) in 2014 traffic accidents were the third leading cause of death after coronary heart disease and tuberculosis [9], and the number of motorcycle accidents continues to increase with the increase in the number of motorcycles.

As the most popular vehicles, motorcycles indeed have the highest number of vehicles among other types of motorized vehicles [2]. However, awareness about driving safety is still lacking in the community, especially motorcycle riders [3]. The important factors in accidents seen from the behavior of the rider are the least written characteristics and there are not as many research papers about this particular topic as other factors in research [4].

Several studies, including the results from Bolla [5] regarding the factors of accidents in the city of Kupang seen from the influence of road geometry, and Widyastuti [6] regarding the Theory of Planned Behavior, show that the attitude factor of motorcyclists has not been discussed too much, although this is part of the human factor part as a vehicle driver, or in this case, motorcycle riders.

In Kupang city, the capital city of East Nusa Tenggara (NTT), it is stated that up to 70% of the number of traffic accidents that occur on Kupang city roads involve motorbikes, according to data from Jasa Raharja NTT in 2013. Throughout 2014 to the end of 2018, the number traffic accidents that continues to increase is quite concerning, both in terms of the number of deaths and serious to minor injuries. Based on the records of the Traffic Directorate of the Kupang Police (Director of Road Traffic Polresta Kupang, NTT), in 2018 the number of traffic accidents that occurred was three times more involving SIM C holders than other SIM holders vehicle involved in the accident.

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## RESEARCH SIGNIFICANCE

Motorbike riders or road users in general are identified as the most responsible factor in the safety of motorcyclists. Therefore, it is important to look at some of the internal factors that influence riders who experience motorcycle road accidents. It is hoped that this research can be a contribution in more accurately studying the behaviour of humans who act as the motorcycle riders in Indonesia, especially in Kupang city as the case study.

## METHODOLOGY

There are 11 description data for the respondents which are essentials to this paper and shown in Table 1. They act as the independent variables.

Table 1 Riders' characteristics in MRBQ

| No | Characteristic |
|---|---|
| 1 | Gender |
| 2 | Tendency to Use Motorcycle |
| 3 | Motorcycle Mileage (in a day) |
| 4 | Level of Education |
| 5 | Occupation |
| 6 | Level of Income |
| 7 | Status |
| 8 | Motorcycle Ownership |
| 9 | Age |
| 10 | License (SIM C) Ownership |
| 11 | Motorcycle Experience |

These variables would then be taken as the characteristics of motorcycle riders processed from the number of respondents' samples. While these characteristics are the independent variables, the dependant variable is obtained by the response from a part of the questionnaire in a form of question of whether the respondents with their motorcycles have or have not entangled in an accident occurrence.

Determination of the sample size between 150 and 400 people, based on the MLE or Maximum Likelihood Estimation [7] procedure, for an optimal estimate for analysis. The independent variables were all run against the dependant variable, which here was the riders' involvement in one or multiple road accidents in this last year (Y). The Y variable is coded in 0 and 1 where 0 means the respondent, who is a motorcycle rider, had not been involved in a traffic accident, and while the code number 1

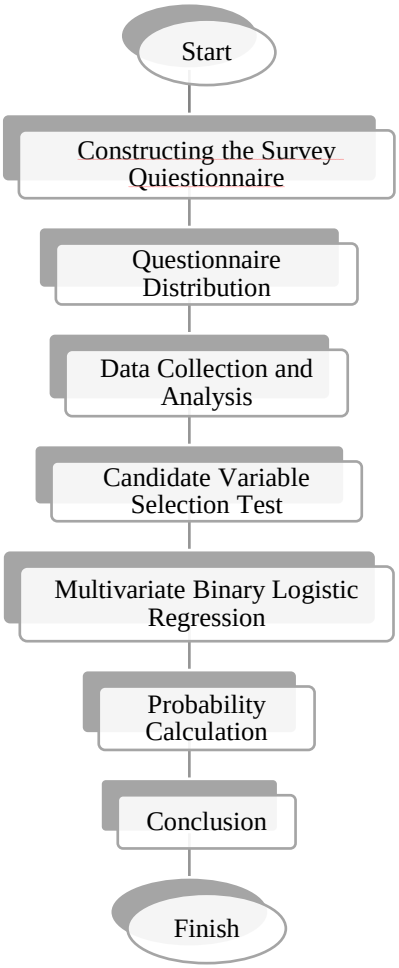

Figure 1 Research flowchart

means the respondent had gained an involvement in one or multiple incidents of motorcycle accident in this past year.

The analysis process was carried out using multivariate logistic regression method. The result of the analysis is the value that pays attention to the aspect of Sig (Pvalue) < 0,25. If these requirements are not met, then the analysis is carried out repeatedly in several stages to gain control over the Exp(B) value or commonly called the Odd Ratio (OR) value, namely Exp(B) [ΔExp(B) ] < 10%, by eliminating one of the variables that has the greatest significance value (P-value). If there are variables that qualify for the stated value, then the omitted variables are other variables that have a significance value or Sig. (P-value) the largest after. In the end, variables will be obtained as candidates to be tested in the multivariate stage. The applied logistic regression model can be shown in the following equation (1).

$$Logit(p(x)) = g(x) = \ln[\frac{p(x)}{1-p(x)}] = \beta o + \sum_{k-1}^{p} \beta_k X_k \quad (1)$$

$$P = \frac{\exp^{\log it(p)}}{1+\exp^{\log it(p)}} \quad (2)$$

As seen above, equation (2) is referred to achieve the probability of a rider's chance in getting involved in road accidents.

## ANALYSIS AND DISCUSSIONS

The answers to the questionnaire obtained from a total of 212 respondents are summarized in Table 3 which points out the number of each category in the characteristics of the riders. Table 2 shows the percentage of dominant indicator of each characteristic of motorcyclists in Kupang city.

Table 2 Dominant characteristics

| Characteristic | | Percentage |
|---|---|---|
| Gender | Male | 61% |
| Tendency to Use Motorcycle | Positive | 93% |
| Motorcycle Mileage (in a day) | 11-15 km | 34% |
| Level of Education | Senior High School Diploma | 60% |
| Occupation | Student | 44% |
| Level of Income | No Income | 54% |
| Marital Status | Not Married | 68% |
| Motorcycle Ownership | 1 unit | 68% |
| Age | 21-30 years old | 44% |
| License (SIM C) Ownership | Positive | 79% |
| Motorcycling Experience Period | 4-6 years | 31% |

The next step was to select the variables which were used as candidates in multivariate analysis. In this stage, if the results of the analysis between the independent and dependent variables produced a P-value that was smaller than 0.25, then the independent variable was entered into the multivariate stage. The characteristics served as the variables influencing the dependant variable, however it is necessary to not skip this step beforehand. The purpose of this step was to select the variables to be included in the multivariate logistic stage [10]. Table 3 below shows the significance value of all the characteristics. There are two riders' characteristic whose Sig. values do not fit the requirement mentioned before, namely gender and the tendency of the riders to use motorcycle rather than other modes.

Table 3 Variable candidate selection test

| Variable | Sig. |
|---|---|
| Gender | 0.438 |
| Tendency to Use Motorcycle | 0.407 |
| Motorcycle Mileage (in a day) | 0.123 |
| Level of Education | 0.017 |
| Occupation | 0.012 |
| Level of Income | 0.000 |
| Status | 0.000 |
| Motorcycle Ownership | 0.000 |
| Age | 0.000 |
| License (SIM C) Ownership | 0.000 |
| Motorcycling Experience | 0.000 |

It can be seen in Table 3 that of the eleven variables, the values of the 2 variables that do not meet the requirements, which are less than 0.25 are Gender and Tendency to Use Motorcycle. Thus, the other nine variables deserve to be further candidate variables to be

analysed by multivariate testing. The independent variables were all run against the dependant variable, which here was the riders' involvement in one or multiple road accidents in this last year (Y variable). The multivariate analysis process was carried out repeatedly until the output was a suitable variable and fulfilled the requirements [10, 12] or was significant. The results of all logistic regression tests in this paper were run for 7 times until the final variables fit the required necessity.

Table 4 shows the independent variables that have been tested in candidate selection, after 7 steps. Variables that display a significance value greater than 0,25 (Sig.> 0,25) are "Gender" and "Tendency to Use Motorcycles". Thus, the two characteristic variables were eliminated. Characteristics with a significance value less than 0,25, were then included as candidates in the next process, namely the multivariate stage. The multivariate stage was carried out repeatedly until it showed which independent variables were able to be concluded to have an effect on the dependent variable [5][10][11]. Below is Table 4 which represents the output of the multivariate stages carried out afterwards.

Table 4 Respondent data regression test outcome

| | B | Sig. | Exp(B) |
|---|---|---|---|
| Motorcycle Mileage | 1,022 | 0,002 | 1,276 |
| Motorcycle Ownership | -0,378 | 0,001 | 0,389 |
| *Constant* | -0,463 | 0,678 | 0,290 |

The value of B in Table 4 is a constant or regression coefficient using the Y equation. The positive and negative forms of the B value indicate the level of relationship between the independent variable and the dependent variable. To determine the logit modelling equation on the independent variable, apply Equation (1).

$$\begin{aligned} \textit{Logit(P)} &= \frac{p}{1-p} = \beta_0 + \beta_1 (X) \\ &= \text{-0,463 + 1,022 Motorcycle Mileage} - \\ &\quad \text{0,378 Motorcycle Ownership} \\ &= 0,18 \end{aligned}$$

The results of the logit calculation are then entered into the probability calculation formula.

$$P = \frac{exp^{\text{logit(p)}}}{1+ exp^{\text{logit(p)}}} = \frac{2,718^{0,18}}{1+ 2,718^{0,18}} = 0,55 = 55\%$$

Table 5 Significant variables regression test

The mileage has a positive effect on the occurrence of accidents indicated by the value B, which means that the higher the distance travelled by the rider, the greater the chance of a motorcycle accident occurring, as well as the license ownership variable.

| | B | Sig. |
|---|---|---|
| Motorcycle Mileage(2) | 1,030 | 0,008 |
| Motorcycle Mileage(3) | 1,111 | 0,023 |
| Motorcycle Mileage(4) | 1,292 | 0,017 |
| Motorcycle Ownership(2) | -1,097 | 0,006 |
| Motorcycle Ownership(3) | -1,259 | 0,006 |
| *Constant* | 1,261 | 0,001 |

Variable of motorcycle mileage and motorcycle ownership were taken for simultaneous testing on multiple variables. Table 5 below presents which indicator of the variables holds the significant influence towards the dependant variable. It can be seen from Table 5 that there are 5 indicators which have the significance towards the dependant variable Y. Respectively from top to bottom, the indicators represent mileage or distance travelled of 6-10 km, 11-15 km, 16-20 km, 1 unit, and 2 units of motorcycle owned. The following Table 6 shows the test run on both significant variables in earlier Table 4 towards the dependant variable, along with the calculation of logit(p) and probability by using the equations. Below is the value of logit(p) for Motorcycle Mileage (2) and Motorcycle Ownership (2) variable.

$$\begin{aligned} \textit{Logit(P)} &= \frac{p}{1-p} = \beta_0 + \beta_1 (X) \\ &= 1,261 + 1,030 \text{ Motorcycle Mileage (2)} \\ &\quad - \ 1,159 \text{ Motorcycle Ownership (2)} \\ &= 1,13 \end{aligned}$$

The probability of Motorcycle Mileage (2) and Motorcycle Ownership (2) variable is as follows:

$$P = \frac{exp^{\text{logit(p)}}}{1+ exp^{\text{logit(p)}}} = \frac{2,718^{1,13}}{1+ 2,718^{1,13}} = 0,76 = 76\%$$

These calculations were then applied to all the variable pairs, namely Motorcycle Mileage (2) and Motorcycle Ownership (2), Motorcycle Mileage (2) and Motorcycle Ownership (3), Motorcycle Mileage (3) and Motorcycle Ownership (2), Motorcycle Mileage (3) and Motorcycle Ownership (3), Motorcycle Mileage (4) and Motorcycle Ownership (2), and Motorcycle Mileage (4) and Motorcycle Ownership (3). The result of the calculation for each variable pair is summarized and shown in Table 6 and Figure 2 below.

Table 6 Value of probability for the significant variables

| Motorcycle Ownership | Motorcycle Mileage | Logit (P) | P (%) |
|---|---|---|---|
| 1 unit | 6 – 10 km | 1,19 | 77 % |
| | 11 – 15 km | 1,28 | 78 % |
| | 16 – 20 km | 1,46 | 81 % |
| 2 units | 6 – 10 km | 1,13 | 74 % |
| | 11 – 15 km | 1,21 | 75 % |
| | 16 – 20 km | 1,39 | 78 % |

Table 6 presents the probability of motorcycle accident in a form of percentage, between two variables of each characteristic, as seen. When the riders travel with their motorcycle further and own fewer units of motorcycle; the road incident probability number is peaking higher for them. According to a study by Widyastuti [6], it shows that to determine an accident rate, the factors influencing the occurrence needed is not only the number of accidents, but also the traffic volume and the length of the road.

The length of the road might have a close relationship to how the motorcycle milage acts on the occurrence of a motorcycle accident. Hence the result of the motorcycle mileage characteristics having positive effect on motorcycle traffic incident. This also fits the result of the

said study that a road with the highest amount of accident numbers does not always possess the highest number of accident rate.

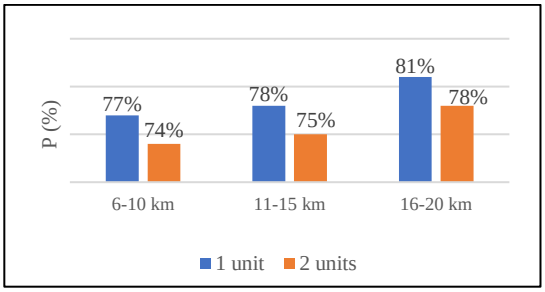


Figure 2 Probability of accident based on significant variables of motorcycle mileage and motorcycle ownership

Figure 2 then points out a finding that the further the motorcycle riders travel, the higher the probability of them to get involved in a road accident. Meanwhile the more units of motorcycle owned by the riders, the lower the probability of them to get involved in a road accident.

## CONCLUSIONS

With the dependent variable in the form of involvement in the occurrence of motorcycle accidents, the characteristics that play the biggest role in the incidence of accident experiences in Kupang are indicated by the motorcycle ownership variable and the motorcycle mileage travelled by the riders. The probability of motorcycle riders to be involved in an incident of a road accident is highly affected by how far the riders travel, thus the further the higher the probability. However, the variable of motorcycle ownership shows that the probability of the incident could be possibly affected by how much the riders are used to their own vehicle, therefore if the riders own their own vehicle, the more units they have the smaller the chance of them to be involved in an accident.

This finding might as well be related to the act of road safety violations since long distance of motorcycling increases the chance of road accident. Various types of violations of traffic regulation also could lead to a study regarding road users' behavior especially the motorcycle riders. Further analysis is necessary in order to form a better understanding and program recommendation in tackling the increasing number of motorcycle road accident number.

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