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Determinants of Workplace Accidents among Heavy Equipment Operators: A Cross-Sectional Study in Indonesia

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ABSTRACT

Introduction: Heavy equipment operators are prone to incidents, particularly due to fatigue, which affects concentration and safety. Although companies have committed to safety measures, incidents still occur due to various internal and external factors.
Objective: This study aims to analyze the factors influencing workplace accidents among heavy equipment operators.
Method: The research method used a quantitative research design with a cross-sectional approach, with a sample of 99 heavy equipment operators selected using simple random sampling. Data analysis was performed using the Chi-square test and Logistic Regression Test.
Result: The results of the study indicate that work fatigue has a significant effect on workplace accidents ($p = 0.048 < 0.05$), age also has a significant effect on workplace accidents ($p = 0.025 < 0.05$), Nutritional status does not show a significant relationship with workplace accidents ($p = 0.111 > 0.05$), Workload is proven to have a significant effect ($p = 0.008 < 0.05$), and length of service is also significantly associated with workplace accidents ($p = 0.048 < 0.05$).
Conclusion: The conclusion of this study is that there is a significant relationship between work fatigue, age, workload, and length of service with work accidents at PT. Subur Sedaya Maju. There is no relationship between nutritional status and work accidents at PT. Subur Sedaya Maju. Therefore, the company should consider adding work shifts to improve operational efficiency and reduce the workload on existing shifts, as well as conduct a comprehensive and ongoing evaluation of factors that may contribute to workplace accidents.

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INTRODUCTION

According to OSHA (Occupational Safety and Health Administration), fatigue is a condition that can reduce alertness, slow reaction time, and increase the possibility of human error and focuses on controlling fatigue through work and rest time management, as well as ensuring the work environment supports healthy conditions (such as adequate lighting, ventilation, and controlled noise). Workplace accidents can be categorized as minor, moderate, or severe. Minor injuries are often not considered important by business owners, but they can actually affect the health and productivity of workers. If minor injuries are ignored, they can lead to fatal accidents. Therefore, awareness of workplace safety and accident prevention must be a priority for all parties involved in the workplace (1).

Tanriono et al. state that work fatigue has a significant relationship with workplace accidents, especially for heavy equipment operators. According to research, fatigue can reduce concentration, slow response times, and increase the risk of errors in operating heavy equipment. Operators who experience fatigue are more prone to

incidents such as falls, collisions, or loss of control over heavy equipment. Additionally, insufficient rest can worsen workers' physical and mental conditions, increasing the risk of accidents that impact worker safety and equipment damage. Therefore, managing working hours and safety policies that consider fatigue aspects are crucial to minimizing workplace accidents (2). According to Hamudya, fatigued workers are more prone to operational errors, such as failing to follow safety procedures or losing control while operating heavy machinery. Furthermore, fatigue can also cause coordination and balance issues, increasing the likelihood of incidents occurring at the workplace (3).

One sector with a high risk of workplace accidents is the construction sector, particularly in the area of heavy equipment, which has a high risk of workplace accidents, where incidents can be influenced by various factors (4). Heavy machinery refers to large-scale machinery designed to perform construction functions, such as earthwork, road construction, building construction, mining, and agriculture. Anugerah states that operating heavy machinery requires operator skills, expertise, and mastery of heavy machinery maintenance. Potential hazards that may arise during heavy machinery operation include electric shock, machinery overturning, rolling over, or tipping, operators being struck by loads, or operators falling from heavy machinery (5).

The causes of workplace accidents are generally classified into two categories: the behavior of the workers themselves (human factors) and workplace conditions (work environment factors). Human factors include aspects such as work fatigue. Work fatigue is a significant problem in the workplace (6). Fatigue can affect worker performance and potentially increase the risk of workplace accidents. Several factors contribute to workplace fatigue, including heavy workloads, long working hours, and unsupportive environmental conditions (7).

Previous studies have shown that there is a link between work fatigue and workplace accidents. For example, a study of construction companies in Semarang found that work fatigue contributed to workplace accidents among hull workers. Hull workers faced excessive workloads during a 6-day work week, with a total of 48 hours of work per week. In addition, a hot work environment, noise, job demands, and the heavy nature of the work also contributed to work fatigue among workers in this department (8).

PT. Subur Sedaya Maju is a heavy equipment transportation service company that focuses on safety. The company was established in 2004 and is located in Prabumulih City, South Sumatra, serving customers throughout Indonesia. The company's vision is to provide the best service to its customers in terms of quality and timeliness while prioritizing work safety, occupational health, and environmental protection. To achieve this vision, the company has a mission to maintain equipment in good condition, cultivate workers with high moral and ethical standards, and create safe and secure working conditions. However, in carrying out its operations, the company also faces various challenges and obstacles that can affect performance and worker safety, such as weather conditions, road conditions, traffic conditions, heavy equipment conditions, and others.

Based on PT. Subur Sedaya Maju's accident incident report, several work accidents involving heavy equipment operators were caused by carelessness, such as falling from heavy equipment, collisions with other vehicles, and injuries due to negligence while working. Factors such as fatigue, lack of concentration, and non-compliance with safety procedures play a major role in increasing the risk of accidents. Therefore, research on the factors that influence work fatigue and its impact on safety is very important to minimize accident incidents.

METHOD

This research has been ethically reviewed with number 299/UN9.FKM/TU.KKE/2024. This study is a quantitative study using a cross-sectional research design that is analytical and observational. Analytical observational research is conducted to determine the relationship between independent variables (age, nutritional status, workload, length of service, and work fatigue) and dependent variables (work accidents).

The population studied was workers employed as heavy equipment operators at PT. Subur Sedaya Maju. This population was selected based on the research requirements to understand certain aspects relevant to their work and work environment. These workers were selected because they represented the characteristics needed to answer the research questions that had been formulated. In this study, the inclusion criteria included other workers who were heavy equipment operators and willing to be respondents. The exclusion criteria included operators who were on leave or sick at the time of data collection.The minimum sample size for this study was determined using a formula

for calculating the two-proportion hypothesis test. The minimum sample size obtained from previous studies was 90 respondents. To anticipate the possibility of missing data, the minimum sample size was increased by 10% of the obtained result. Thus, the total sample size in this study was 99 samples. The sampling technique used was simple random sampling.

There are two types of data used in this study, namely primary data and secondary data. Primary data was obtained through several different methods, including observation, interviews, and measurement of work fatigue at the research site. Meanwhile, secondary data was obtained from various relevant literature sources, such as books, articles, scientific journals, as well as documents and archives from related institutions, including archives containing the profiles of heavy equipment operators at PT. Subur Sedaya Maju.

The instruments and tools used in data collection for this study were the Subjective Symptoms Test (SST) questionnaires developed by the Industrial Fatigue Research Committee (IFRC) in Japan. These questionnaires were used to measure the level of work fatigue. The SST questionnaires were designed to evaluate subjective symptoms experienced by workers related to fatigue, both physical and mental. This tool is used to identify the level of worker fatigue and assist in designing interventions that can reduce the risk of fatigue in the workplace. The Subjective Symptoms Test (SST) questionnaire by the Industrial Fatigue Research Committee has been tested for validity and reliability (9).

All data collected in this study will be processed using computer programs with the help of data processing applications through four stages of data processing, namely Data Editing, Data Coding, Data Entry, and Data Cleaning. After that, the data will be analyzed univariately, bivariately, and multivariately. Univariate analysis helps in understanding the frequency distribution and percentage of each variable, which is then presented in the form of a frequency table. Bivariate analysis is conducted to examine the relationship or differences between two variables, namely between the independent variable and the dependent variable. The data is presented in a 2×2 table and analyzed using the Chi-Square test with a confidence level of 95% ($\alpha = 0.05$). Meanwhile, multivariate analysis is conducted using multiple logistic regression because the dependent variable in this study is categorical. The data is presented in a table accompanied by an interpretation of the hypothesis testing results. The tables used include univariate and bivariate tables. Univariate tables present the distribution of a single variable, while bivariate tables describe the relationship between two variables.

RESULTS

Univariat Analysis

Based on the results of interviews conducted by filling out the Subjective Symptoms Test (SST) questionnaire related to work fatigue experienced by workers at PT. Subur Sedaya Maju, the results can be seen in Table 1 below :

Table 1. Frequency Distribution of Work Fatigue Variables among Employees of PT. Subur Sedaya Maju

Work Fatigue	Number	Percentage (%)
Mild work fatigue	0	0
Moderate work fatigue	39	39.4
Severe work fatigue	45	45.5
Extreme work fatigue	15	15.1
Total	99	100

Based on the table above regarding the frequency distribution of work fatigue variables, the results show that out of 99 research respondents, 45 respondents (45.5%) experienced high work fatigue.

The gender of the sample in this study was male who worked as a heavy equipment operator. For the characteristics of respondents can be seen in table 2 below

Table 2. Frequency distribution of respondent characteristics

Characteristics of Respondent Age	Number	Percentage (%)
≥ 35 years	56	56.6
< 35 years	43	43.4

Nutritional Status	Number	Percentage (%)
Abnormal	17	17.2
Normal	82	82.8
Workload	Number	Percentage (%)
Light workload	0	0
Moderate workload	64	64.4
Heavy workload	20	20.2
Very heavy workload	15	15.2
Length of service	Number	Percentage (%)
Older ≥ 2 years	69	69.7
Less < 2 years	30	30.3

Based on Table 2 above regarding the age characteristics of respondents, it is known that of the 99 respondents, 56 respondents (56.6%) were over 35 years old, 82 respondents (82.8%) had a normal nutritional status (18.5 kg/m – 25 kg/m), 64 respondents (64.4%) had a moderate level of workload and 69 respondent (69.7%) have a working perod of more than 2 years. Based on the results of interviews conducted by researchers with workers at PT. Subur Sedaya Maju regarding the variable of workplace accidents, the results of this study can be seen in Table 3 below.

Table 3. Frequency distribution of workplace accidents

Workplace accidents	Number	Percentage (%)
No	34	34.3
Yes	65	65.7
Total	99	100

Based on Table 3 above, it is known that of the 99 respondents, 65 respondents (65.7%) experienced work accidents.

Bivariate Analysis

Bivariate analysis was conducted to determine the relationship between the independent and dependent variables studied. This analysis used the SPSS application with a chi-square test. To see the relationship between work fatigue and workplace accidents, refer to table 4 below.

Table 4. Relationship between work fatigue and workplace accidents

Fatigue	Workplace Accident				*P-Value*	OR CI (95%) (Lower-Upper)
	Yes		No			
	N	%	N	%		
Moderate work fatigue	4	21.1	15	78.9	0.047	0.305 (0.068-1.364)
Severe work fatigue	54	83.1	11	16.9		5.610 (1.683-18.700)
Extreme work fatigue	7	46.7	8	53.3		

Table 4 above shows that the OR values are 0.305 and 5.610. This means that respondents with moderate work fatigue have a 30.5% lower risk of work accidents compared to respondents with very high work fatigue (p value = 0.120). Meanwhile, respondents with high levels of work fatigue have a 56.10% greater risk of workplace accidents compared to respondents with very high levels of work fatigue (p-value = 0.005). The statistical test results obtained a p-value of 0.047 (p-value<0.05), so it can be concluded that there is a significant relationship between work fatigue and work accidents.

Table 5 below shows the relationship between age and workplace accidents.

Table 5. Relationship between age and workplace accidents

Age	Workplace Accidents				*P-Value*	OR CI (95%) (Lower-Upper)
	Yes		No			
	N	%	N	%		
≥ 35 years	42	65	14	58.9	0.025	0.383 (0.164-0.898)
< 35 years	23	35	20	41.1		

Based on Table 5 above, it shows that of the 59 respondents aged 35 years or older, 42 respondents (65%) experienced a work accident. Meanwhile, of the 43 respondents aged less than 35 years, 23 respondents (35%) experienced a work accident. This means that the proportion of work accidents among respondents aged ≥ 35 years is greater than the proportion of work accidents among respondents aged < 35 years. The statistical test results obtained a p-value of 0.025 (p-value<0.05), so it can be concluded that there is a significant relationship between age and work accidents.

To see the relationship between nutritional status and workplace accidents, refer to Table 6 below.

Table 6. Relationship between nutritional status and workplace accidents

Nutritional Status	Workplace Accidents				*P-Value*	OR CI (95%) (Lower-Upper)
	Yes		No			
	N	%	N	%		
Abnormal	14	82.4	3	17.6	0.111	0.353 (0.094-1.326)
Normal	51	62.2	31	37.8		

Based on Table 6, it shows that of the 17 respondents with abnormal nutritional status, 14 respondents (82.4%) experienced work accidents. Meanwhile, of the 82 respondents with normal nutritional status, 51 respondents (62.2%) experienced work accidents. The statistical test yielded a p-value of 0.111 (p-value > 0.05), so it can be concluded that there is no significant relationship between nutritional status and work accidents.

The relationship between workload and workplace accidents can be seen in Table 7 below.

Table 7. Relationship between workload and workplace accidents

Workload	Workplace Accident				*P-Value*	OR CI (95%) (Lower-Upper)
	Yes		No			
	N	%	N	%		
Moderate workload	41	64.1	23	35.9	0.008	2.674 (0.845-8.464)
Heavy workload	18	90	2	10		13.500 (2.256-80.792)
Very heavy workload	6	40	9	60		

Table 7 shows that the OR values are 2.674 and 13.500. This means that respondents with a moderate workload have a 2.7 times greater risk of occupational accidents than respondents with a very heavy workload (p value = 0.094). Meanwhile, respondents with a heavy workload have a 13.5 times greater risk of workplace accidents compared to respondents with a very heavy workload (p-value = 0.004). The statistical test results obtained a p-value of 0.008 (p-value < 0.05), so it can be concluded that there is a significant relationship between workload and work accidents.

Table 8 shows the relationship between length of service and workplace accidents.

Table 8. Relationship between length of service and workplace accidents

Length of Service	Workplace Accidents				*P-Value*	OR CI (95%) (Lower-Upper)
	Yes		No			
	N	%	N	%		
Older ≥ 2 years	41	59.4	28	40.6	0.048	2.732 (0.990-7.541)
Less < 2 years	24	80	6	20		

Based on Table 8 above, it shows that of the 69 respondents with ≥ 2 years of service, 41 respondents (59.4%) experienced a work accident. Meanwhile, of the 30 respondents with < 2 years of service, 24 respondents (80%) experienced a work accident. The statistical test yielded a p-value of 0.048 (p-value < 0.05), indicating a significant association between length of service and workplace accidents. The results show an OR value of 2.732. This means that respondents with ≥ 2 years of service have a 2.732 greater tendency (risk) of experiencing a work accident compared to respondents with < 2 years of service.

Multivariate Analysis

Multivariate analysis was performed to analyze the relationship between several independent variables and one dependent variable simultaneously. The multivariate analysis used was logistic regression analysis to determine which independent variables had the most influence on the dependent variable. The independent variables used were those with a p-value < 0.25 in the bivariate analysis. The summary of the bivariate analysis results can be seen in table 9 below.

Table 9. Summary of Bivariate Analysis Results

No	Variable	P
1	Fatigue	0.047
2	Age	0.025
3	Workload	0.008
4	Length of Service	0.048

Based on table 9 above, there are four variables that influence work accidents with a p-value < 0.05. Therefore, these variables can be used in multivariate analysis. The next step is to select the variables that are most closely related to work accidents at PT. Subur Sedaya Maju. The multivariate analysis used is multiple logistic regression testing with a prediction model. If the test results show that there are still variables with a p-value > 0.05, then these variables must be eliminated or removed from the model. Variables are removed from the model in stages, according to the highest variable probability value. After exclusion, the logistic regression test is performed again until there are no variables with a p-value > 0.05. The results of the factor determination model test can be seen in the following table 10.

Table 10. Results of Multivariate Analysis of Multiple Logistic Regression Tests between Independent Variables and Dependent Variables

No	Variable	Model 1	Model 2
1	Fatigue	0.162	0.101
2	Age	0.010	0.012
3	Workload	0.248	-
4	Length of Service	0.009	0.016

Based on the analysis results, it can be seen that there is one variable that has a probability value < 0.05, namely Work Fatigue (0.012). This result shows that this variable has a significant relationship with work accidents at PT. Sumber Sedaya Maju. The results of the determinant factor model can be seen in Table 11 below .

Table 11. Results of Multivariate Analysis of Modeling Work Fatigue and Age in Relation to Work Accidents at PT. Subur Sedaya Maju

No	Variable	P - Value	OR	OR 95% CI	
				Lower	Upper
1	Fatigue	0.012	0.294	0.114	0.762

Based on table 11 above, it shows that work fatigue is the most dominant variable with a p-value of 0.012 (p-value < 0.05), even after controlling for other variables such as age, workload, and length of service. The work fatigue variable has an OR value of 0.294 (0.114-0.762). This OR value means that workers who experience work fatigue are 11.4% more likely to experience a work accident compared to workers who do not experience fatigue at PT. Subur Sedaya Maju.

DISCUSSION

Workplace accidents are inseparable from the Domino Theory – H.W. Heinrich (1931). Heinrich likened accidents to a row of dominoes falling in sequence. There are five main factors that cause accidents: social factors (ancestry and social environment), human error (person fault), unsafe act, unsafe condition, and accident. If one domino is removed (for example, eliminating an unsafe error), then the chain of accidents can be prevented.

The Relationshio between work fatigue and work accident among heavy equipment operators at PT. Subur Sedaya Maju

Based on the results of research related to the relationship between work fatigue and work accidents at PT. Subur Sedaya Maju, namely that based on statistical tests using the chi-square test, there is a significant relationship between work fatigue and work accidents at PT. Subur Sedaya Maju with a p-value of 0.047 < α 0.05. Most workers experience headaches quite frequently, which indicates a high potential for physical/mental fatigue.

The results of this study are in line with research conducted by Agus Yudha Prawira Adistana et al at 2018 entitled "Accuracy of Project Completion Duration Predictions Using Earn Value Management and Earn Schedule (Case Study of a Building Construction Project at Unesa," which found that workers who experience fatigue have a higher risk of workplace accidents compared to those who do not experience fatigue. In that study, 75 workers (66.4%) who experienced workplace accidents also experienced fatigue (10). In addition, the results of this study are also in line with those conducted by Papendang, Seprianto Maddusa and Klesaran at 2022 entitled “The Relationship between Fatigue and Work Accidents among Fishermen in Bahu Lingkungan 1 Village, Manado City” that chronic fatigue can significantly increase the risk of traffic accidents, which also applies to workplace accidents. Driving fatigue and poor physical condition are major factors in increasing accident rates (11).

To reduce the risk of accidents due to fatigue, companies need to implement effective health and safety policies. This includes setting reasonable working hours, providing adequate rest periods, and providing training on stress management and mental health for workers.

The Relationship Between Age and Work Accidents Among Heavy Equipment Operators at PT. Subur Sedaya Maju

Based on the results of research related to the relationship between age and work accidents at PT. Subur Sedaya Maju, based on the results of statistical tests using the chi-square test, there is a significant relationship between the age of workers and work accidents at PT. Subur Sedaya Maju with a p-value of0.025 < α 0.05.

This is in line with the research by Darmayanti, Handayani and Supriyono at 2021 with entitled "The Relationship between Age, Hours, and Work Attitude Towards Work Accidents of Office Workers at the Central Java Province Small and Medium Enterprises Cooperative Office" that there is a significant relationship between age and work fatigue. Younger workers have better physical capacity and can complete heavy work more efficiently than older workers. Statistical test results show that p-value < 0.05, indicating that the older a person is, the higher the risk of experiencing work fatigue (12). In addition, this is also in line with research conducted by Helmianto and Yekti Pulih Asih at 2023 entitled "Literature Review: Factors Affecting the Rate of Work Accidents among Workers in High-Rise Building Construction Projects" which shows that there is no significant influence between age and the occurrence of work accidents. Although younger workers tend to be healthier and react faster, they are also less experienced and tend to be more careless than older workers. Conversely, older workers may have more experience but also experience physical decline that can affect their performance at work (13).

However, this is not in line with research conducted by Hamudya at 2023 entitled "Factors Related to Work Accidents among Construction Workers at The Canary Apartment Serpong Project in 2022," which states that workers under the age of 36 are more likely to experience work accidents than those who are older. This study found that young workers (≤ 36 years old) are four times more likely to experience workplace accidents than older workers (≥ 36 years old), with a p-value of 0.008. This shows that although young workers have better stamina, they are also more prone to accidents due to their lack of experience (14).

Younger workers tend to have better stamina and experience lower levels of work fatigue compared to older workers. This shows the importance of considering age factors in human resource management and occupational health in industry. Younger workers are more prone to accidents due to lack of experience and carelessness, while older workers may face risks due to declining physical abilities. Therefore, it is important to implement appropriate safety training programs for all age groups to reduce workplace accident incidents (15).

Relationship Between Nutritional Status and Work Accidents Among Heavy Equipment Operators at PT. Subur Sedaya Maju

Based on the results of research related to the relationship between nutritional status and work accidents at PT. Subur Sedaya Maju, based on the results of statistical tests using the chi-square test, there is no significant relationship between the nutritional status of workers and work accidents at PT. Subur Sedaya Maju with a p-value of 0.111 > α 0.05.

This is in line with the research conducted by Mada at 2020 entitled "The Relationship between Demographic Characteristics and Mental Health with the Severity of Injuries Due to Work Accidents among Workers in Sleman Regency, Yogyakarta," which found that workers with mental or physical health disorders tend to be more prone to errors and accidents . This is because health disorders can interfere with concentration and reaction ability, thereby increasing the risk of accidents (16). Additionally, the research by Prisnayanti and Widowati (2024) titled "Implementation of the Occupational Safety and Health Management System at PT X" also discusses the relationship between worker health status and work accidents. The results show that workers with poor health status have a higher risk of experiencing workplace accidents. This study emphasizes the importance of implementing an occupational safety and health management system (SMK3) to improve health status and reduce accident incidents in the workplace. The data collected shows that workers who do not getting regular medical checkups has a higher accident rate (17).

The relationship between nutritional status and the severity of injuries resulting from workplace accidents is very important to understand in the context of occupational safety. Workers with poor mental and physical health tend to suffer more severe injuries when accidents occur. Therefore, it is important for companies to pay attention to worker health through prevention programs and the implementation of effective safety management systems (18).

Relationship Between Workload and Work Accidents among Heavy Equipment Operators at PT. Subur Sedaya Maju

Based on the results of research related to the relationship between workload and work accidents at PT. Subur Sedaya Maju, based on the results of statistical tests using the chi-square test, there is a significant relationship between workload and work accidents at PT. Subur Sedaya Maju with a p-value of 0.008 < α 0.05.

This study is in line with research conducted by Amaliah in 2022 entitled “The Relationship Between Work Load And the Risk of Work Accidents at PT. X” which shows a relationship between workload and the risk of work accidents. The results of the analysis using the chi-square test showed a p-value of 0.039, which is smaller than α (0.05). This means that there is a significant relationship between workload and the risk of work accidents at PT. X (19). However, this is not in line with the research conducted by Di and Soeradji in 2016 in their study entitled "The Relationship Between Workload and Accident Rates: The Relation Between Workload and Workplace Accidents," which found no significant relationship between workload and work accident rates. However, this study still emphasizes that excessive workload can cause work stress, which can then lead to workplace accidents (20).

The relationship between workload and workplace accidents is very complex and influenced by various factors such as physical and mental fatigue, the work environment, work schedule arrangements, and compliance with safety procedures. Therefore, it is important for companies to audit their human resource management systems and ensure that employee workloads are well managed to reduce the risk of accidents. High workloads often cause physical and mental fatigue in workers. When workers feel tired, their concentration and alertness decrease, which increases the risk of negligence and errors in performing tasks. Workers who are burdened with heavy tasks in a short period of time tend to be unable to complete their work properly, thereby increasing the likelihood of errors. Workers who are burdened with heavy tasks in a short period of time tend to be unable to complete their work properly, thereby increasing the likelihood of errors (21).

Relationship Between Length of Service and Work Accidents among Heavy Equipment Operators at PT. Subur Sedaya Maju

Based on the results of research related to the relationship between length of service and work accidents at PT. Subur Sedaya Maju, based on the results of statistical tests using the chi-square test, there is a significant

relationship between length of service and work accidents at PT. Subur Sedaya Maju with a p-value of 0.048 < α 0.05.

Conversely, workers with longer tenure tend to have better experience in dealing with dangerous situations and understand the importance of safety in the workplace. Research by Puteri and Afrianti at 2019 entitled "Factors Related to Work Accidents Among Technical Service Unit Employees at PT. PLN Bangkinang City" indicates that while long-term employees may have greater knowledge about safety, they may also become less vigilant over time, potentially neglecting safety procedures. The results of this study indicate that even though veteran workers have experience, they can still experience accidents if they do not comply with safety protocols. There is a difference in the risk of workplace accidents between workers with long and short tenure. New workers tend to have a higher risk due to their lack of experience and knowledge of safety procedures. However, veteran workers can also be at risk if they neglect safety practices because they feel overconfident (22).

New employees (with ≤ 2 years of service) tend to have a higher risk of experiencing workplace accidents compared to experienced employees (with > 2 years of service). This is due to a lack of experience and knowledge of adequate safety procedures. New employees usually do not yet fully understand the risks that exist in the New employees usually do not fully understand the risks that exist in the workplace and how to avoid them. As their length of service increases, employees usually develop better skills and knowledge about their tasks. This includes a deeper understanding of the use of personal protective equipment (PPE) and proper safety procedures (23).

Multivariate Results

Based on the results of the study, work fatigue is the most dominant variable with a p-value of 0.012 (p-value < 0.05), even after controlling for other variables such as age, workload, and length of service. The work fatigue variable has an OR value of 0.294 (0.114-0.762). This OR value means that workers who experience work fatigue are 11.4% more likely to experience a work accident compared to workers who do not experience fatigue at PT. Subur Sedaya Maju.

This is in line with research conducted by Triana and Wahyuni at 2017 in a manufacturing company, which shows that work fatigue significantly increases the risk of workplace accidents, where workers who experience fatigue are more likely to experience decreased concentration and alertness while working (24). A similar point is also explained by Rudyarti, who states that physical and mental fatigue due to excessive workloads can reduce work performance and increase the likelihood of accidents in the workplace. Fatigue also affects a person's reaction time. When a person's body or mind is fatigued, reactions to urgent situations, such as avoiding danger or responding to warnings, become slower. In addition, when a person feels tired, there is a tendency to ignore existing safety procedures or standards. For example, tired workers may not want to follow time-consuming safety measures, such as wearing personal protective equipment (PPE) or checking the condition of machinery. Decisions like this increase the risk of accidents, both minor and fatal (25).

Recommendation for Future Research

Further research suggestions or recommendations are to develop and add variables that were not examined in this study, such as K3 socialization, length of service, housekeeping, noise, and others, as well as to identify the dominant factors causing work accidents in the construction sector.

CONCLUSIONS

The conclusion of the study is the majority of respondents were over 35 years old, with most having normal nutritional status. The level of workload varied among respondents, with most falling into the moderate workload category, while a small number had a heavy workload. In addition, the majority of respondents had a long period of employment. Then, that there was a significant relationship between work fatigue, age, workload, and length of service with work accidents at PT. Subur Sedaya Maju. There was no significant relationship between the nutritional status of workers and work accidents at PT. Subur Sedaya Maju.

CONFLICTS OF INTEREST

All Author Declare No. conflict of interest

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