EVALUATION OF READINESS OF AGRA MAS BUS DRIVERS BASED ON PHYSICAL, MENTAL, AND WORK ASPECTS USING THE FITNESS FOR DUTY MODEL

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ABSTRACT

Fitness for duty (FFD) is an individual’s ability to perform tasks in relation to the physical and mental health of each member and individual readiness to work. The development of a bus driver’s work readiness model based on physical, mental, and work aspects is very important so that bus drivers are in a fit condition or ready to work. This study aims to develop a model of Agra Mas Bus driver’s fitness for duty using measuring instruments in the form of the Visual Analogue Scale (VAS), Karolinska Sleepiness Scale (KSS) and Quantitative Analysis of Situational Awareness (QUASA).

Thirty Agra Mas Bus drivers on the Wonogiri - Kendal - Karawang route participated in the study with independent variables such as age, weight, height, sleep duration, sleep quality, cigarette consumption, caffeine consumption, eye health, shift work, attention level, fatigue, and sleepiness, as well as the dependent variable in the form of FFD results of physical test screening. The results of this study indicate that the study and evaluation of the driver’s job readiness level are quite good. That is, 100% of the drivers can be declared ready to be seen from the model that has been made. A total of 96.7% of drivers were correctly predicted, meaning that the predictive power or the accuracy of the model in classifying its observations was 96.7%. The ability of the model to predict the observation value is high, which is 75.8%. The adjusted R² value of the model is 66.67%. VAS and KSS can be used to evaluate the work readiness of drivers, while QUSASA cannot be used. Fatigue and sleepiness affect the driver’s work readiness, while attention does not. Fatigue affects the driver’s level of sleepiness. The more tired a driver is, the higher the level of sleepiness felt. A shift has no significant effect on attention, fatigue, and sleepiness. Shifts can affect the duration and quality of a driver’s sleep. The expected results of this study can be a reference for predicting the fitness for duty of bus drivers so that the risk of road accidents is reduced.

Keywords: Bus Driver, Fitness For Duty, Visual Analogue Scale, Karolinska Sleepiness Scale, Quantitative Analysis of Situational Awareness

INTRODUCTION

Public transportation is a group trip operated according to a predetermined route, according to the departure schedule and is subject to a fee for each trip. Public transportation is very important for the people of Indonesia due to the geographical condition of Indonesia, which consists of thousands of islands separated by oceans, rivers and lakes, allowing transportation to be carried out by land, sea and air to reach the territory of Indonesia. The increasing mobility of the population results in need for increased public transportation services.

Inter-city buses between provinces are one of the most popular forms of public transportation. Public interest in using buses is based on several factors, one of which is the relatively affordable price. This is based on the basic tariff, upper limit tariff and lower limit tariff¹. However, based on data from the National Transportation Safety Committee from 2007-2016, bus collisions were the most common type of accident at 65%². The most frequent area is Java Island, with the largest percentage in West Java. 29.7% of accidents with the type rolled over, and the remaining 4.7% burned². The National Transportation Accident Commission notes that fatigued drivers cause most road transport accidents. Fatigue is a natural mechanism of the body which indicates that the body needs rest time to recover the stamina and energy that has been used during work². Fatigue that arises in workers can cause a decrease in work efficiency and performance, as well as a weakening of physical strength and endurance so that the body cannot continue its work¹.

The monotonous work characteristics of bus drivers make it easy to make mistakes because the work is repetitive and has a low level of control⁴. Potential factors that contribute to increasing monotony among bus drivers are straight and long toll roads. Consequently, the driver has a high demand to always be alert or pay constant attention while driving. Based on observations, it was found that the average sleep time of bus drivers was about 4.5 hours, and most bus drivers...
consumed cigarettes and caffeine. A person who sleeps less than 5 hours a night or less than 6 hours for several nights will experience a decrease in performance in the ability to sustain attention\textsuperscript{23}. Sustained attention is the ability to focus on an activity or stimulus for a long period of time\textsuperscript{3}.

Related research was found by\textsuperscript{4}; the results showed that 5 out of 18 drivers had very high levels of sleepiness, with an average increase in the Karolinska Sleepiness Scale (KSS) questionnaire of 1.94 while driving in the afternoon. The level of alertness showed a significantly increased response time and blink duration, although not significantly. In addition, 12 out of 18 bus drivers have to struggle to stay awake\textsuperscript{4}.

This study develops research results from\textsuperscript{24}, which discusses the Fitness for Duty prediction model applied to the Batik Solo Trans driver, Surakarta. The study stated that the model’s results were quite good; 90.9% of the drivers could be declared fit. As much as 86.7% of drivers correctly predicted, the model’s accuracy in classifying observations is 86.7%. The adjusted $R^2$ value of the model is 68%, meaning that the factors can explain the driver’s Fitness for Duty in the model of 68%. The model’s ability to predict the observation value is 76% (high). However, this model is not suitable when applied to Batik Solo Trans (BST) bus drivers because the route traversed is not long enough, which means that the level of fatigue is not high. Therefore, the researchers tried to use this model on the Agra Mas bus driver.

P.O. Agra Mas is a bus company with a head office in Jakarta and branch offices in Karawang, Bogor and Wonogiri. P.O. Agra Mas serves routes between cities and provinces with destinations in Central Java, East Java and West Java. Therefore, it is important to consider the examination related to driver readiness to know whether or not each driver is fit before starting work. The object of this research is the intercity bus between the provinces of Agra Mas, which is following its vision of commitment to realizing Agra Mas’ mission to become a bus company with the best service. In addition, measurements related to fitness for duty in P.O. Agra Mas (autobus company) have never been carried out, even though the bus driver plays an important role in the safety of its passengers. Driver readiness checks are known as Fitness for Duty, namely the ability to carry out duties of each individual who will carry out the work concerning physical and mental health\textsuperscript{7}.

**METHODS**

This research begins with conducting field studies through interviews, observations, and literature studies to identify problems. This stage was carried out to determine the conditions in the field through observations and interviews with Mr. Susanto as the Head of the pool P.O. Agra Mas and the Agra Mas Bus driver. This field study was conducted to obtain direct and in-depth information related to the problems in this research. The questions asked include the schedule of buses that pass the Wonogiri - Klari Terminal route, determining the fit and unfit conditions of the bus driver, the number of buses that pass that route, and other supporting questions.

The population in this study were Agra Mas Bus Drivers on the Wonogiri - R.M. route. Kendil Mas and also Wonogiri - Klari Terminal. Respondents were selected by choosing drivers with at least one year of work experience. The drivers involved in this study were 30 male drivers, consisting of 4-morning-shift drivers, 21 afternoon-shift drivers, and 5 night-shift drivers. The average age of the driver is 41.8 years, height is 166.67 cm, and weight is 69.13 kg.

After conducting field studies and literature studies, the next step is to identify the formulation of the problem to find out how the condition of the driver, the level of fatigue, the level of sleepiness, and the level of alertness before and after work, whether there is a difference and testing the Fitness for Duty model to predict whether or not the bus driver is fit or not. P.O. Agra Mas has never regularly measured a driver’s readiness as a Fitness For Duty (FFD) determination. Measuring the readiness of P.O. drivers. Agra Mas is only an assessment of a physical test carried out by health workers. In this study, the assessment of driver readiness was carried out by screening physical measurements in the form of heart rate and blood pressure to determine whether the driver is fit or not and whether driver fatigue occurs after driving. Determination is not fit if the parameters are outside the normal limits with a normal pulse of 60-100 beats per minute.

The purpose of this study is to produce a predictive model for the fitness for duty of Agra Mas Bus drivers, to find out whether measuring tools such as QUASA, KSS, and VAS can be used to evaluate the fitness for duty, and to determine the relationship between internal factors (age, weight, height, sleep quality, sleep duration, caffeine consumption, cigarette consumption, and eye health) and external factors (shift work) with the level of sleepiness and fatigue on Agra Mas Bus drivers.

The questionnaire data obtained is processed using QUASA calculations and logistic regression. QUASA data is tested for validity and reliability. If the data is valid and reliable, situational awareness calibration is carried out to determine the driver’s level of alertness. Then do the calculation of signal detection theory, calculation of sensitivity and calculation of responses and biases. KSS and VAS questionnaire data were
processed using SPSS software with a logistic regression test. The initial stage of the logistic regression test is the normality test. If the data is normal, it can use the independent sample t-test and paired samples t-test. If the data is not normal, it can use the Mann-Whitney u-test and the Wilcoxon signed-rank test. After that, the QUASA, VAS and KSS questionnaires were tested for correlation and logistic regression, and the last stage was analysis.

Quantitative Analysis of Situational Awareness
The QUASA questionnaire is in the form of statements that must be answered “true” or “false” and the level of confidence used to see how confident the respondents are in answering the statements on the questionnaire. Questionnaires with “true” or “wrong” answers will be assessed against the actual answers so that it will be known whether the respondent’s answers are correct or incorrect (score 1 if the answer is correct and score 0 if the answer is incorrect). Determining the level of confidence using a multi-categorical ordinal rating consisting of 4 (four) levels, namely very high (100%), high (75%), moderate (50%), and low (25%). The step of the QUASA method is below9.

Validity Test
This validity test uses the reproducibility coefficient and scalability coefficient formulas. This validity test was carried out on a questionnaire with the Guttman Scale, with a score of 0 for wrong answers and 1 for correct answers10. The following is the formula for the reproducibility coefficient11.

\[ Kr = 1 - \left( \frac{c}{n} \right) \]  

(1)

The following is the formula for the scalability coefficient.

\[ Kr = 1 - \left( \frac{c}{n} \right) \]  

(2)

The requirement for acceptance of the reproducibility coefficient value is if the reproducibility coefficient has a value > 0.9012 and the scalability shows > 0.6013. This test was conducted to determine whether or not the measurement instruments, such as the QUASA questionnaire, were valid.

Reliability Test
In this reliability test, the researcher uses the Kuder Richardson 20 formula, for the details of the formula used are as follows14.

\[ KR - 20 = \left( \frac{n}{n-1} \right) \left( \frac{S^2 - Z_{pq}}{S^2} \right) \]  

(3)

Situational Awareness Calibration
The following is an equation that can be used to calculate the percentage on the calibration curve15.

Actual = \frac{\text{correct answer}}{\text{total score}} \times 100\%  

(4)

To determine the value of perceived accuracy:

Perceived = \frac{\text{confidence score total}}{\text{total score}} \times 100\%  

(5)

The following equation can be used to measure respondents’ awareness level is:

\[ \text{Alert level} = \frac{\text{perceived}}{\text{perfect score}} \times 100\% \]  

(6)

Signal Detection Theory
The following is an equation that can be used to calculate the probability in the contingency table.

\[ \text{Probabilitas hit rate} = \frac{\text{correct answer}}{\text{total correct answer} \times \text{total of respondent}} \]  

(7)

So,

\[ \text{Probabilitas miss rate} = 1 - \text{hit rate} \]  

(8)

The probability of a false alarm rate is an error that may occur or be made by the bus driver in answering the questionnaire that has been given. The probability value of the false alarm rate can be calculated using the following formula:

\[ \text{Probabilitas false alarm rate} = \frac{\text{false answer}}{\text{total wrong answer} \times \text{total of respondent}} \]  

(9)

So,

\[ \text{Correct rejection rate} = 1 - \text{false alarm} \]  

(10)

Sensitivity Calculation
The sensitivity value on the normal curve can identify how well a person can distinguish between signal and noise16. The following is an equation that can be used to calculate sensitivity:

\[ \text{Sensitivity} = \frac{Z(\text{Hit}) - Z(\text{False Alarm})}{Z(\text{Hit})} \]  

(11)

Calculation of Responses and Bias
This bias value will be obtained based on the difference between the neutral distance and the conditions the research subjects possessed17. The following is an equation that can be used to calculate responses and bias.

\[ \text{Responses}(k) = -Z(\text{false alarm}) \]  

with,

\[ \text{Bias} = k - \frac{d}{2} \]  

(12)

(13)

Normality Test
The normality test aims to determine the distribution of data in a group of data to determine whether the data is normally distributed or not. Based on the data obtained, the data are not normally distributed, so using the Mann-Whitney U test to determine whether there is a difference in the average VAS and KSS of the drivers between the three shifts and the Wilcoxon signed rank test to determine whether driving work affects changes in working conditions before and after working with the VAS and KSS questionnaires.

Regression Logistics
Logistic regression is a test to make predictive models such as linear regression, commonly referred to as Ordinary Least Squares (OLS) regression18. Generally, the dependent variable has been marked with the letter Y, while the independent variable was the letter X. Algebraic equation models such as OLS that we usually use are as follows19:

\[ Y = B_0 + B_1X + e \]  

(14)
Where $e$ is the error variance or residual model, the equation formed differs from the OLS equation. It does not use the same interpretation as the OLS regression equation with logistic regression. The following is the logistic regression equation:

$$\ln \left( \frac{p}{1-p} \right) = B_0 + B_1X$$  \hspace{1cm} (15)

Where:

- $\ln$: Natural Logarithm.
- $B_0 + B_1X$: Equation commonly known in OLS.

While $p$ accent is the logistic probability obtained by the logistic regression probability formula as follows:

$$p = \frac{\exp(B_0 + B_1X)}{1 + \exp(B_0 + B_1X)}$$  \hspace{1cm} (16)

Where:

- $\exp$ or written “$e$” is an exponential function. (The exponential is the opposite of the natural logarithm. In contrast, a natural logarithm is a logarithmic form with a constant value of 2.71828182845904 or usually rounded to 2.72).

Based on the equation model above, it will be very difficult to interpret the regression coefficient. So introduced Odds Ratio, commonly abbreviated as Exp (B) or OR. Exp (B) is the exponent of the regression coefficient. So, suppose the slope/gradient value of the regression is 0.90, then Exp (B) can be predicted/estimated as follows:

$$2.72^{0.9} = 2.226$$  \hspace{1cm} (17)

The value of Exp (B) can be interpreted as follows: For example, the Exp value (B) of the effect of fatigue on understanding the readiness of the bus driver’s office is 2.226. It can be concluded that bus drivers who experience fatigue are more guaranteed to measure the fitness for duty of bus drivers’ than bus drivers whose fatigue is not measured. Another difference is that there is no "R Square" value in logistic regression to measure the magnitude of the simultaneous effect of several independent variables on the dependent variable. In logistic regression, the term Pseudo R Square is known, namely the pseudo-R Square value, which is identical to R Square in OLS. If the OLS uses the F Anova test to measure the significance level and how well the equation model is formed, then the logistic regression uses the Chi-Square Value. The calculation of the Chi-Square value is based on the Maximum Likelihood calculation. This study has independent variables such as age, weight, height, sleep duration, sleep quality, cigarette consumption, caffeine consumption, eye health, attention, fatigue, drowsiness, and shift work. This test uses IBM-SPSS software.

**RESULTS**

The results from the study are the calculation of the QUASA score obtained by the level of alertness of the driver, the level of sensitivity and the level of response and bias. Then from the logistic regression test, the driver readiness model was obtained to predict whether the driver was declared fit or unfit.

**Quantitative Analysis of Situational Awareness**

The calculation results show that the reproducibility coefficient is 0.917, and the scalability coefficient is 0.71. These results indicate that the data is valid. Because the reproducibility coefficient shows > 0.90 and the scalability shows > 0.60. Then, based on the calculation results, the results of the KR-20 reliability test are 0.6955. Then it is included in reliable with sufficient criteria. The situational awareness calibration curve can be seen in figure 1.

![Calibration Curve](image1)

**Figure 1: Calibration Curve of Situational Awareness**

**Visual Analogue Scale**

The visual analog scale (VAS) is a psychometric response scale that can be used in questionnaires. VAS is a measuring tool for subjective characteristics or attitudes that cannot be measured directly. Respondents determined their level of agreement with the statement when responding to a VAS item by indicating the position along a continuous line between the two end point.
Table 1: Mann Whitney U-Test Result (VAS)

<table>
<thead>
<tr>
<th>Z</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.077</td>
<td>0.939</td>
</tr>
<tr>
<td>-0.503</td>
<td>0.615</td>
</tr>
<tr>
<td>-0.842</td>
<td>0.400</td>
</tr>
</tbody>
</table>

Table 2: Wilcoxon Signed Rank Test Result (VAS)

<table>
<thead>
<tr>
<th>Z</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1.826b</td>
<td>0.068</td>
</tr>
<tr>
<td>-4.050b</td>
<td>0.000</td>
</tr>
<tr>
<td>-2.032b</td>
<td>0.042</td>
</tr>
</tbody>
</table>

Karolinska Sleepiness Scale (KSS)
The purpose of this scale is to subjectively measure the level of sleepiness at certain times of the day. On this scale, the subject indicates which level best reflects the psycho-physical state experienced in the last 10 minutes. KSS is a measure of situational sleepiness that is sensitive to fluctuations. SSC measurements are carried out at a certain time with a predetermined time span.

Table 3: Mann Whitney U-Test Results (KSS)

<table>
<thead>
<tr>
<th>Z</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.536</td>
<td>0.592</td>
</tr>
<tr>
<td>-0.524</td>
<td>0.600</td>
</tr>
<tr>
<td>-0.344</td>
<td>0.731</td>
</tr>
</tbody>
</table>

Table 4: Wilcoxon Signed Rank Test Results (KSS)

<table>
<thead>
<tr>
<th>Z</th>
<th>Asymp. Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1.857b</td>
<td>0.063</td>
</tr>
<tr>
<td>-4.057b</td>
<td>0.000</td>
</tr>
<tr>
<td>-2.070b</td>
<td>0.038</td>
</tr>
</tbody>
</table>

Regression Logistics Results
The data used for logistic regression testing are the driver's fit condition, age, height, weight, sleep duration (in hours), sleep quality, cigarette consumption, caffeine consumption, eye health, work shift, QUASA value, VAS value, KSS value. The overall model fit test or the overall model test is to test the independent variables in the logistic regression simultaneously or simultaneously affecting the dependent variable. The overall model fit test is calculated from the difference in the value of -2LL between models consisting only of constants, and the estimated model consists of constants and independent variables.

Table 5: Omnibus Tests of Model Coefficient

<table>
<thead>
<tr>
<th>Chi-Square</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.359</td>
<td>12</td>
<td>0.105</td>
</tr>
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<td>12</td>
<td>0.105</td>
</tr>
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<td>12</td>
<td>0.105</td>
</tr>
</tbody>
</table>

Table 6: Variables in the Equation

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>S.E.</th>
<th>df.</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.168</td>
<td>0.109</td>
<td>1</td>
<td>0.123</td>
<td>0.845</td>
</tr>
<tr>
<td>Weight</td>
<td>0.157</td>
<td>0.151</td>
<td>1</td>
<td>0.300</td>
<td>1.170</td>
</tr>
<tr>
<td>Height</td>
<td>0.258</td>
<td>0.277</td>
<td>1</td>
<td>0.352</td>
<td>1.294</td>
</tr>
<tr>
<td>Sleep Duration</td>
<td>-1.441</td>
<td>5.807</td>
<td>1</td>
<td>0.804</td>
<td>0.237</td>
</tr>
<tr>
<td>Sleep Quality</td>
<td>1.526</td>
<td>6.377</td>
<td>1</td>
<td>0.811</td>
<td>4.601</td>
</tr>
<tr>
<td>Cigarette</td>
<td>0.460</td>
<td>2.670</td>
<td>1</td>
<td>0.863</td>
<td>1.584</td>
</tr>
<tr>
<td>Cons.</td>
<td>5.180</td>
<td>3.291</td>
<td>1</td>
<td>0.116</td>
<td>177.758</td>
</tr>
<tr>
<td>Caffeine Cons.</td>
<td>1.398</td>
<td>2.145</td>
<td>1</td>
<td>0.515</td>
<td>4.048</td>
</tr>
<tr>
<td>Eye Health</td>
<td>-0.409</td>
<td>2.445</td>
<td>1</td>
<td>0.867</td>
<td>0.664</td>
</tr>
<tr>
<td>Shift</td>
<td>-3.010</td>
<td>2.713</td>
<td>1</td>
<td>0.267</td>
<td>20.296</td>
</tr>
<tr>
<td>VAS Score</td>
<td>-4.104</td>
<td>2.302</td>
<td>1</td>
<td>0.075</td>
<td>60.594</td>
</tr>
<tr>
<td>KSS Score</td>
<td>-0.252</td>
<td>0.731</td>
<td>1</td>
<td>0.731</td>
<td>0.778</td>
</tr>
<tr>
<td>QUASA Score</td>
<td>-53.440</td>
<td>58.432</td>
<td>1</td>
<td>0.360</td>
<td>0.000</td>
</tr>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

Based on the curve of Figure 1, the actual accuracy value for the Agra Mas Bus driver is 91.67%, and the perceived accuracy is 80.12%. The driver of the Agra Mas Bus has lower-confident characteristics, which means that the driver lacks confidence in driving. The actual accuracy value is higher when compared to the perceived accuracy value; the difference in this value is 11.55%. The error value or deviation to the well-calibrated line is 11.55%. So based on this comparison, it can be judged that the Agra Mas Bus driver in driving a vehicle lacks confidence even though the reality of driving is good and appropriate.

Based on the calculations that have been carried out using equation (6), the level of vigilance of the Agra Mas Bus driver is 73.45%. It can be judged that the Agra Mas Bus driver knows and sufficiently applies the applicable traffic regulations. Signal Detection Theory provides the right language and graphical notation to analyze decision-making amid uncertainty. Based on calculations using equations 7-10, the hit rate probability value is 0.9194%, the miss rate probability is 0.0806, the false alarm rate probability is 0.91, and the correct rejection rate probability is 0.09.

The sensitivity displayed on the normal curve aims to identify how well a person can distinguish between signal and noise. It is known that the hit rate value is 0.92 and the false alarm rate is 0.91 with (α = 10%), so the sensitivity calculation can be calculated using equation (11) so that the result is 0.1. When placed on a normal curve with = 10%, the value of d’ is in the acceptance region. This means that Agra Mas bus drivers can distinguish between stimuli that should be responded to and those that should not.

Calculating responses using equation (12) and calculation of bias using equation (13) results in the value of k = -1.3 so that the value of C = -1.35.

When placed on the normal curve with = 10%, then the value of C is in the acceptance region. This means that Agra Mas Bus drivers can deal with ambiguous stimuli. Based on Table 1, the probability number for the fatigue level condition of the morning shift driver with the afternoon shift is 0.939, the probability number for the fatigue level condition of the morning shift driver with the night shift is 0.615, and the probability number for the fatigue level condition of the afternoon shift driver with the night shift is 0.4. Since all probability values are > 0.05, it can be concluded that the increase in the level of driver fatigue between the three shifts is not significantly different.

Based on Table 2, the probability value for the morning shift driver fatigue level is 0.068, for the afternoon shift is 0.000 and for the night shift is 0.042. For the morning shift, the probability value is more than 0.05, so H₀ is accepted, which means that work has no significant effect on increasing driver fatigue. While the day and night shifts are less than 0.05, H₀ is rejected or means the work significantly affects increasing driver fatigue. It can be concluded that work does not have a significant effect on increasing driver fatigue in the morning shift, while the day and night shift work significantly increases driver fatigue.

Based on the probability value, the probability number for the sleepy condition of the morning shift driver with the afternoon shift is 0.592. Because 0.592 > 0.05, then H₀ is accepted. The probability number for the sleepy condition of the morning shift driver with the night shift is 0.6. Because 0.6 > 0.05, then H₀ is accepted. The probability number for the sleepiness level of the day shift driver with the night shift is 0.731. Because 0.731 > 0.05, then H₀ is accepted. Based on these results, it can be concluded that the increase in the driver’s level of sleepiness between the three shifts is not significantly different.

Based on Table 4., the probability value for the morning shift driver fatigue level is 0.063, for the afternoon shift is 0.000, and for the night shift is 0.038. Because the value of the morning shift is more than 0.05, then H₀ is accepted or means that work has no significant effect on increasing driver sleepiness in the morning shift. The probability value of the day and night shifts is greater than 0.05. Then H₀ is rejected so that work has a significant effect on increasing driver sleepiness in a day and night shifts. It can be concluded that work has a significant effect on increasing driver sleepiness in the day and night shifts but not for the morning shift.

The predictive power of the regression model to predict the possible condition of a fit driver is 100% correct. This shows that by using the regression model, as many as 22 drivers (100%) are predicted to be in a fit condition out of 22 drivers who are declared FIT. The model’s predictive power on drivers who are not fit for work is 87.5% correct, which means that with the regression model used, there are as many as one drivers (87.5%) who are predicted to be a fit condition. It was concluded that the predictive power or accuracy of the model in classifying the observations was 96.7. Based on the results of the logistic regression test from Table 6, the regression equation obtained is as follows:

$$FDF = -53.440 - 0.168X1 + 0.157X2 + 0.258X3 - 1.441X4 + 1.526X5 + 0.460X6 + 5.180X7 + 1.398X8 - 0.409X9 + 3.01(X10) + 4.104X11 - 0.252X12$$

The results of this study impact the development of a fitness-for-duty model in Indonesia, especially for bus drivers, because there are only
a few related studies. Many studies have been conducted on fitness for duty for bus drivers. However, research related to fitness for duty for bus drivers has only been conducted by Suhardi 2022, but the buses studied and the variables and measurement tools used are different, so it is hoped that the results of this study will contribute to the development of research on fitness for duty in Indonesia.

The limitation of this study is the difficulty of controlling the variables. The weakness of the field study is that it is difficult to control variables that can cause the data distribution to widen. In contrast to research that uses a simulator where we can see the effect of the variables studied. In field study research, all situations can become new variables affecting research results. In addition, it is difficult to ask all bus drivers to work together to arrive earlier due to research. During the research, several drivers arrived close to duty time, so the tests were not optimal.

CONCLUSION

The driver's fitness for duty-level evaluation results is quite good. As much as 100% of the drivers can be declared ready to be seen from the model that has been made. A total of 96.7% of drivers were correctly predicted, meaning that the predictive power or accuracy of the model in classifying observations was 96.7%. The adjusted R² value of the model is only 66.67%. However, the model's ability to predict the observation value is 75.8% (high).

The Visual Analogue Scale (VAS) and the Karolinska Sleepiness Scale (KSS) can be used to evaluate the work readiness of the driver, while the Quantitative Analysis of Situational Awareness cannot be used in terms of validity and reliability.

Variables that have significant categories are the relationship between age and changes in VAS, weight with caffeine consumption, weight with shifts, height with sleep quality, cigarette consumption with alertness level (QUASA) and caffeine consumption with alertness level (QUASA). In contrast, the variables with a very significant category are the relationship between sleep duration and sleep quality, changes in VAS with FFD, and changes in KSS with FFD. In contrast, the variable that does not affect FFD is eye health.

The challenge for further research is the need to measure other variables that may further affect fitness for duty, such as eye movements and the need to pay attention to other variables that might keep the driver awake. In addition, in the future, testing can be carried out using Structural Equation Modeling (SEM) to find out the relationship between dimensions and between indicators in the model.

REFERENCES

1. Regulation of the Minister of Transportation of the Republic of Indonesia Number 74 of 2017 concerning the Implementation of Transportation of People With Public Motorized Vehicles Not On Routes


