

Work Environment and Fatigue Factors on Public Transportation Driver Productivity: A Cross-Sectional Study in Padangsidempuan City

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ARTICLE INFO	ABSTRACT
<p>Manuscript Received: 12 Oct, 2024 Revised: 27 Nov, 2024 Accepted: 17 Dec, 2024 Date of Publication: 27 Dec, 2024 Volume: 14 Issue: 2 DOI: 10.56338/promotif.v14i2.6604</p>	<p>Background: Public transportation plays a vital role in supporting community mobility in Padangsidempuan City, one of the cities located in North Sumatera Province. As a city with a relatively high urbanization rate and growing population density, the need for efficient public transportation is becoming increasingly urgent. Public transportation supports daily transportation needs and facilitates the community's economic, educational, and social activities. To analyze the factors of work environment and fatigue on the productivity of public transportation drivers in the city of Padangsidempuan.</p> <p>Methods: This study is an observational study with a cross-sectional study design. The population and sample consisted of 145 city transportation public transportation drivers. The sampling technique used is total sampling (exhaustive sampling), and data analysis is carried out using chi-square tests and logistic regression.</p> <p>Results: The study showed that vehicle condition ($p=0.001$), road condition ($p=0.001$), noise level ($p=0.001$), and fatigue ($p=0.001$) were related to the productivity of public transportation drivers. At the same time, the most related variable is Exp. (B)= 29,649 road conditions.</p> <p>Conclusion: This study concludes that work environment factors, such as noise, road conditions, and fatigue, have a significant effect on the productivity of public transportation drivers in Padangsidempuan City. Improving road conditions, managing noise, and reducing fatigue can increase driver productivity.</p>
<p>KEYWORDS</p> <p>Vehicle Condition; Road Condition; Noise Level; Fatigue; Public Transport Driver Productivity</p>	

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INTRODUCTION

Public transportation plays a significant role in supporting community mobility in the city of Padangsidempuan, one of the cities located in North Sumatera Province (1). As a city with a relatively high urbanization rate and growing population density, efficient public transportation is becoming increasingly urgent (2). Public transportation not only supports daily transportation needs, but also facilitates the community's economic, educational, and social activities (3–5). Therefore, ensuring the smooth operation of public transportation is very important for the development of this city (6). As the main actors in carrying out transportation operations, public transportation drivers play a crucial role in maintaining the smooth and efficient transportation process. They are responsible for getting passengers to their destinations safely and on time (7,8). However, the tasks carried out by the driver are not light. They have to face

various challenges in daily work, such as congestion, bad weather, and interaction with passengers. Unfavorable working environment conditions and high levels of fatigue can affect drivers' performance and reduce their productivity (9).

A comfortable and safe work environment is a significant factor that can affect the quality of work of a public transportation driver (10,11). Good and usable vehicle condition is one of the important elements in creating a conducive work environment. A well-maintained vehicle with adequate safety features provides a sense of comfort for the driver when carrying out his duties. Additionally, a work environment supported by adequate facilities, such as comfortable rest areas and access to healthcare facilities, can improve drivers' well-being and positively impact their productivity (12). Not only the vehicle's physical condition but also social factors in the work environment greatly influence driver productivity. Good interpersonal relationships between drivers and co-workers and positive interactions with passengers can create a harmonious and pleasant working atmosphere (10,11,13,14).

Conversely, conflicts or tensions between drivers or passengers can add to the driver's psychological burden, potentially reducing morale and performance. Therefore, a supportive social environment is essential to create high motivation and morale for public transport drivers (15). On the other hand, fatigue is one of the main factors that can reduce the productivity of public transportation drivers. Fatigue can be both physical and mental, and is often caused by long working hours, lack of rest time, or pressure to get work done. Drivers who work without enough time to rest tend to experience a decrease in concentration, which can jeopardize safety on the road. Fatigue can also reduce work efficiency, as drivers become slower in making decisions, and their reactions become slower when dealing with emergencies on the road (16).

A decrease in concentration caused by fatigue can increase the risk of traffic accidents, which endangers not only the driver but also passengers and other road users. Fatigue also risks lowering drivers' job satisfaction, which can impact their productivity. Physical fatigue experienced after working for a long time without enough rest will affect the driver's stamina, while mental fatigue due to work pressure can reduce the quality of their interaction with passengers (17). This study aims to identify the extent to which work environment factors and fatigue affect the productivity of public transportation drivers in Padangsidempuan City. In this study, the work environment in question covers various aspects, ranging from the vehicle's physical condition to the workplace's social aspects. Meanwhile, fatigue will be analysed in terms of drivers' workload, work duration, and rest time. By analysing these two factors, it is hoped that insight can be obtained on how the two affect drivers' productivity in carrying out their duties.

With a deeper understanding of the relationship between work environment, fatigue, and productivity, it is hoped that valuable recommendations can be found to improve the working conditions of public transportation drivers in Padangsidempuan City. Improved working conditions and effective fatigue management will positively impact driver productivity, which in turn can improve the quality of public transport services in the city. In addition, increasing driver productivity is also expected to reduce the risk of accidents, thereby creating a safer and more comfortable transportation environment for all road users.

METHOD

This study uses an observational approach with a cross-sectional study design to evaluate the influence between dependent and independent variables observed in the same time period. This research will be conducted in Padangsidempuan City from October to November 2024. The population in this study is all city transportation drivers in Padangsidempuan City, which will number 145 people in 2024. The sample used in this study is all city transportation drivers in Padangsidempuan City, with sampling using the total sampling technique. The instruments used in this study include questionnaires (list of questions), observation forms, and various other forms related to data recording. For data analysis, chi-square test and logistic regression are used.

RESULTS

This research will be carried out for 53 days, from October 3 to November 25, 2024. The data obtained will be processed and analyzed following the research objectives. The results of the data analysis will be presented in the form of a table equipped with the following explanations:

Table 1. Distribution of Public Transportation Driver Characteristics in Padangsidempuan City

Driver Characteristics	n	Percentage
Age Group (Years)		
15-20	4	2,8
21-26	8	5,5
27-32	10	6,9
33-38	50	34,5
39-44	14	9,7
45-50	31	21,4
51-56	24	16,6
57-62	4	2,8
Sum	145	100
Education Level		
Primary school	8	5,5
Junior High School	78	53,8
High School/Equivalent	58	40,0
Higher Education	1	0,7
Sum	145	100
Vehicle Condition		
Bad Conditions	98	67,6
Good Condition	47	32,4
Sum	145	100
Road Condition		
Bad	75	51,7
Good	70	48,3
Sum	145	100
Noise Level		
Tall	89	61,4
Low	56	38,6
Sum	145	100
Fatigue		
Tall	86	59,3
Low	59	40,7
Sum	145	100
Public Transportation Driver Productivity		
Low	93	64,1
Tall	52	35,9
Sum	145	100

Source: Primary Data

Table 1 shows that of the 145 public transportation drivers who have the highest age group of 33 – 38 years old, the highest level of junior high school education is 53.8%, vehicle condition is 67.6%, road condition is 51.7%, the highest noise level is 61.4%, fatigue is the highest is 59.3% and which states that the productivity of public transportation drivers is high as 64.1%.

Table 2. Relationship between vehicle condition, road condition, noise level, and fatigue to the productivity of public transport drivers

Vehicle Condition	Public Transportation Driver Productivity				Sum	X ² (p)
	Low		Tall			
	n	Per cent	n	Per cent		
Bad Conditions	80	81,6	18	18,4	98	40.231 0,001
Good Condition	13	27,7	34	72,3	47	
Sum	93	64,1	52	35,9	145	
Road Condition						
Bad	73	97,3	2	2,7	75	74.428 0,001
Good	20	28,6	50	71,4	70	
Sum	93	64,1	52	35,9	145	
Noise Level						
Tall	74	83,1	15	16,9	89	36.199 0,001
Low	19	33,9	37	66,1	56	
Sum	93	64,1	52	35,9	145	
Fatigue						
Tall	78	90,7	8	9,3	86	64.820 0,001
Low	15	25,4	44	74,6	59	
Sum	93	64,1	52	35,9	145	

Source: Primary Data

Table 2 shows that of the 98 public transportation drivers who stated that the condition of vehicles in poor condition was low, the productivity of public transportation drivers was 81.6%. Meanwhile, of the 47 public transportation drivers, there were poor vehicle conditions, and some experienced low productivity, as much as 27.7%. The results of statistical analysis were obtained that the value of X² was calculated (40,231) > X² table (3,841) or the value of p (0.001) < α (0.05). This means that the vehicle's condition is related to the productivity of public transportation drivers. Of the 75 public transportation drivers who stated that the road condition was low, 97.3%. Meanwhile, of the 70 public transportation drivers, road conditions were low, and productivity was 28.6%. The results of statistical analysis were obtained that the value of X² was calculated (74,428) > X² table (3.841) or the value of p (0.001) < α (0.05). This means that road conditions are related to the productivity of public transportation drivers. Of the 89 public transportation drivers who stated that the noise level to the productivity of public transportation drivers was low, 83.1%. Meanwhile, of the 56 public transportation drivers who stated that the noise level was low, the productivity of public transportation drivers was 33.9%. The results of statistical analysis were obtained that the value of X² was calculated (36.199) > X² table (3.841) or the value of p (0.001) < α (0.05). This means that the noise level is related to the productivity of public transportation drivers. Of the 86 public transportation drivers who stated fatigue, there was a low productivity of 90.7%. Meanwhile, of the 59 public transportation drivers, low fatigue experienced the productivity of public transportation drivers by as much as 25.4%. The results of statistical analysis were obtained that the value of X² was calculated (43.191) > X² table (3.841) or the value of p (0.001) < α (0.05). This means that fatigue is related to the productivity of public transportation drivers.

Table 3. Multivariate Analysis of Work Environment and Fatigue Factors on Public Transportation Driver Productivity in Padangsidempuan City

Variable	B	S.E	Sig	Exp (B)	95% C for EXP (B)	
					Lower	Upper
Vehicle Condition	0,190	0,617	0,759	1.209	0,361	4.053
Kondisi Jalan	3.389	0,894	0,000	29.649	5.139	171.053
Noise Level	-.019	0,666	0,977	0,981	0,266	3.620
Fatigue	1.771	0,639	0,006	5.877	1.679	20.575
Constant	-9.188	1.565	0,000	0,000		

Source: Primary Data

Table 3 shows that vehicle condition (p-value = 0.759), road condition (p-value = 0.000), noise level (p-value = 0.977), and fatigue (p-value = 0.006) are related to the productivity of public vehicle drivers. Of the four variables, the most related variable to the productivity of public vehicle drivers is the variable of road condition Exp (B) = 29.649.

DISCUSSION

The Effect of Vehicle Condition on Public Transportation Driver Productivity

Vehicle conditions significantly influence the productivity of public transportation drivers in Padangsidempuan City. Vehicles that are in good condition, with regular maintenance and maintained operational feasibility, can improve drivers' comfort and work efficiency. Clean, comfortable, and free from technical issues allow drivers to work more focused, reduce distractions that can reduce concentration, and speed up transportation (18). Conversely, frequently damaged vehicles or vehicles that are less comfortable to use will add to the driver's physical and mental workload, increase fatigue, and extend the time needed to complete the travel route. This will undoubtedly hurt their productivity in transporting passengers. In addition, poorly maintained vehicles can worsen the driver's physical condition (19–22). For example, drivers may experience discomfort such as back pain or injuries due to unergonomic sitting positions or wobbly vehicle conditions. Poor vehicle conditions also have the potential to cause delays in transporting passengers, which can reduce efficiency and service quality. Therefore, it is important for transportation companies to ensure that the vehicles used by drivers are in excellent condition to improve driver comfort and overall productivity in public transportation services in the city of Padangsidempuan (23).

The results of this study show that of the 98 public transportation drivers who stated that the condition of vehicles in poor condition was low, the productivity of public transportation drivers was 81.6%. Meanwhile, of the 47 public transportation drivers, there were poor vehicle conditions, and some experienced low productivity, as much as 27.7%. The results of statistical analysis were obtained that the value of X^2 was calculated $(40,231) > X^2$ table $(3,841)$ or the value of $p(0.001) < \alpha(0.05)$. This means that the vehicle's condition is related to the productivity of public transportation drivers. This study aligns with research (24) of Fisher exact statistical testing; a p-value of 0.049 was obtained with a CI of 95% = 1,004-5,006. These results show a relationship between Bus Airworthiness and safe driving behaviour in Bus Drivers at the Tirtonadi Terminal. The Odd Ratio (OR) value of 2,242 means that roadworthy buses have a chance of 2,242 times with safe driving behaviour compared to those that are not roadworthy.

The Effect of Road Conditions on Public Transportation Driver Productivity

This study shows that road conditions in Padangsidempuan City significantly influence public transportation drivers' productivity. Poor roads, with many potholes, bumpy surfaces, and lack of maintenance, cause drivers to drive more carefully and slow down the vehicle, so the travel time increases. This reduces the number of passengers transported daily, lowering the driver's income (25). In addition, poor road conditions also increase the risk of vehicle damage, which requires drivers to spend more on maintenance costs and time for repairs. All of these factors directly reduce public transit drivers' productivity, as they cannot work efficiently and optimize their time and resources. This result is in line with previous research, which shows that poor road conditions can worsen the performance of public

transportation drivers, both in terms of travel time, operational costs, and driver comfort. On the contrary, good and well-maintained road conditions allow drivers to run their vehicles smoothly, reduce fatigue, and improve transportation efficiency, ultimately contributing to increased productivity (26).

Of the 75 public transportation drivers who stated that the road condition was low, 97.3%. Meanwhile, of the 70 public transportation drivers, road conditions were low, and productivity was 28.6%. The results of statistical analysis were obtained that the value of X^2 was calculated $(74,428) > X^2$ table (3.841) or the value of $p(0.001) < \alpha(0.05)$. This means that road conditions are related to the productivity of public transportation drivers. This study's results align with the research: (1) Of the 52 drivers who stated that the effects/conditions of the environment were terrible, 96.3% did not apply K3. Meanwhile, of the 75 drivers who stated that the environmental effect/condition was good, 89.3% did not apply K3. The results of the statistical analysis were obtained in that the value of X^2 was calculated $(1.969) < X^2$ table (3.841) or the value of $p(0.161) > \alpha(0.05)$. This means that the effect/environmental condition of the driver does not affect the implementation of K3.

Effect of Noise Level on Public Transportation Driver Productivity

Research on the effect of noise levels on the productivity of public transportation drivers in Padangsidempuan City shows that high noise levels can hurt driver performance. Drivers who work in areas with high noise levels, such as around markets, congested intersections, or industrial areas, have difficulty maintaining concentration while driving. Excessive noise interferes with drivers' focus, increases stress, and accelerates fatigue, ultimately reducing productivity. This noise interference can cause drivers to work more slowly and suboptimally, impacting the number of passengers transported and longer travel times. In addition, high noise levels can also affect the driver's long-term health, such as hearing loss and sleep impairment, which further decreases the quality and effectiveness of their work (27). This study's results align with previous studies that show that traffic noise or other noises are directly related to increased stress in workers who drive, thereby reducing their productivity. In contrast, in areas with lower noise levels, drivers can work more quietly and focus, which supports time efficiency and passenger transport(28). Therefore, noise management in areas frequented by public transportation can be important in increasing driver productivity and traffic safety in Padangsidempuan City.

Based on research results from 56 public transportation drivers who stated that the noise level was low, the productivity of public transportation drivers was 33.9%. The results of statistical analysis were obtained that the value of X^2 was calculated $(36.199) > X^2$ table (3.841) or the value of $p(0.001) < \alpha(0.05)$. This means that the noise level is related to the productivity of public transportation drivers. In line with the study (29) based on statistical tests, it was found that there was a significant relationship between noise and work fatigue where the Sig. The value was 0.010, and therefore the p -value < 0.05 . From the data, it is known that the noise value of the work environment of Bimbar public transportation drivers is considered abnormal because it is above the noise limit, so the exposure received by workers is relatively abnormal. As mentioned in Kepmenaker No.51 of 1999, the higher the noise, the less time there is in the workplace. KEP/51/MEN/1999 explains that the noise NAV is 85 dB for 8 hours/day and 40 hours/week. From the research results and the noise measurement above, the noise exposure received by Bimbar public transportation drivers and the length of working hours does not follow the working hours that the Ministry of Agriculture has set. The working time for Bimabar public transportation drivers is erratic, and almost all Bimbar drivers work beyond the normal limit of working hours, which is 8 hours per day.

The Effect of Fatigue on Public Transportation Driver Productivity

Fatigue can significantly impact the productivity of public transportation drivers in the city of Padangsidempuan. Based on the study's findings, drivers who experience physical and mental fatigue due to long working hours, lack of rest time, or work pressure tend to show a decrease in the quality of their performance. Physical fatigue can reduce the driver's ability to concentrate, increase the risk of driving errors, and reduce punctuality in transporting passengers (30). Additionally, drivers who experience burnout tend to have lower productivity levels in terms of the number of passengers transported and the time it takes to complete their routes. Decreased concentration and stamina can affect the driver's ability to manage time efficiently, resulting in delays in completing the trip. Fatigue can also affect the quality of social relationships in the workplace, as tired drivers tend to be more prone to conflict or less friendly in interacting with co-workers or passengers (31).

The results of a study of 86 public transportation drivers who stated that fatigue was low experienced 90.7% productivity of public transportation drivers. Meanwhile, of the 59 public transportation drivers, low fatigue experienced the productivity of public transportation drivers by as much as 25.4%. The results of statistical analysis were obtained that the value of X^2 was calculated (43.191) $> X^2$ table (3.841) or the value of p (0.001) $< \alpha$ (0.05). This means that fatigue is related to the productivity of public transportation drivers. The results of this study are in line with the results of probability 0.000 (p -value = 0.000 < 0.05), showing that the strength of the relationship between work fatigue and work stress is Medium and the direction of correlation shows a positive direction; this means that the lighter the work fatigue experienced by the respondents, the less stress will be. One of the risks of work fatigue is the onset of stress due to work; fatigue in humans is a process that accumulates from various factors that cause and bring tension to the human body (32). The study's results (32) showed that most respondents experienced mild fatigue, 61.5%; moderate work fatigue, 32.3%; and regular work fatigue, as much as 6.2%. This study shows that most respondents experience mild work fatigue. This is because most of the work as a driver is done in a sitting position. The sitting position can prevent the driver from doing much physical activity. This lack of physical activity prevents most drivers from feeling heavy fatigue.

Limitations and Cautions

This study has several limitations: a cross-sectional design that only describes conditions at one time, a sample limited to drivers in Padangsidempuan City, and a focus on certain work environment factors such as noise and road conditions. In addition, the assessment of fatigue is subjective, and the possibility of measurement errors or other uncontrolled factors can affect the validity of the results.

CONCLUSION

The results of this study show that work environment and fatigue factors have a role in productivity, especially in the productivity efforts of public transportation drivers. Therefore, adequate attention and support are needed to ensure drivers can carry out their duties optimally. This support includes vehicle conditions, road conditions, noise levels and fatigue so public transportation drivers' productivity can be more guaranteed.

CONFLICTS OF INTEREST

No Conflicts of Interest.

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