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Analysis of Risk Factors for The Level of Work Fatigue in Trans Semarang Bus Rapid Transit (BRT) Drivers Using the Suggestive Aelf Rating Test (SSRT) Measurement Method

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ABSTRACT

Background: Work fatigue is one of the occupational health and safety problems that can be a risk factor for accidents at work. Fatigue can be caused by several risk factors including age, hypertension, BMI, work period, work duration, work pattern, and active smokers. The purpose of this study is the benefit to be achieved to know and understand some important factors to the cause of the level of fatigue in Bus Rapid Transit (BRT) Trans Semarang drivers. **Methods:** This study used a structured questionnaire and made observations of cross sectional research using quantitative methods. The population in the study was all Trans Semarang Bus Rapid Transit (BRT) drivers who amounted to a sample in this study amounted to 35 drivers, and the sampling technique used in this study was simple random sampling technique. Data processing techniques using data analysis techniques, namely the Spearman rank correlation test statistical test used for non-normally distributed data. **Results:** All variables do not have a significant relationship with driver fatigue, but positive variables that are still related in the same direction with the level of fatigue are age, BMI, work mass, and work duration. **Conclusion:** Based on the results of the research conducted, the level of job fatigue has a low level of job fatigue with 32 drivers (91.4%).

Keywords: Driver, BRT, Level Of Occupational Fatigue, IFRC

Introduction

Bus Rapid Transit (BRT) is a popular means of transportation in Indonesia due to its convenient, fast, safe, and timely bus transportation lines based on infrastructure, vehicles, and schedules. As well as Bus Rapid Transit (BRT) systems being the right choice for transportation, due to their value for money, service capacity, affordability, relative flexibility, and network coverage, Bus Rapid Transit (BRT) has become a popular mode of transit around the world, especially in Europe, South America, and Asia. The methods used to implement Bus Rapid Transit (BRT) can differ greatly between countries and cities across countries. Bus Rapid Transit (BRT) can be a cost-effective method of providing high-performance transportation services, according to many case studies (Huboyo et al., 2022)

The operation of Bus Rapid Transit (BRT) will help solve transportation problems. Trans Semarang Bus Rapid Transit (BRT) services and management are provided by the Trans Semarang Public Service Agency (BLU), which works with several bus operators (Hikmah, 2020b).

A driver must have the ability to take responsibility for the safety of himself, passengers, or the load being carried. Bus Rapid Transit (BRT) drivers must stay focused until they reach their destination with a long working time and a predetermined distance. Since driving is a monotonous activity, these conditions can cause fatigue. Because Bus Rapid Transit (BRT) is different from buses that operate on other roads, BRT has a special route with special passenger stop shelters with repetitive road routes and other provisions. As a result, Bus Rapid Transit (BRT) drivers have a major workload to perform. In addition, the main responsibility of Bus Rapid Transit (BRT) drivers is to deliver passengers safely and on time to their destination. The high demands of the Bus Rapid Transit (BRT) driver's job can interfere with the health of the Bus Rapid Transit (BRT) driver and cause fatigue (Hikmah, 2020a).

Based on the investigation results of the National Transportation Safety Committee (NTSC), there are several factors that influence road transportation traffic accidents, including human factors, facilities, infrastructure, fatigue and the environment. Fatigue can lead to a lack of awareness of what is happening on the road and a lack of ability to act safely and quickly in critical situations. Overall, the NTSC identified 57 contributing factors to Road Traffic and Transportation (LLAJ) accidents from 2018-2022, with human factors being the most dominant factor for 36 accidents from 2018-2022 (Komite Nasional Keselamatan Transportasi Republik Indonesia, 2022).

These problems not only provide additional burden but also musculoskeletal system disorders, subjective complaints and fatigue which result in reduced work productivity. The company is required to provide quality, safe, and fast services with a precise schedule with a predetermined time. Seeing working conditions like this will affect the level of worker comfort, so that it can increase workload, accelerate the appearance of fatigue and subjective complaints and can reduce work productivity. Significantly increased work fatigue can jeopardize worker safety, characterized by increased work errors, increasing the likelihood of work accidents. The implementation of the Occupational Health and Safety system (SMK3) is an effort to prevent or minimize the existence of

hazards and risks, such as diseases and accidents, as well as other losses that may occur (Quamilla & Tri Martiana, 2022).

By using the mental and subjective aspects of workload by measuring subjective feelings of fatigue, known as Subjective Feelings Of Fatique. This fatigue measurement method was created by the Intrenational Fatigue Research Committee (IFRC), also known as the Subjective Self Rating Test (SSRT). By providing a list of 30 questions that are divided into 3 categories, namely 10 questions about activity attenuation, 10 questions about motivation attenuation and 10 questions about physical fatigue description (Oktavia & Uslianti, 2021).

There are many variables that contribute to affecting fatigue in industry. The workplace environment can affect employee performance such as noise, hot weather, poor lighting, and vibration can disturb workers while working. If after a long time working in an uncomfortable environment, then over time it can cause fatigue. The purpose and benefit to be achieved is to know and understand some important factors towards the causes of work fatigue levels, such as age, hypertension, nutritional status/Body Mass Index (BMI), length of service, amount of time spent working, work patterns, and active smoking (Juliana et al., 2018).

Repetitive work is a major cause of fatigue. Nature has regulated work time and rest time. Humans have an instinct to work during the day when there is sun, which makes the environment bright, and at night when it is dark, it creates an instinct to rest. Daytime is known as the ergotropic phase, where human performance reaches its peak. In contrast, the night period is known as the trophotropic phase, where people rest to regain energy (Umyati, 2015).

Research Methodology

The study was conducted in August and September 2023 to Trans Semarang Bus Rapid Transit (BRT) drivers in corridors 3, 4, 7, 8. This study used a structured questionnaire and conducted cross-sectional research observations using quantitative methods. The object of this research is the fatigue level of Trans Semarang Bus Rapid Transit (BRT) drivers, while the subject of this research is Trans Semarang Bus Rapid Transit (BRT) drivers, where Bus Rapid Transit (BRT) drivers are used as respondents in this research. The list of Trans Semarang Bus Rapid Transit (BRT) pool names that became the population and the number of Bus Rapid Transit (BRT) drivers used as respondents in this study are as follows:

Table 1 Trans Semarang Bus Rapid Transit (BRT) pool list and number of Trans Semarang Bus Rapid Transit (BRT) drivers

No.	Koridor *Bus Rapid Transit* (BRT)	Number of Bus Rapid Transit (BRT) Drivers
1.	Koridor 3	16
2.	Koridor 4	26
3.	Koridor 7	17
4.	Koridor 8	15
	Total	**74**

Population with a total of 74 respondents, the sampling technique in this study is using simple random sampling technique is a technique of determining a random sample of all population respondents. This method is a sampling ensures that so that each individual can have the same opportunity to be taken as a sample. The instruments used in this study are as follows:

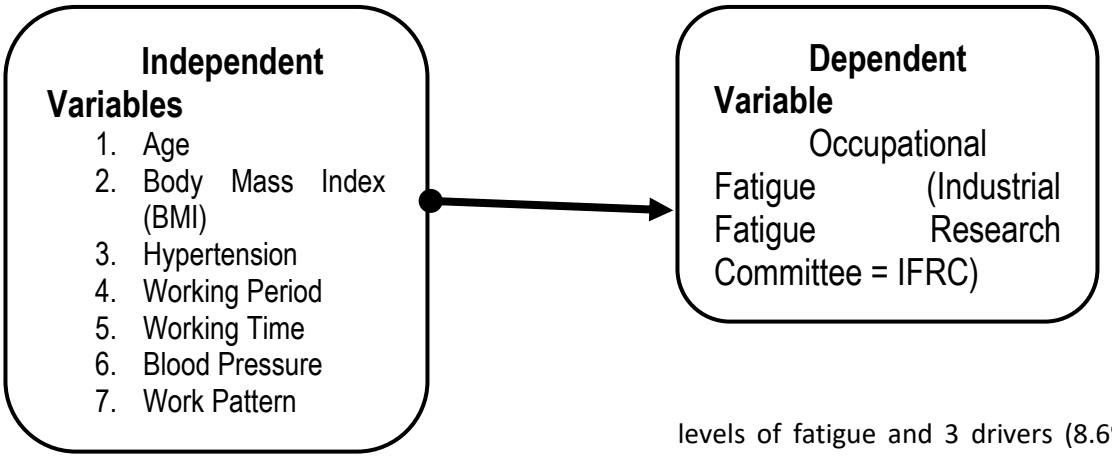
1. Digital Blood Pressure Monitor Arm Type KF-65A tensimeter tool
2. Han River Type F1006-1 digital weight scales
3. Height measuring device brand Stature Meter
4. The questionnaire was used to obtain data on the drivers and record the measurement results, which consisted of:

Measurement of work fatigue using the Subjective Self Rating Test from the Industrial Fatigue Research Committee (IFRC) with 30 questionnaires (10 questions about activity fatigue, 10 questions about motivation fatigue, and 10 questions about physical fatigue) was used to measure the fatigue level of Trans Semarang Bus Rapid Transit (BRT) drivers. Then for the answers of the IFRC questionnaire was divided into several categories, namely score 1 (never felt), score 2 (sometimes), score 3 (often), and score 4 (very often). The answers to each IFRC question were aggregated, then matched with a classification measuring subjective fatigue levels based on each individual's total score.

Table 2 Classification of Subjective Fatigue Levels Based on Individual Total Score

No.	Total Individual Score	Fatigue Classification	Corrective Action
1.	30-52	Low	No corrective action required
2.	53-75	Medium	May require future action
3.	67-98	High	Immediate action required
4.	99-120	Very High	Immediate comprehensive action required

Data analysis consists of univariate analysis that shows each variable, and bivariate analysis is a technique used to analyze how the independent variable and dependent variable interact with each other. The Spearman Rank correlation test is a statistical test used for non-normally distributed data, the relationship between the independent variable and the dependent variable is recognized if the p value <0.05. Then, the data that has been processed is presented in the form of text and tables using words that function as narratives. Description of Ethical Approval "Ethical Approval" No. 620/EA/KEPK/Fkes-UDINUS/VIII/2023 Faculty Of Health Dian Nuswantoro University.



Results and Discussion

The fatigue levels of Trans Semarang Bus Rapid Transit (BRT) drivers vary considerably, as shown in the data above. Table 1 shows that 32 drivers (91.4%) experienced low levels of fatigue and 3 drivers (8.6%) experienced moderate levels of fatigue. These categories still fall into the category of low levels of fatigue and have not reached high or dangerous levels of fatigue that could potentially lead to job burnout and health problems. Rest periods are usually

given to prevent fatigue, which leads to decreased physical and mental abilities and

decreased work efficiency. Rest periods are also used to give the body time to recover and make social contacts. This is due to the sufficient rest periods and flexible working hours used by drivers. However, Law No. 22 of 2009 stipulates that drivers are required to take a break of at least half an hour after driving a vehicle for 4 (four) consecutive hours if the official working and rest time has been appropriately arranged (work capacity = main workload + additional load). Thus, the number of stolen and spontaneous breaks can be reduced, because when drivers are more tired, they will take more stolen breaks (Tarwaka & Bakri, 2004).

Table 2 Frequency Distribution of Work Fatigue Levels in Trans Semarang Bus Rapid Transit (BRT) Stewards

Work Fatigue Category	Total Respondents	
	Frequency	**%**
Low	32	91,4
Medium	3	8,6
Total	**35**	**100**

As indicated above, this study focused on measuring the fatigue level of Trans Semarang Bus Rapid Transit (BRT) drivers as the analysis was conducted to determine if there was a relationship or correlation between the independent and dependent variables, both of which were taken observationally and at the same time (Aisy Rahmania, Ramadhan Gilar, Dian Afif Arifah, 2022).

Table 3 Frequency Distribution of Risk Factors for Occupational Fatigue Level in Trans Semarang Bus Rapid Transit (BRT) Drivers

Variable	Total Respondents	
	F	**%**
Age		
< 40 Years	14	40
≥ 40 Years	21	60
Hypertension		
Not Hypertensive	15	42,9
Hypertensive	20	57,1
BMI		
Normal	14	40
Excessive High	21	60
Period Of Employment		
≤ 3 Years	26	74,3

Variable	Total Respondents	
	F	%
> 3 Years	9	25,7
Working Time		
≤ 12 Hours	27	77,1
> 12 Hours	8	22,9
Work Pattern		
2 working days and 1 holiday	27	77,1
4 working days and 1 holiday	8	22,9
Active Smoker		
Yes	23	65,7
No	12	34,3

Table 3 shows that out of a total of 35 respondents, the age of the driver was ≥40 years old by 60%, who had hypertension by 57.1%, with the results of BMI Excessive Weight by 60%, the majority of the driver's tenure was ≤3 years by 74.3%, the average working time of the driver in 1 day was ≤12 hours by 77.1%, then the majority of work patterns are 2 days of work and 1 holiday by 77.1%, 65.7% of the drivers are active smokers, and all NBM results are 100% painless.

1. Age

Table 4 Age Variables with Work Fatigue of Trans Semarang Bus Rapid Transit (BRT) Drivers

		IFRC
Age	Significance	0,812
	Correlaction	0,042

Age is the amount of time a person has spent from the date of their birth to their last birthday at the time of the study. As the data collected in this study was not normally distributed, the mean value was used as the endpoint to categorize age.

Thus, there is no significant relationship of >0.05 = 0.812 between age and job fatigue of Trans Semarang Bus Rapid Transit (BRT) drivers. Furthermore, this value indicates that the strength of the relationship (variable) is very weak between age and fatigue of Trans Semarang Bus Rapid Transit (BRT) drivers is 0.042. The correlation coefficient in the results above is positive at 0.042 so that the relationship between the two variables is unidirectional.

Monotonous working conditions can cause fatigue. Repetitive or monotonous working conditions can cause employees to be tired, bored, and saturated. However, the workload felt by employees and environmental conditions such as a hot workplace can also cause fatigue. Older employees may also experience low-level fatigue due to their experience in the workplace.

2. Hypertension

Table 5 Hypertension Variables with Occupational Fatigue of Trans Semarang Bus Rapid Transit (BRT) Stewards

		IFRC
Hypertension	Significance	0,398
	Correlaction	-,147

Table 5 shows that there is no significant correlation of >0.05 = 0.398 between hypertension and fatigue of Trans Semarang Bus Rapid Transit (BRT) drivers. Furthermore, this value shows the level of strength of the relationship (variable) is very weak between hypertensive disease and fatigue of Bus Rapid Transit (BRT) Trans Semarang drivers is -.147. The correlation coefficient in the above results is negative at -.147 so that the relationship between the two variables is unidirectional.

It is seen that twenty Trans Semarang Bus Rapid Transit (BRT) drivers have hypertension. This hypertension can be caused by the drivers' working conditions that require them to sit in the vehicle for a long time or not doing enough physical activity, which can potentially cause health problems.

3. Body Mass Index

Table 6 Body Mass Index Variables with Work Fatigue of Trans Semarang Bus Rapid Transit (BRT) Stewards

		IFRC
BMI	Significance	0,812
	Correlaction	0,042

Table 6 shows that there is no significant relationship worth >0.05 = 0.812 between Body Mass Index (BMI) and work fatigue of Trans Semarang Bus Rapid Transit (BRT) drivers. Furthermore, this value shows the level of strength of the relationship (variable) is very weak between Body Mass Index (BMI) with fatigue of Bus Rapid Transit (BRT) Trans Semarang helmsmen is 0.042. The correlation coefficient in the above results is positive, namely 0.042 so that the relationship between the two variables is unidirectional.

A thin or fat body affects health and work efficiency. A normal body has a high immune system and a lower risk of disease, making it more productive. The results showed that the average body mass index of Trans Semarang Bus Rapid Transit (BRT) drivers is Excessive Body Mass Index (BB Excess), which indicates that the level of fatigue felt by drivers is not too worrying, which is mild.

4. Working Mass

Table 7 Work Mass Variables with Work Fatigue of Trans Semarang Bus Rapid Transit (BRT) Drivers

			IFRC
Working Mass	e	Significanc 1	0,76
	n	Correlactio 3	0,05

Table 7 shows there is no significant relationship worth >0.05 = 0.761 between work mass and fatigue of Trans Semarang Bus Rapid Transit (BRT) drivers. Furthermore, this value indicates the level of strength of the relationship (variable) is very weak between work mass and fatigue of Trans Semarang Bus Rapid Transit (BRT) drivers is 0.053. The correlation coefficient in the above results is positive at 0.053 so that the relationship between the two variables is unidirectional.

Employees with less than 3 years of service have a long time to adjust and adapt to

daily activities at work, with a tendency for 26 people to have less than 3 years of service and 9 people to have more than 3 years of service. There are also other factors that affect fatigue, such as monotonous work environment and individual factors.

5. Duration of Work

Table 8 Variables of Work Duration with Occupational Fatigue of Trans Semarang Bus Rapid Transit (BRT) Driver

		IFRC
Duration Of Work	Significance	0,812
	Correlaction	0,042

Table 8 shows that there is no significant relationship worth >0.05 = 0.812 between work duration and fatigue of Trans Semarang Bus Rapid Transit (BRT) drivers. Furthermore, this value shows the level of strength of the relationship (variable) is very weak between the duration of work with fatigue of Bus Rapid Transit (BRT) Trans Semarang driver is 0.042. The correlation coefficient in the above results is positive, namely 0.042 so that the relationship between the two variables is unidirectional.

In the daily work of Trans Semarang Bus Rapid Transit (BRT) drivers, they tend to work with a flexible system but on a timer to manage the time of each trip.

The duration of driving as stated in Article 90 of Law No. 22 of 2009 concerning LLAJ states that the maximum duration of driving is 8 hours a day for those drivers or workers who drive public transportation and goods. drivers are allowed to drive for 4 hours in a row after which they are required to rest for at least 30 minutes ("Undang-Undang Republik Indonesia Nomor 22 Tahun 2009 Tentang Lalu Lintas Dan Angkutan Jalan," 2009).

6. Work Pattern

Table 9 Work Pattern Variables with Work Fatigue of Trans Semarang Bus Rapid Transit (BRT) Drivers

			IFRC
Work Pattern	Significance		0,33
	Correlactio n	9	-,167

Table 9 shows that there is no significant relationship worth >0.05 = 0.339 between active smoking and fatigue of Bus Rapid Transit (BRT) Trans Semarang drivers. Furthermore, this value indicates that the strength of the relationship (variable) is very weak between active smoking and fatigue of Trans Semarang Bus Rapid Transit (BRT) drivers is -.167. The correlation coefficient in the above results is negative at -.167 so that the relationship between the two variables is unidirectional.

Because the average work pattern used by Trans Semarang Bus Rapid Transit (BRT) drivers is 2 working days and 1 day off, it helps reduce fatigue while working because there is a break for them to get enough rest.

7. Active Smoker

Table 10 Active Smoking Variables with Work Fatigue of Trans Semarang Bus Rapid Transit (BRT) Drivers

		IFRC
Active Smoker	Significance	0,202
	Correlaction	-,221

Table 10 shows that there is no significant correlation of >0.05 = 0.202 between active

smoking and work fatigue of Trans Semarang Bus Rapid Transit (BRT) drivers. Furthermore, this value indicates the strength of the relationship (variable) is very weak between active smoking and fatigue of Bus Rapid Transit (BRT) Trans Semarang drivers. Is -.221. The correlation coefficient in the above results is negative, namely -.221 so that the relationship between the two variables is unidirectional.

According to this study, the majority of Trans Semarang Bus Rapid Transit (BRT) drivers are active smokers, but do not smoke while driving the Trans Semarang Bus Rapid Transit (BRT). However, smoking is the habit of smoking cigarettes repeatedly, starting from one cigarette or more in one day (Savitri Camelia, Denny Ardiyanto, 2020).

Smoking reduces the amount of oxygen in the bloodstream and lungs. Cigarette smoke also displaces oxygen in the body, which can cause fatigue. However, the Trans Semarang Bus Rapid Transit (BRT) drivers obey the company's rules and SOPs not to smoke while driving the bus so as to minimize their feeling of fatigue while working even though they are active smokers.

Conflicts of interest in this context may relate to the high work demands on BRT drivers, including getting passengers to their destinations safely and on time. These activities can be monotonous and potentially lead to fatigue.

Recognition of these results is important to raise awareness about drivers' working conditions and their potential impact on their and passengers' safety. It can also assist in formulating strategies to reduce driver fatigue levels and improve the operational efficiency of Trans Semarang Bus Rapid Transit (BRT).

Conclusion

The results show that Trans Semarang Bus Rapid Transit (BRT) drivers experience low-level fatigue with 91.4%. While driving, drivers showed symptoms of fatigue, such as facial pallor, yawning, and thirst. In addition, they showed symptoms such as eye fatigue, drowsiness, and headaches with no clear cause.

This study shows that there is a positive correlation between age, BMI, work mass, and work duration, based on the Spearman rank correlation test.

Based on the above conclusions, this study can suggest to routinely maintain the health of the driver's body in order to avoid hypertension and maintain a diet so as not to experience excess weight which can cause fatigue while working.

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