Motorcyclist Perceptions on Road Safety Considering Awareness, Riding Behavior, and Risk-Taking Behavior, as Latent Variables

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Abstract. World Health Organization (WHO) reported in 2018, as many as 74% of the death tolls of road users in Indonesia derived from motorcycle riders. Factors causing traffic accidents originate commonly from humans, vehicles, and roads, in which human factor stands on top. One of the most significant contributor areas to traffic accidents in Indonesia was Aceh Province, because of risky riding behavior. This study aimed to investigate the motorcyclist perception toward road safety according to awareness, riding behavior, and risk-taking behavior, as latent variables. Primary data was collected by distributing questionnaires among motorcyclists in Banda Aceh City, Aceh Province. The questionnaire structure consisted of 2 parts, i.e., motorcyclist characteristics and motorcyclist perceptions using latent variables. The analysis utilized the Confirmatory Factor Analysis of the Structural Equation Model. The results showed that the risk-taking behavior was positively influenced by riding behavior, and the awareness of motorcycle rider affected the riding behavior positively. In terms of indicator affecting the latent variable was, parking close to the intersection showed the highest contribution to riding behavior. In sum, the model constitutes as good fit.

1. Introduction
Traffic accident is among the significant indicators in assessing road safety. Traffic accident injuries constitute the eighth-most substantial cause of death in the world. Traffic accidents killed 1.4 million people in 2016, 8th leading cause of death for people of all ages and male cause of death for children and young adults 5-29 years of age [1].

In some countries, traffic accident constitutes one of the government priorities to achieve the people wellbeing. Developed countries such as Britain, Sweden, Switzerland, and Singapore are those countries with low mortality rates [2]. About 85% of deaths due to traffic accidents occur in low and middle-income countries [3].

In China, motorcyclists with risky riding behavior account for 95 percent of traffic accidents [4]. Emotional factors and lack of awareness in complying with traffic regulations may affect the risky riding behavior. The relationship between personality characters and risky riding behavior is mediated through attitude. It implies that the motor-riding rider's nature can indirectly influence risky riding behavior [5]. In the younger age group, motorists who have high self-confidence in riding, have a low desire to drive. The more riding experience, the more confidence to ride a motorcycle [6].
2. Data and Method

2.1 Data

This study takes motorcyclists' perceptions of awareness and riding behavior into account. A questionnaire survey was utilized and distributed to 200 respondents in nine sub-districts in Banda Aceh City. The study location can be seen in Figure 1, in which the targeted respondent was motorcycle riders or motorcyclists. The online questionnaire survey technique, designed by Google Form, was adopted for collecting data. The two sections in the questionnaire consisted of socio-demographic of respondent and perceptions of the respondent in riding (including risk-taking behavior, riding behavior, and awareness).

![Figure 1. Banda Aceh city (map data ©2019 Google)](image)

The descriptive statistics results showed that female riders (54%) were more dominant than those male riders (46%). However, respondents who have had an accident were dominated by the male (55.2%) compared to female (44.8%). For more details, the respondent's socio-demographic distribution can be seen in Table 1.

Some questions were derived from studies conducted in other countries [10-14], and others were based on Indonesian laws and regulations. Samples were distributed based on the number of motorcycle ownership for each district.

This study used eight indicators (Table 2) that are part of 3 latent variables, using the 1-4 Likert scale to assess riders' behavior and perception. The 4-point Likert scale [7] describes levels from *Never* to *Always* or vice versa, and *Strongly Disagree* to *Highly Agree* or vice versa. The Likert scale is used to measure the attitudes, opinions, and perceptions of a person or group of people about social phenomena. This social phenomenon is designed by researchers and considers as research variables. The research variable is translated as an indicator. The indicator is made as a starting point for compiling instrument items that can be in the form of agreements or questions [8].
Table 1. Socio-demographic of Respondents

| Item            | Category         | Share (%) |
|-----------------|------------------|-----------|
| Gender          | Male             | 46%       |
|                 | Female           | 54%       |
| Age             | 15-24 years      | 43.5%     |
|                 | 25-34 years      | 25%       |
|                 | 35-44 years      | 12%       |
|                 | 45-54 years      | 14%       |
|                 | 55-64 years      | 5.5%      |
|                 | 65 years or more | 0%        |
| Education       | Junior High School | 1%       |
|                 | Senior High School | 40.5%   |
|                 | College Degree   | 13.5%     |
|                 | Bachelor's Degree | 37.5%     |
|                 | Master Degree    | 7.5%      |
| License Ownership | Yes              | 89.5%     |
|                  | No               | 10.5%     |
| Accident history | Yes              | 29%       |
|                  | No               | 71%       |

Table 2. Latent Variables and Indicators

| Latent Variables             | Code  | Indicators                                  |
|------------------------------|-------|---------------------------------------------|
| Risk-Taking Behavior (RTB)   | RTB1  | Overtaking, if possible                     |
|                              | RTB2  | Using handphone while riding                |
| Riding Behavior (RB)         | RB1   | Turn over without signal alert             |
|                              | RB2   | Parking close to the intersection           |
|                              | RB3   | Keep safety on overtaking                  |
|                              | RB4   | Stopping close to the front vehicle        |
| Awareness of Motorcycle Rider (AMR) | AMR1 | Promoting a helmet is a solution to reduce the risk of injury |
|                               | AMR2  | Use a helmet to obey the rules             |

2.2 Method
The analysis of correlation was performed to determine the potential relationship between indicators. The relationship between risk-taking behavior, riding behavior, and motorcyclist awareness were utilizing Confirmatory Factor Analysis (CFA) of the Structural Equation Modeling (SEM) with maximum likelihood estimation. SEM combines aspects of factor analysis and regression analysis to confirm measurement models and structural models that are built based on certain theoretical studies [9].
The variable of *Overtaking, if possible* (RTB1) is part of the study [10]. It aims to find out the rider's behavior in taking this risk when riding. The questions of *Turn over without signal alert* (RB1), *Parking close to the intersection* (RB2), *Keep the safety on overtaking* (RB3) and *Stopping close to the front vehicle* (RB4) are some behaviors carried out by motorists in Indonesia, previously part of the study [11-13]. Some questions from awareness factors such as *Promoting a helmet is the solution to reduce the risk of injury* (AMR1) and *Use a helmet to obey the rules* (AMR2) have also been examined previously by [14] in Thailand and [15] in Indonesia.

### 3. Results and Discussions

Table 3 shows the descriptive analysis of respondents, in which the average value of each indicator is above the average value (2.5) of the 4-point Likert scale. It shows the positive value of riding safety perception, except overtaking. Overtaking has a value below 2.5, which means that respondents often take risks when overtaking as adopted from [16].

| Latent Variable | Indicator                                                                                   | Mean |
|-----------------|---------------------------------------------------------------------------------------------|------|
| **Risk-Taking Behavior (RTB)** | Overtaking, if possible                                                                    | RTB1 2.12 |
|                 | Using handphone while riding                                                               | RTB2 3.23 |
| **Riding Behavior (RB)** | Turn over without signal alert                                                             | RB1 3.39 |
|                 | Parking close to the intersection                                                          | RB2 3.63 |
|                 | Keep safety on overtaking                                                                 | RB3 3.57 |
|                 | Stopping close to the front vehicle                                                       | RB4 2.98 |
| **Awareness of Motorcycle Rider (AMR)** | Promoting a helmet is a solution to reduce the risk of injury                              | AMR1 3.58 |
|                 | Use a helmet to obey the rules                                                             | AMR2 3.29 |

Figure 2 displays the Confirmatory Factor Analysis (CFA) model explaining the relationship among latent variables in terms of motorcyclist awareness, riding behavior and risk taking behavior. The fit model test results showed that the Goodness of Fit values are as follows: GFI is 0.976> 0.900 (good fit), AGFI is 0.952> 0.900 (good fit), CFI is 0.989> 0.900 (good fit), and RMSEA is 0.023, showing good results [17, 18]. It further tested the research hypothesis on the structural model. Structural model testing is related to the evaluation of coefficients or parameters showing a causal relationship on latent variables.

Figure 2 shows the relationship between latent variables and indicators. In the latent variable *Risk-Taking Behavior* (RTB), the indicator “using handphone while driving” has the most significant coefficient that affects the RTB variable, with 233%. It is more influential than “Overtaking, if possible” as a standardized variable.

The indicator “Parking close to the intersection” becomes the indicator with the largest coefficient affecting the Riding Behavior (RB) variable. The value is 133% better than “Turn over without signal alert” indicator, as the standardized variable. The indicator with the smallest influence is "Stopping close to the front vehicle", the estimate value is only 1% smaller than the standardized variable.

In the Awareness of Motorcycle Rider (AMR) latent variable, the indicator "Promoting a helmet is a solution to reduce the risk of injury" is a standardized variable and an indicator with the most significant coefficient affecting the AMR latent variable as well. Another indicator "Use a helmet to obey the rules" has a coefficient of 23% lower than standardized variables.
3.1 Measurement Model

Table 4 shows the results of modeling the relationship among Risk Taking Behavior (RTB), Riding Behavior (RB), and Awareness of Motorcycle Riders (AMR), as Latent Variables.

| Latent Variable | Indicator | Estimate | t-value |
|-----------------|-----------|----------|---------|
| RTB             | RTB1      | 1.000    |         |
|                 | RTB3      | 2.326*   | 2.042   |
|                 | RB1       | 1.000    |         |
|                 | RB2       | 1.334*   | 4.162   |
|                 | RB3       | 1.216*   | 3.710   |
|                 | RB4       | 0.992*   | 3.333   |
|                 | AMR1      | 1.000    |         |
|                 | AMR2      | 0.771*   | 3.015   |

*Significant at the 1% level

Five significant variables appeared, with 1% significant level and t-values ≥ 1.96, out of the eight variables considered. The measurement parameter of 8 measurement models is a loading factor with one indicator selected having a coefficient of 1.

Based on the results, RB latent variable has the highest significant value of 4.162>1.96 represented by the indicator "Parking close to the intersection". Another variables are "Keep safety on overtaking" with the significant value 3.710>1.96 and “Stopping close to the front vehicle” with the significant value of 3.333>1.96.

3.1.1. The Relationship among Latent Variables and Its Influences

Figure 3 illustrates the results of parameter calibration using AMOS. It indicated a positive correlation between AMR and RB variables with a positive contribution value of 0.506, indicating that the awareness of motorcycle riders influences riding behavior. Motorcyclist with good awareness have good riding behavior. RB and RTB have a correlation of 0.405, indicating that good driving habits
determine risk-takers while driving. The results also analyze the direct effect and indirect effect of each latent variable as can be seen in Table 5.

![Diagram](image)

**Figure 3.** The latent variable of motorcyclist perception using Confirmatory Factor Analysis (CFA) model.

| Latent Variable | Direct Effect | Indirect Effect |
|-----------------|---------------|-----------------|
| AMR → RB        | 0.506         | -               |
| AMR → RTB       | -             | 0.911           |
| RB → AMR        | -0.506        | -               |
| RB → RTB        | 0.405         | -               |
| RTB → RB        | -0.405        | -               |

4. Conclusions

This study examined the motorcyclist perception toward road safety according to awareness, riding behavior, and risk-taking behavior. It was investigated using the Confirmatory Factor Analysis of Structural Equation Model. Data from an interview survey of motorcyclists in Banda Aceh City, Indonesia. It was found that, there was a positive correlation between Awareness of Motorcycle Riders and Riding Behavior as latent variables indicating that the awareness of motorcycle riders influences riding behavior.

In terms of the relationship between latent variables and indicators, it was found that the indicator of Using handphone while driving has the most significant coefficient that affects the latent variable of Risk-Taking Behavior. It was followed by the indicator of Parking close to the intersection that affects the latent variable of Riding Behavior. In the latent variable of Awareness of Motorcycle Rider, the indicator of Promoting a helmet is a solution to reduce the risk of injury indicated a standardized variable and it was also an indicator with the most significant coefficient affecting the latent variable. In sum, referring to the suitability of the model, the model constitutes as good fit.

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