



Analysis of Subjective Fatigue Among Urban Transportation Drivers in Tataaran, North Sulawesi, Indonesia

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ABSTRACT / ABSTRAK

This study examines subjective fatigue among urban transportation drivers in Tataaran, Minahasa Regency, North Sulawesi where the occupation exposes individuals to stressors that can induce fatigue. The research aims to analyze the levels of subjective fatigue and identify contributing factors. A cross-sectional study was conducted from August to November 2024, involving 43 drivers. Data was collected using a structured questionnaire, including the Fatigue Severity Scale (FSS), to assess socio-demographic, work-related, and vehicle-related factors. The results indicate that increased age, daily work duration, irregular working hours, heavy driving workload, and uncomfortable vehicle ergonomics are significantly associated with higher subjective fatigue levels ($p < 0.05$). Conversely, greater driving experience is significantly associated with lower subjective fatigue ($p < 0.05$), while rest patterns and deposit targets showed no significant relationship with fatigue. In conclusion, urban transportation drivers in Tataaran experience significant subjective fatigue, influenced by a combination of occupational and individual factors.

INTRODUCTION

Subjective fatigue represents a prevalent concern among occupational groups, and urban transportation drivers are particularly vulnerable to its effects (Che Hasan et al., 2022). Subjective fatigue refers to an individual's personal experience or perception of tiredness, lack of energy, or exhaustion, which is not directly measurable by external tools or physiological indicators (Kluger et al., 2013). The driving profession, especially within the demanding context of urban environments like Tataaran, exposes individuals to a confluence of stressors that can precipitate fatigue. The monotonous yet attention-intensive nature of driving, coupled with heavy traffic congestion, irregular work schedules, and continuous interaction with passengers, collectively contributes to both physical and mental strain, thereby elevating the risk of subjective fatigue (Phillips, 2014).

Subjective fatigue, while experienced internally, exerts significant influence over driver performance and safety. Research has consistently demonstrated that fatigue impairs reaction time, diminishes decision-making capabilities, and reduces overall vigilance (Wingelaar-Jagt et al., 2021). These impairments not only jeopardize the well-being of drivers but also

substantially increase the likelihood of traffic accidents involving passengers and other road users (Rolison et al., 2018).

In Indonesia, the urban transportation sector plays a crucial role in facilitating population mobility and economic activity. However, the working conditions of drivers often receive inadequate attention. Extended work hours, pressure to meet revenue targets, and suboptimal infrastructure and vehicle conditions can exacerbate the risk of fatigue within this workforce (Cunningham et al., 2022). Data from Badan Pusat Statistik (BPS) indicates that the transportation and warehousing sector exhibits some of the highest average weekly working hours in Indonesia, highlighting the potential for significant fatigue-related risks among its employees (BPS, 2023).

Tataaran, a suburb with significant city transportation activity located in Minahasa Regency, North Sulawesi, currently lacks in-depth research on the prevalence and contributing factors of subjective fatigue among transportation drivers. Gaining a thorough understanding of this issue is essential for designing effective interventions and preventive that support driver well-being, enhance job performance, and ensure transportation safety. Although subjective fatigue is widely acknowledged as a critical occupational health issue, most existing studies focus on drivers in major metropolitan or intercity transport settings. This has led to a notable research gap concerning smaller suburb like Tataaran, which may present distinct environmental, infrastructural, and socio-economic conditions influencing fatigue. Moreover, while international studies have explored the effects of fatigue on driver performance, limited research has addressed its contributing factors within the Indonesian context, particularly in under-studied regions such as North Sulawesi. This study seeks to address this gap by assessing the levels and influencing factors of subjective fatigue among city transportation drivers in Tataaran. The findings are expected to provide meaningful scientific and practical insights to inform policies aimed at improving working conditions and transport safety in similar suburb settings.

METHODS

This research employed a cross-sectional study design. A cross-sectional study allows for the examination of the relationship between variables at a single point in time. The study was conducted within the urban area of Tataaran. Data collection took place over a period from August to November 2024. The population for this study comprised all city transportation drivers operating in Tataaran. Based on initial estimations, the total population size was 48 drivers. During the research of the study, 3 drivers were excluded from the population as they were no longer working as drivers and 2 could not be located. Therefore, the total population sampled was 43 drivers. Due to the manageable size of the population, all 43 drivers were included in the study. Therefore, this study employed a total population sampling approach.

Data for this study was collected using a structured questionnaire. The questionnaire consisted of several sections designed to gather information on Socio-demographic characteristics of the drivers, Work-related factors, Vehicle-related factors. Subjective fatigue levels, measured using Fatigue Severity Scale (FSS), a standardized and validated instrument (Physiopedia, 2022).

RESULTS

Tabel 1. Frequency Distribution of Respondents by Age, Daily Work Duration, Rest Pattern, Working Hours, Driving Work Load, Deposite Target, Vehicle Ergonomics and Subjective Fatigue

Variable	<i>n</i>	%
Age		
Early Adult	11	25.6
Middle Adult	17	39.5
Late Adult	15	34.9
Daily Work Duration		
Short	2	4.7
Medium	37	86
Long	4	9.3
Rest Pattern		
< 30 Minutes	0	0
30-60 Minutes	20	46.5
> 60 Minutes	23	53.5
Working Hours		
Regular	14	32.6
Irregular	29	67.4
Driving Work Load		
Light	15	34.9
Moderate	21	48.8
Heavy	7	16.3
Deposite Target		
Existing	9	20.9
None	34	79.1
Vehicle Ergonomics		
Uncomfortable	11	25.6
Moderately Comfortable	32	74.6
Comfortable	0	0
Subjective Fatigue		
Low	0	0
Medium	17	39.5
Hight	26	60.5

Source: Primary Data, 2024

Table 1, summarizes data from 43 respondents. The majority of respondents were in middle adulthood (39.5%) and worked moderate hours (86%) but irregular hours (67.4%). Most had adequate rest periods (>30 minutes) and perceived a moderate driving workload (48.8%). Furthermore, the majority of respondents did not have a target deposit (79.1%) and rated their vehicle ergonomics as comfortable (74.6%). Interestingly, most respondents reported high levels of subjective fatigue (60.5%).

The results of the Spearman Rank correlation test in Table 2, showed several significant relationships between the independent variables and subjective fatigue at the 95% confidence level. Age ($\rho=0.327$, $p=0.032$), daily work duration ($\rho=0.357$, $p=0.019$), irregular working hours ($\rho=0.352$, $p=0.021$), heavy driving workload ($\rho=0.394$, $p=0.009$), and uncomfortable vehicle

ergonomics ($\rho=0.398$, $p=0.008$) were significantly positively correlated with subjective fatigue levels. This indicates that the higher the values on these variables, the higher the level of fatigue perceived by the respondents. In contrast, longer driving experience ($\rho=-0.339$, $p=0.026$) showed a significant negative correlation with subjective fatigue, implying that more experienced drivers tend to report lower levels of fatigue.

On the other hand, rest patterns ($\rho=0.200$, $p=0.199$) and the presence of a deposit target ($\rho=0.169$, $p=0.280$) showed no significant relationship with subjective fatigue in this study. Although the direction of the correlation could be observed, the relationship was not strong enough ($p>0.05$) to be considered statistically significant at the 95% confidence level.

Tabel 2. Spearman Rank Test Results Independent Variables Against Dependent Variables

Variable	Subjective Fatigue	
	Correlation Coefficient	Sig. (2-tailed)
Age	0.327	0.032
Daily Work Duration	0.357	0.019
Rest Pattern	0.200	0.199
Working Hours	0.352	0.021
Driving Workload	0.394	0.009
Deposit Target	0.169	0.280
Vehicle Ergonomics	0.398	0.008
Driver Experience	-0.339	0.026

Source: Primary Data, 2024

DISCUSSION

This study reveals several key factors influencing subjective fatigue among urban transportation drivers in Tataaran. A significant positive correlation was observed between subjective fatigue and age, daily work duration, irregular working hours, driving workload, and uncomfortable vehicle ergonomics. This suggests that older drivers, those working longer hours with irregular schedules, experiencing heavy workloads, and operating vehicles with poor ergonomic design, tend to report higher levels of fatigue. These findings align with previous research indicating that prolonged work hours and demanding work conditions contribute to increased fatigue levels across various occupational groups, including transportation workers (Cunningham et al., 2022). The irregular working hours may disrupt the circadian rhythm, further exacerbating fatigue. Indeed, recent studies on shift work have consistently demonstrated the detrimental effects of circadian rhythm disruption on fatigue and overall health (Akerstedt & Wright, 2009).

The positive association between age and subjective fatigue could be attributed to age-related physiological changes that affect the body's ability to recover from fatigue (Lin, 2023). While this study indicates that older drivers experience more fatigue, other recent research has also indicated that older drivers may have compensatory strategies. However, the current study did not examine self-regulation, and the increased subjective fatigue suggests that such strategies may not fully compensate for the effects of age.

However, this contrasts with the study's finding of a negative correlation between driving experience and subjective fatigue, wherein more experienced drivers reported lower fatigue levels. This seemingly contradictory result may indicate that experience enables drivers to develop coping mechanisms or adaptive strategies to manage fatigue. For instance, experienced drivers might be better at pacing themselves, taking strategic micro-breaks, or recognizing early signs of fatigue, thus mitigating its impact (Tucker, 2023). This is consistent with the skill acquisition theory, which posits that with increased experience, individuals develop more efficient strategies for task performance, potentially reducing strain and fatigue (Locke & Latham, 1991).

Moreover, the significant correlation between uncomfortable vehicle ergonomics and higher subjective fatigue underscores the importance of the work environment in influencing driver well-being. Prolonged driving in poorly designed vehicles can lead to musculoskeletal discomfort and increase the physical demands on drivers, contributing to fatigue. This is consistent with recent studies that highlight the role of ergonomic factors in occupational fatigue. The discomfort experienced by drivers can lead to increased muscle tension and decreased blood flow, both of which contribute to the perception of fatigue (Che Hasan et al., 2022).

Interestingly, this study found no significant relationship between rest patterns and subjective fatigue. This contrasts with expectations and some previous studies that have shown that insufficient rest is a major contributor to fatigue. It is possible that in this study, the self-reported rest patterns did not accurately reflect the quality or effectiveness of rest, or that other factors outweighed the impact of rest duration on fatigue. Similarly, the absence of a significant correlation between deposit targets and subjective fatigue suggests that, in this context, the pressure to meet financial goals does not significantly contribute to drivers' feelings of fatigue. This might be due to the fact that most of the drivers did not have target setoran. However, other recent studies have indicated that high job demands, including financial pressures, can increase stress and fatigue (Rolison et al., 2018).

This study identifies key factors contributing to subjective fatigue among urban transportation drivers in Tataaran, emphasizing the need for interventions to improve working conditions, such as optimizing schedules, reducing workload, and enhancing vehicle ergonomics. Additionally, further research is required to explore the interplay between driving experience, age, and fatigue, as well as to assess the effectiveness of rest strategies and financial pressures in mitigating driver fatigue. However, several limitations must be acknowledged. The relatively small sample size may limit the generalizability of the findings, and the reliance on self-reported data introduces potential biases, such as social desirability and recall bias. Future studies with larger, more diverse samples, and the use of objective or triangulated measurement tools, could enhance the reliability of findings. The cross-sectional design also restricts causal inferences, suggesting the need for longitudinal studies to assess changes over time and determine causal relationships. Observational or interventional studies could further explore the impact of specific interventions or environmental factors, and examining additional variables such as demographic, psychological, or socio-economic factors could provide deeper insights into the study's findings.

CONCLUSION

This study analyzed factors influencing subjective fatigue among urban transportation drivers in Tataaran. Increased age, daily work duration, irregular work hours, driving workload, and uncomfortable vehicle ergonomics were significantly associated with higher fatigue levels, while greater driving experience was associated with lower fatigue. Rest patterns and deposit targets were not significant factors. These findings suggest that older drivers with longer hours, irregular schedules, high workloads, and poor vehicle ergonomics are more prone to fatigue, while experienced drivers are less so.

Recommendations include policies to regulate work hours, regular health check-ups (especially for older drivers), improved vehicle ergonomics, and driver training on fatigue management. Future research should explore the interplay of age, experience, and fatigue; the effectiveness of rest strategies; the impact of other factors like sleep quality and stress; and the development of interventions to reduce driver fatigue and improve safety.

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