

ORIGINAL

The Influence of Individual Characteristics and Job Factors on Traffic Accidents Through Work Stress on Drivers Two Wheels (Online Motorcycle Taxi) In Makassar City

La influencia de las características individuales y los factores laborales en los accidentes de tráfico causados por el estrés laboral en conductores de mototaxis en la ciudad de Makassar

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Cite as: Madina R, S. Russeng S, Thamrin Y, Muis M, Wahiduddin. The Influence of Individual Characteristics and Job Factors on Traffic Accidents Through Work Stress on Drivers Two Wheels (Online Motorcycle Taxi) In Makassar City. Salud, Ciencia y Tecnología. 2025; 5:2036. <https://doi.org/10.56294/saludcyt20252036>

Submitted: 11-03-2025

Revised: 05-06-2025

Accepted: 10-09-2025

Published: 11-09-2025

Editor: Prof. Dr. William Castillo-González 

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ABSTRACT

Introduction: traffic accidents in Indonesia have risen sharply, with 94 617 cases in 2023 (up 34,6 %), dominated by human factors (61 %), and the rise of online motorcycle taxis –with 4 million drivers–contributing to the problem due to low safety awareness and high work-related stress, with 41 % of workers worldwide affected by stress and Indonesia ranking 9th in Southeast Asia.

Method: this study used a quantitative approach with a cross-sectional design. A total of 106 respondents were selected using accidental sampling techniques. Data were collected through questionnaires involving various variables such as age, length of service, working hours, mental workload, and traffic accidents, as well as using a cocorometer to measure objective work stress.

Results: results at a 95 % confidence level or CL = 0,05 indicate that age and length of service have a significant effect on work stress ($p=0,001$; $p=0,000$), and age and length of service also have a direct effect on traffic accidents and a significant mediating effect through work stress ($p=0,032$; $p=0,022$). Working period does not influence work-related stress or traffic accidents ($p > 0,05$), and the mediating effect of work-related stress is also not significant ($p = 0,142$). Working hours and mental workload significantly influence work-related stress ($p=0,007$; $p=0,009$), but only mental workload directly influences traffic accidents ($p=0,007$), with both having work-related stress as a significant mediator ($p=0,048$; $p=0,036$).

Conclusions: age, working period, working hours and mental workload significantly affect traffic accidents both directly and through work stress as an intervening variables.

Keywords: Age; Working Period; Length of Service; Working Hours; Mental Workload; Work Stress; Traffic Accidents.

RESUMEN

Introducción: los accidentes de tráfico en Indonesia han aumentado drásticamente, con 94.617 casos en 2023 (un 34,6 % más), dominados por factores humanos (61%). El auge de los mototaxis online, con 4 millones de conductores, contribuye al problema debido a la baja concienciación sobre la seguridad y al elevado estrés laboral. El 41% de los trabajadores a nivel mundial se ven afectados por estrés, e Indonesia ocupa el 9.º lugar en el Sudeste Asiático.

Método: este estudio utilizó un enfoque cuantitativo con un diseño transversal. Se seleccionó a un total de 106 encuestados mediante técnicas de muestreo accidental. Los datos se recopilaron mediante cuestionarios que incluían diversas variables como la edad, la antigüedad, la jornada laboral, la carga mental y los accidentes de tráfico, así como mediante un cocorómetro para medir el estrés laboral objetivo.

Resultados: los resultados con un nivel de confianza del 95% (IC del 95% o CL = 0,05) indican que la edad y la antigüedad laboral tienen un efecto significativo en el estrés laboral ($p = 0,001$; $p = 0,000$), y que la edad y la antigüedad también tienen un efecto directo en los accidentes de tráfico y un efecto mediador significativo a través del estrés laboral ($p = 0,032$; $p = 0,022$). El horario laboral no influye en el estrés laboral ni en los accidentes de tráfico ($p > 0,05$), y el efecto mediador del estrés laboral tampoco es significativo ($p = 0,142$). El horario laboral y la carga mental influyen significativamente en el estrés laboral ($p = 0,007$; $p = 0,009$), pero solo la carga mental influye directamente en los accidentes de tráfico ($p = 0,007$), y en ambos casos el estrés laboral es un mediador significativo ($p = 0,048$; $p = 0,036$).

Conclusiones: la edad, la jornada laboral, la jornada laboral y la carga mental influyen significativamente en los accidentes de tráfico, tanto directamente como a través del estrés laboral como variable interviniente.

Palabras clave: Edad; Jornada Laboral; Antigüedad; Jornada Laboral; Carga Mental; Estrés Laboral; Accidentes de Tráfico.

INTRODUCTION

Traffic accidents are a serious problem that continues to increase globally. According to data from the World Health Organization, more than 1,19 million people die each year due to road accidents, and around 92 % of these deaths occur in low- to middle-income countries, including Indonesia.⁽¹⁾ This condition is exacerbated by the findings of the Indonesian National Police Traffic Corps which reported that there were 94617 cases of traffic accidents in Indonesia, an increase of 34,6 % from the previous year. Most of the causes of accidents are human factors (61 %), followed by vehicle factors (9 %) and the environment (30 %). Locally, in South Sulawesi, 48693 cases of traffic accidents were recorded between 2020 and 2022, with 3,056 fatalities. The most vulnerable age group is adolescents aged 15 to 19 years. In the city of Makassar itself, accident cases increased from 1090 cases in 2021 to 1,895 cases in 2023. The majority of accidents involved two-wheeled vehicles, especially motorbikes used by online motorcycle taxi drivers.⁽²⁾

The phenomenon of the rise of online motorcycle taxis since 2014 has had a significant impact on the transportation patterns of people in Indonesia. The existence of online motorcycle taxis that facilitate people's mobility has also contributed to a fairly high number of accidents. It is estimated that there are currently more than 4 million online motorcycle taxi drivers actively operating, but unfortunately not all of them have adequate understanding and driving safety skills. In addition, the characteristics of work that do not have working hour limits, the demand to always be ready to receive orders, and pressure from the customer assessment system have the potential to increase work stress experienced by drivers. Work stress, according to WHO, has become a global epidemic in the 21st century, where 41 % of world workers experience stress, including in Indonesia which is ranked 9th in Southeast Asia with a prevalence of 16 %. Riskesdas data shows that work stress contributes to 43 % of lost work days and even 35 % of stress cases end in death.⁽³⁾

The stress experienced by online motorcycle taxi drivers has a direct impact on their driving behavior. Under high stress conditions, drivers tend to lose focus, become more emotional, and do not consider risks rationally, so they are more likely to have an accident. Research by Napitu et al.⁽⁴⁾ and Pertiwi⁽⁵⁾ shows that drivers with high stress levels are more likely to commit traffic violations. The Loss Causation Model theory reinforces this by explaining that stress is the root cause of unsafe acts and unsafe conditions in the work environment. Individual factors such as age, marital status, and length of service have been shown to be significantly related to stress levels. Young drivers, although physically fit, are more prone to dangerous maneuvers and reckless driving. Meanwhile, drivers with longer service periods tend to be more careful and comply with safety regulations.

In addition to stress factors, long working hours are also a major contributor to the risk of accidents. Many online motorcycle taxi drivers work more than 8 hours a day to pursue incentives and bonuses, even though this has a negative impact on their physical and mental health. Research by Adam et al.⁽⁶⁾ and Kamim et al.⁽⁷⁾ shows that excessive workload causes fatigue and reduces the ability to respond to emergency conditions on the road. In fact, according to Suma'mur⁽⁸⁾, working more than 10 hours per day has been shown to reduce work effectiveness and increase the risk of accidents. Recent research in Denpasar shows that online motorcycle taxi drivers who work more than 8 hours are 2,47 times more likely to have an accident than those who work within reasonable time limits. Drivers, online transportation service providers, and regulators must work together to develop accident prevention strategies through work stress management,

working hour limits, and ongoing safety education. Therefore, the purpose of this study is to analyze the influence of individual characteristics (age and length of service) and work factors (length of service, working hours and mental workload) on traffic accidents through work stress in two-wheeled vehicle drivers (online motorcycle taxis) in Makassar city.

METHOD

This study used a quantitative approach with an analytical observational and cross-sectional design. The study was conducted over a one-month period (April 7-May 7, 2025) in Makassar City, covering 14 sub-districts (except Sangkarrang Sub-district). The study population consisted of online motorcycle taxi drivers selected incidentally, with a sample size of 106 respondents, calculated using the Lemeshow formula with a 10 % margin of error. This research uses the code of ethics issued by the Faculty of Public Health with ethics number 532/UN4.14.1/TP.01.02/2025 and protocol number 10324062057. The instruments used in this study included:

- **Age:** Respondents' age was measured using a self-data questionnaire that recorded the respondent's year and month of birth.
- **Work Stress:** work stress was measured using the Work Stress Questionnaire, which includes indicators such as workload, time pressure, and job demands. This questionnaire is designed to measure stress levels based on an individual's perception of various aspects of their work.
- **Traffic Accidents:** data on traffic accidents were collected using the Traffic Accident Questionnaire, which covers the frequency and type of accidents experienced by respondents over a specific time period.
- **Working Period:** this variable was measured using a self-reported questionnaire that recorded the length of time respondents had worked as online motorcycle taxi drivers, in months or years.
- **Length of Service:** this was measured by recording the number of years of work experience each respondent had in the online motorcycle taxi industry.
- **Job Stress:** the validated Job Stress Questionnaire was used to assess the level of stress experienced by respondents at work, covering factors such as relationships with coworkers, pressure from superiors, and physical fatigue.
- **Working Hours:** data on working hours were collected using a self-reported questionnaire, which recorded the number of hours respondents worked per week.
- **Mental Workload:** mental workload was measured using the NASA-TLX (Task Load Index), a standard tool for assessing mental workload based on five dimensions: mental, physical, time, performance, and effort.

Data analysis was conducted in three stages. The first stage was univariate analysis to describe the distribution and characteristics of each variable. In the second stage, bivariate analysis was conducted using the chi-square test to determine the relationship between the independent and dependent variables. In the third stage, multivariate analysis was conducted using the Path Analysis approach through SmartPLS 4 software to evaluate the direct and indirect effects between the research variables. This study measures the direct effect of work stress on traffic accidents, as well as the indirect effect through mediator variables such as mental workload and working hours. Using Path Analysis, the relationship model between these variables will be analyzed in depth, including path coefficients and the statistical significance of each existing relationship.

RESULTS

Analysis of 106 online motorcycle taxi drivers in Makassar City showed that the majority of respondents were male (95 %), had a high school education (66 %), and were married (71,7 %). Most were young (≤ 35 years) at 57 %, and had a new work period (≤ 5 years) at 51 %. As many as 52 % of respondents were considered to have a length of service that did not meet standards, and 63 % worked during the day. Mental workload was divided almost evenly, with 54 % of respondents experiencing a light workload. Meanwhile, 37 % experienced work stress, and 59 % had experienced traffic accidents. Of the 63 respondents who had experienced accidents, most had experienced accidents 1-2 times, with mild and moderate severity. Most accidents occurred at night (60 %) and on arterial roads (43 %), and the majority occurred when carrying passengers (76 %) and involving other vehicles (68 %).

Bivariate Analysis

Bivariate analysis was conducted to analyze the relationship between independent and dependent variables as follows.

Table 1. The effect of rider age on the incidence of traffic accidents and levels of occupational stress among (online motorcycle taxis) in makassar city

Age	Traffic accident				P-Value	Job Stress				P-value
	Ever		Never			Stress		No		
	n	%	n	%		n	%	n	%	
Young	28	46,7	32	53,3	0,002*	11	18,3	49	81,7	0,000*
Old	35	76,1	11	23,9		28	60,9	18	39,1	
Total	43		63			39		67		

Based on table 1, there is a significant relationship between age and the incidence of traffic accidents ($p = 0,002$) and work stress ($p = 0,000$) in online motorcycle taxi drivers in Makassar City. Older respondents experienced more accidents (76,1 %) and work stress (60,9 %) than younger respondents, most of whom did not experience accidents (53,3 %) and did not experience work stress (81,7 %).

Table 2. The effect of length of employment working period on the incidence of traffic accidents and levels of occupational stress

Working Period	Traffic accident					Job Stress				
	Ever		Never		P-Value	Stress		No		P-value
	n	%	n	%		n	%	n	%	
Long	32	61,5	20	38,5	0,665*	26	50,0	26	50,0	0,006*
New	31	57,4	23	42,4		13	24,1	41	75,9	
Total	63		43			39		67		

Based on table 2, the working period does not have a significant relationship with the occurrence of traffic accidents ($p = 0,665$), but has a significant relationship with work stress ($p = 0,006$) in online motorcycle taxi drivers in Makassar City. Respondents with a long work period experienced more work stress (50 %) than respondents with a new work period (24,1 %).

Table 3. The effect of length of service on traffic accidents and levels of occupational stress

Length of service	Traffic accident					Job Stress				
	Ever		Never		P-Value	Stress		No		P-value
	n	%	n	%		n	%	n	%	
Not eligible	46	78,0	13	22,0	0,000*	34	57,6	25	42,4	0,000*
Qualify	17	36,2	30	63,8		5	10,6	42	89,4	
Total	63		43			39		67		

Table 3 shows that unqualified working hours significantly increase the incidence of traffic accidents ($p = 0,000$) and work stress ($p = 0,000$) in online motorcycle taxi drivers. Drivers with unqualified working hours experience more accidents (78,0 %) and work stress (57,6 %) than those with appropriate working hours.

Table 4. The effect of working hours on traffic accidents and levels of occupational stress

Working Hours	Traffic accident					P-Value	Job Stress				P-value
	Ever		Never		Stress		No				
	n	%	n	%	n		%	n	%		
Night	31	79,5	8	20,5	0,001*	24	61,5	15	38,5	0,000*	
Day	32	47,8	35	52,2		15	22,4	52	77,6		
Total	63		43			39		67			

Online motorcycle taxi drivers who work at night have a much higher risk of traffic accidents (79,5 %) and

work stress (61,5 %) than those who work during the day. The results of statistical tests show that the effect of working hours on accidents and work stress is significant ($p = 0,001$ and $p = 0,000$).

Table 5. The effect of mental workload on the incidence of traffic accidents and levels of occupational stress

M e n t a l Workload	Traffic accident					Job Stress				
	Ever		Never		P-Value	Stress		No		P-value
	n	%	n	%		n	%	n	%	
Heavy	40	81,6	9	18,4	0,000*	28	57,1	21	42,9	0,000*
Light	23	40,4	34	59,6		11	19,3	46	80,7	
Total	43		63			39		67		

Online motorcycle taxi drivers with heavy mental workload experience traffic accidents (81,6 %) and work stress (57,1 %) higher than those with light workload. Statistical tests show a significant relationship between mental workload and accidents and work stress ($p=0,000$).

Table 6. The effect of work stress on the incidence of traffic accidents

Work stress	Traffic accident				P-value
	Ever		Never		
	n	%	n	%	
Stres	37	94,9	2	5,1	0,000*
No stress	26	38,8	41	61,2	
Total	63		43		

As many as 94,9 % of online motorcycle taxi drivers who experienced traffic accidents also experienced work stress, while only 5,1 % of those who did not experience accidents experienced stress. The results of the Chi-Square test showed a significant effect between work stress and traffic accidents ($p = 0,000$).

Multivariate Analysis

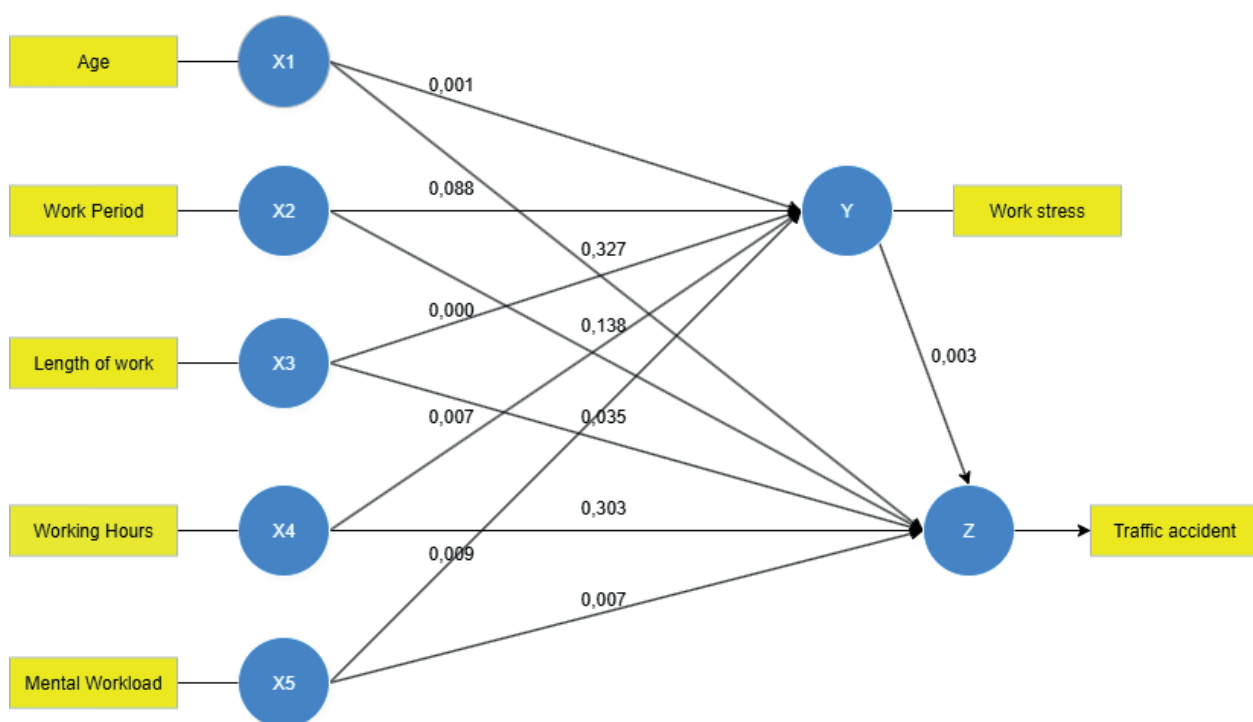


Figure 1. Path analysis model

Path analysis in this study was used to test the direct and indirect effects of the variables age, working period, length of service, working hours, and mental workload on traffic accidents through work stress as an intervening variable, using the SMART-PLS application.

There are 11 hypotheses that can be investigated on the direct effect, here are the results of direct testing of the hypotheses.

Hypothesis	Path Coefficient	P-values	F-Square
Age → Traffic accident	0,091	0,327	0,011
Age → Work stress	0,267	0,001*	0,121
Working period → Traffic accident	-0,119	0,138	0,022
Working period → Work stress	0,129	0,088	0,030
Length of service → Traffic accident	0,205	0,035*	0,054
Length of service → Job stress	0,332	0,000*	0,193
Working hours → Traffic accidents	0,087	0,303	0,011
Working hours → Work stress	0,226	0,007*	0,089
Mental workload → Traffic accidents	0,230	0,007*	0,076
Mental workload → Job stress	0,211	0,009*	0,079
Work stress → Traffic accidents	0,325	0,003*	0,093

Based on the results of the direct hypothesis analysis in table 7, it was found that age, length of service, working hours, mental workload, and work stress had a significant effect on other variables in the model, with a P-value < 0,05.

Hypothesis	Path Coefficient	P-values	Z-Sobel
Age → Work stress → Traffic accidents	0,087	0,032	2,152*
Working period → Work stress → Traffic accidents	0,042	0,142	1,470
Length of service → Job stress → Traffic accident	0,108	0,022	2,295*
Working hours → Work stress → Traffic accident	0,073	0,048	1,986*
Mental workload → Job stress → Traffic accidents	0,069	0,036	2,100*

Based on the results of indirect hypothesis testing using the Sobel test in table 8, it was found that work stress significantly mediated the effect of age, length of service, working hours, and mental workload on traffic accidents, as indicated by the P-value < 0,05 and Z-Sobel > 1,96. This indicates that the higher these factors, the higher the risk of traffic accidents through increased work stress. However, the indirect effect of work period on traffic accidents through work stress was not significant, with a P-value > 0,05 and Z-Sobel < 1,96, so that work period was not proven to indirectly affect accidents through work stress.

DISCUSSION

The Effect of Age on Traffic Accidents and Work Stress

This study shows that age has no significant effect on traffic accidents, although it shows a positive direction of influence, the value is not strong enough to state a significant relationship. Other studies such as Milyarini et al.⁽⁸⁾ actually found that age is related to accidents, both due to lack of experience at a young age and decreased response at an older age. Cross-tabulation data revealed that 76,1 % of older drivers (>35 years) had accidents compared to 53,3 % of younger drivers (≤35 years). This indicates that in practice, older age is more prone to accidents, although not statistically significant. The insignificant effect of age in this study may be caused by the even distribution of experience among respondents, the dominance of other factors that play a greater role, and the old age of respondents who are still in their productive age.

There is a significant effect between age and work stress. The older the online motorcycle taxi driver, the higher the level of work stress experienced. This is supported by research by Ifadah et al.⁽⁹⁾ and Rahmadina et al.⁽¹⁰⁾, which shows a significant relationship between age and work stress, due to decreased physical and cognitive conditions, and increased psychological burden with age. The data shows that of the 39 respondents who experienced work stress, 28 of them (60,9 %) were old. This shows that older online motorcycle taxi

drivers are more susceptible to stress than younger drivers. Thus, there needs to be an intervention in the form of stress management education and special supporting features from online motorcycle taxi application providers to help older drivers maintain their mental health and work performance.

The Influence of Working Period on Traffic Accidents and Work Stress

The study showed no significant effect between length of service and traffic accidents. Although the results were negative, indicating that longer service tends to reduce the risk of accidents, these results were not statistically strong enough. On the other hand, research by Pratama *et al.*⁽¹¹⁾ stated that length of service was significantly related to driving safety, because driving experience makes drivers more careful and alert. Based on the data, 63 respondents experienced traffic accidents, of which 61,5 % had a long service period (> 5 years), which actually shows a tendency that long service periods can contribute to accidents. This can be explained by the possibility of boredom, prolonged work fatigue, or increased exposure to risk over the years of working as an online motorcycle taxi driver.

The study showed no significant effect between work period and work stress. Although the direction of the effect is positive, this result is not statistically strong enough. Bungah Adalia *et al.*⁽¹²⁾ study also concluded that there was no relationship between work period and work stress because online motorcycle taxi work is monotonous, regardless of length of service. The data showed that of the 39 respondents who experienced work stress, 26 people (50 %) had a long work period. Although not significant, the tendency for higher stress in long work periods was still visible. This shows that length of service is not the main factor causing stress, but can still influence indirectly through chronic work fatigue or boredom due to unvaried routines.

Influence Length of Service on Traffic Accidents and Work Stress

The study shows that working hours have a significant effect on traffic accidents in online motorcycle taxi drivers, indicates that the longer the driver's working hours, the higher the risk of accidents. Although the effect is relatively low, his result is still relevant, because drivers with working hours exceeding 8 hours per day show a greater tendency to have accidents than those who work according to the rules. This is also supported by a study in Sidoarjo which showed a positive but weak relationship between working hours and traffic accidents.⁽¹³⁾ The causal factor is the absence of formal working hour limits in the online motorcycle taxi partnership system. Drivers are free to determine their income targets, so many of them choose to work excessively for incentives or bonuses. In fact, working hours that are too long can reduce concentration and alertness, increasing the potential for accidents.

Working hours have also been shown to have a significant effect on work stress in online motorcycle taxi drivers. The results of the analysis indicating that the longer the working hours, the higher the level of stress felt. This effect is classified as moderate in the model structure. This finding is in line with a number of previous studies in various cities, including Depok, South Tangerang, and inter-city public transportation drivers, all of which showed that long working hours trigger work stress.⁽¹⁴⁾ Increased stress occurs because drivers often work longer than they should, especially when facing traffic jams that extend the time on the road without sufficient rest breaks. Data from 106 respondents in Makassar showed that of the 39 drivers who experienced work stress, the majority had a working duration of more than 8 hours. Conversely, of the 67 respondents who did not experience stress, most had a working duration according to recommendations. This shows that limiting working hours is very important to maintain the physical and mental well-being of drivers. According to the literature, working beyond the NAB (Threshold Limit Value) can cause decreased motor and mental function, low productivity, and ongoing stress.

Influence Working Time on Traffic Accidents and Work Stress

The results of the study showed that there was no significant effect between working hours and traffic accidents, although there was a positive effect indicating that working at night or during the day tends to have a unidirectional relationship with accidents. Although the effect is low, this study is in line with Nasution's⁽¹⁵⁾ which found that the risk of accidents is higher in night workers due to circadian rhythm disturbances. Of the 106 online motorcycle taxi drivers in Makassar, 63 had traffic accidents, with 31 of them working at night (79,5 %) and 32 working during the day (47,8 %). Although the number of accidents at night is higher, during the day is also risky due to dense traffic and hot temperatures, as stated by Konlan *et al.*⁽¹⁶⁾ who noted that 67 % of accidents occurred during the day.

The study showed a significant effect between working hours and work stress although the structural effect was low. This means that working at night or during the day affects stress levels in one direction, where night workers tend to experience higher stress. This is supported by research by Lubis *et al.*⁽¹⁷⁾ which found that nighttime stress levels were 78 % higher, and body rhythm disturbances due to nighttime work had an impact on stress and physiological disorders. Of the 106 online motorcycle taxi drivers in Makassar, 39 experienced stress, with 24 (61,5 %) working at night and 15 (22,4 %) working during the day. The majority who did not experience

stress (77,6 %) worked during the day. This finding is in line with the study by Bachrun et al.⁽¹⁸⁾ which concluded that nighttime work has an impact on mental health. Interviews also showed that some night drivers have other jobs during the day, which increases work pressure and the risk of stress.

Influence Mental Workload on Traffic Accidents and Work Stress

The results of the study showed that mental workload has a significant effect on traffic accidents in online motorcycle taxi drivers in Makassar City with a p-value of 0,007 and a path coefficient of 0,230. Cross-tabulation data revealed that the majority of drivers who had accidents had heavy mental workloads (81,6 %), while drivers who did not have accidents were dominated by light mental workloads (59,6 %). This proves that the higher the NASA-TLX score that reflects mental workload, the greater the risk of traffic accidents. This mental workload includes the pressure of chasing bonuses, choosing strategic locations, and meeting customer expectations—all of which require high concentration and quick decision-making, which if continued without stress management can lead to mental fatigue and work accidents.

In addition, this study also found a significant effect between mental workload and work stress with a p-value of 0,009 and a path coefficient of 0,211. The majority of drivers who experienced work stress were recorded as having a heavy mental workload (57,1 %), while those who did not experience stress were dominated by a light mental workload (80,7 %). Working conditions as an online motorcycle taxi driver require physical and mental activity simultaneously, starting from dealing with traffic jams, long working hours, to tight competition for daily incentives. This is in line with Munandar's theory⁽¹⁹⁾ which states that excessive workload without sufficient recovery time can trigger work stress which has a negative impact on psychological health and worker productivity.

Influence Work Stress on Traffic Accidents

The results of this study indicate that work stress has a significant effect on traffic accidents in online motorcycle taxi drivers in Makassar City, which means that the higher the level of work stress, the greater the risk of accidents. In the 95 % confidence interval, the effect of work stress on accidents ranges, although the structural effect is relatively low. Of the 106 respondents, 63 had experienced accidents, and among them, 37 people (94,9 %) experienced work stress, compared to only 2 people (5,1 %) from the group without accidents. Stress measurements were carried out using a cocorometer based on amylase levels in saliva which are influenced by the sympathetic nervous system. These results are in line with the study of Napitu et al.⁽⁴⁾ which showed a significant relationship between work stress and accidents in online motorcycle taxi drivers in Semarang ($p = 0,012$). Uncontrolled work stress can trigger physical and psychological fatigue and reduce concentration, thereby increasing the potential for unsafe acts and work accidents, as explained by Zanuardi et al.⁽²⁰⁾.

Influence Indirect

The results of this study indicate that work stress acts as a mediator in the relationship between age, daily work duration, work shifts, mental workload, and physical workload on traffic accidents. This is in line with the findings of Fatmawati et al.⁽²¹⁾ which states that older workers are more susceptible to stress due to decreased physiological function and ability to adapt to work pressure. Daily work duration also has a significant indirect effect ($p\text{-value} = 0,012$; T Statistic = 2,510), which is supported by research by Ifadah et al.⁽⁹⁾ that working hours exceeding 8 hours per day increase fatigue and work stress. Shift work shows a similar effect ($p\text{-value} = 0,043$; T Statistic = 2,030), where night work disrupts the body's circadian rhythm and causes sleep disturbances and increased stress. Mental and physical workload also showed a significant indirect influence on accidents through work stress ($p\text{-value} = 0,015$ and $0,039$; T Statistic = 2,441 and 2,074), in line with the results of a study by Adam, which stated that excessive cognitive pressure and muscle fatigue due to heavy physical activity are factors that trigger stress and reduce concentration when driving.⁽⁶⁾

In contrast, the work period variable did not show a significant indirect effect ($p\text{-value} = 0,607$; T Statistic = $0,516 < 1,96$), indicating that work experience is not always correlated with stress levels or accidents. This result is different from previous research by Kamim⁽⁷⁾ which stated that work periods of more than five years tend to form resilience to work pressure. This discrepancy could be caused by differences in job characteristics or work culture at the study location. The overall findings strengthen the important role of work stress as a mediating pathway between individual and work factors on the risk of traffic accidents. Therefore, managerial approaches that focus on reducing work stress - such as healthier shift rotations, working hour restrictions, and stress management training - could be effective strategies to reduce accident rates among transportation workers.

CONCLUSIONS

The results of the study indicate that age, working hours, and mental workload have an indirect effect

on traffic accidents through work-related stress, while working hours have both direct and indirect effects, whereas length of service has no significant effect, either directly or indirectly. Based on these findings, online motorcycle taxi drivers in Makassar are advised to limit their working hours, recognize signs of stress, and maintain physical and mental health to reduce the risk of accidents. Application providers are advised to implement a system for limiting working hours, age-based training, psychological services, and flexible work arrangements. However, this study has limitations, namely that stress measurement was conducted in real time, while traffic accident data referred to past incidents. This could introduce temporal bias in linking current stress with previous accident incidents. Therefore, future researchers are encouraged to add environmental and vehicle variables and use a longitudinal approach to obtain more comprehensive and accurate results in understanding the causal relationships between variables.

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FINANCING

The authors did not receive financing for the development of this research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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