



The Relationship Between The Risk Of Obstructive Sleep Apnea (Osa) And The Safety Performance Of Crane Operator Workers At Pt Terminal Petikemas Belawan

Lizahra Izzati¹, Gerry Silaban², Evi Naria³

¹Master Student, Faculty of Public Health, Universitas Sumatera Utara, Medan, Sumatera Utara, Indonesia

^{2,3} Faculty of Public Health, Universitas Sumatera Utara, Medan, Sumatera Utara, Indonesia

email: izzatilizahra@gmail.com

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Abstract

Obstructive Sleep Apnea (OSA) is a disorder characterized by the repeated collapse of the upper airway during sleep. This condition leads to loud snoring and choking in individuals with OSA, often causing them to wake up frequently during the night and experience excessive daytime sleepiness. The aim of this research is to determine the relationship between the risk of OSA and the safety performance of crane operator workers at PT Terminal Petikemas Belawan.

This study utilizes quantitative methods with a cross-sectional research design, which involves simultaneous observation, data collection, and data measurement. The research results reveal a significant relationship between OSA and safety performance. The bivariate test demonstrates a positive correlation coefficient of 0.570 with a p-value of 0.000, leading to the rejection of the null hypothesis (H0). Furthermore, when considering the moderating variable "unsafe actions," it amplifies the influence on safety performance to 37.7%, compared to the initial 32.5% impact of OSA alone. This indicates that the moderating variable strengthens the relationship between OSA risk (X) and the safety performance variable (Y). It is hoped that company leaders will take steps to educate all employees about OSA, including its symptoms, impact, and the importance of early detection. Moreover, they should strive to implement routine health checks, including sleep assessments and OSA screening for employees.

Keywords: OSA; safety performance; crane operator ; unsafe action

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Introduction

Safety performance refers to the evaluation and measurement of how effectively a system, organization, or individual can maintain safety and reduce the risk of injury or danger. It reflects the extent to which safety precautions, procedures, policies, and practices have been implemented and are effective in protecting individuals and preventing accidents or incidents. This encompasses various factors, including compliance with safety standards, the implementation of safety procedures, risk monitoring, adequate training, and the establishment of a strong safety culture. Safety performance can be measured in various ways, such as the rate of accidents or incidents, the number of reported injuries, the level of compliance with safety procedures, or an overall risk assessment. The primary goal of safety performance is to create an environment free from injury and risk for all individuals involved in a particular activity or environment.

Work-related accidents have long been considered a health, social, and economic risk factor in industrial societies. In this decade, international labor organizations have noted that an estimated 1,000 people globally die every day due to work accidents. According to the latest global estimates, there were approximately 380,000 work-related deaths worldwide in the reporting year of 2019 (ILO, 2019).

Several factors influence worker safety performance, including aspects such as fatigue, sleep disturbances, and supervision. Sleep disorders refer to conditions that affect a person's sleep patterns, which can involve difficulty falling asleep, disturbed sleep, or other factors impacting sleep quality. One sleep disorder that often occurs in workers is Obstructive Sleep Apnea (OSA), a health disorder prevalent not only in developed but also in developing countries. A study reports that OSA affects nearly 1 billion people worldwide, with moderate to severe OSA experienced by 425 million adults aged 30 to 69 years (Malhotra et al., 2021).

Obstructive sleep apnea (OSA) is a sleep disorder characterized by temporary cessation or significant reduction in airflow during sleep. This disorder occurs when the upper airway repeatedly becomes blocked during sleep, resulting in breathing problems that often occur multiple times in one night. OSA can impact one of the United Nations Sustainable Development Goals



(SDGs), specifically the eighth goal, which aims to maintain the sustainability of people's social lives by providing decent work, preventing work-related accidents and diseases, and enhancing quality of life. OSA can increase the prevalence of fatigue, depression, heart disease, diabetes, and other complications that can affect people's well-being and health (WHO, 2018).

This disorder elevates the risk of death because decreased oxygen levels in the body cause the body to become stressed, leading to a faster heart rate and narrowing of the blood vessels. This results in high blood pressure, rapid pulse, increased blood volume, and inflammation. The risk of OSA can also interfere with a person's ability to obtain decent employment, affecting concentration and job performance, ultimately hindering their economic well-being. Such disruptions can create socio-economic disparities and impede the fulfillment of the SDGs' goals of achieving social justice and prosperity for all levels of society (WHO, 2022).

Work accidents caused by drowsiness pose a serious risk for workers in the container industry. When workers experience fatigue or lack of sleep, their alertness decreases, concentration wanes, and reactions slow down. This can lead to human errors, vehicle accidents, or other potentially dangerous incidents. Lack of sleep or insufficient sleep is the primary cause of fatigue and drowsiness. Workers who regularly don't get enough sleep may experience decreased motor and cognitive function.

Companies providing ship loading and unloading services are known to have a high potential for workplace hazards and accidents, posing risks to workers, including those at PT Terminal Petikemas Belawan in Medan. PT Terminal Petikemas is a terminal operator that offers container services through an integrated and standardized network system. It operates under the umbrella of the largest port operator in Indonesia, a subsidiary of BUMN (Persero). Companies in this industry must establish an occupational safety and health management system to regulate the use of personal protective equipment, safety rules for workers, and measures to prevent work accidents and work-related illnesses.

Work accidents can also result from unsafe actions or behaviors. Unsafe acts refer to actions or behaviors performed by individuals in a work environment that can lead to injury, harm,



or potential risks to themselves or others. Unsafe actions often involve disregarding safety procedures, wearing inappropriate personal protective equipment, or engaging in actions that contradict established safety practices in the workplace.

Container loading and unloading service companies are particularly prone to accidents resulting from unsafe actions, especially during container operations such as loading, unloading, or handling. Given the involvement of heavy equipment and the associated high risks, the operation of forklifts, cranes, or other heavy machinery must be carried out by trained and licensed operators. Unsafe use of heavy equipment can lead to severe accidents. Preventing such unsafe actions is crucial to avoiding accidents in container loading and unloading service companies.

PT Terminal Petikemas Belawan, a subsidiary of PT Pelindo Indonesia (Persero), operates in the service sector, with a focus on providing the largest container cargo terminal services in Sumatra. PT Terminal Petikemas Belawan is dedicated to enhancing service productivity through continuous innovation, including the addition of equipment and the expansion of dock facilities to improve efficiency. The company places a strong emphasis on occupational safety and health, beginning with efforts to prevent work accidents, aiming for zero accidents, and reducing work-related diseases. This includes conducting annual medical check-ups for all workers, including crane operators, and ensuring a safe and healthy work environment by mandating the use of personal protective equipment (PPE) for all workers within the work zone. Workers are also required to adhere to the company's established rules and regulations.

Being a crane operator in the container industry is a demanding job that involves operating heavy equipment at heights. To perform this role, workers must receive training on the fundamentals of operating heavy machinery. This profession carries a high risk of injury, and crane operators can work safely only when they are in good physical and mental health. As part of this commitment to safety, PT Terminal Petikemas Belawan requires all of its workers, including crane operators, to undergo a general medical check-up annually in December.



Methods

The research employs a cross-sectional research design, which involves simultaneous observation, data collection, and data measurement. The primary objective of this study is to determine the relationship between the risk of OSA and the safety performance of crane operators at PT Terminal Petikemas Belawan. The study's population consists of all crane operators at PT Terminal Petikemas Belawan, totaling 140 individuals. The research selected a sample using a proportional random sampling technique or a random sampling technique based on the workers' daily schedule list. Consequently, a sample of 104 individuals was chosen for this study. Measurement and evaluation in this research were conducted using questionnaire questions that had undergone validity testing for both the dependent and independent variables. For variable measurement, a standard questionnaire from the American Academy of Sleep Medicine, specifically the Berlin Questionnaire Screening, was modified to suit the research requirements. Additionally, a questionnaire for the moderating variable was used, and it had been tested for validity. The research methodology employed Product Moment Correlation analysis, also known as Pearson correlation analysis. This analysis method is used to assess the strength of the linear relationship between two variables with normal data distribution.

Results

Description of the Characteristics of Crane Operator Workers at PT Terminal Container Belawan

The respondents in this study were crane operators at PT Terminal Container Belawan. The total sample in this study was 104 people with worker characteristics including age, education level, length of service, neck circumference, blood pressure, smoking habits, length of work and type of crane used.



Crane Operator Worker Characteristics at PT Terminal Container Belawan

The characteristics of workers based on age are dominated by workers with an age range of 28-38 years totaling 97 people with a percentage of 93.3%. The characteristics of workers based on education level are dominated by workers with a vocational school education level, totaling 57 people with a percentage of 54.8% and a bachelor's level education, totaling 33 people with a percentage of 31.7%. The characteristics of workers based on length of service are dominated by workers with 11-20 years of service, totaling 85 people with a percentage of 81.7%.

The characteristics of workers based on neck circumference are dominated by workers with a neck circumference of 43-51 cm, totaling 68 people with a percentage of 65.4%. The characteristics of workers based on blood pressure are dominated by workers with blood pressure of >140/80 mmHg, totaling 67 people with a percentage of 64.4%. The characteristics of workers based on smoking habits are dominated by workers with smoking habits, numbering 60 people with a percentage of 57.7%, while for the length of work, all 104 workers with a percentage of 100% have the same length of time working, 8 hours.

Table 1. *Distribution of Worker Characteristics at PT Terminal Container Belawan*

Variable		Amount	Percentage (%)
Age			
28-38		97	93.3
39-49		7	6,7
Education			
SENIOR	HIGH	6	5.8
SCHOOL			
vocational school		57	54.8
STM		8	7.7
S1		33	31.7
Years of service			
5-10 Years		19	18.3
11-20 Years		85	81.7
Neck Circumference			
34-42		36	34.6
43-51		68	65.4
Blood pressure			



100/60-140/90 mmHg	37	35.6
>140/90 mmHg	67	64.4
Smoking habit		
No smoking	44	42.3
Smoke	60	57.7
Length of working		
8 hours	104	100.0

Table 2. *Distribution Characteristics Operator Cranes Based on Factor Work*

Variable	Amount	Percentage (%)
Type Tool Cranes		
<i>Rubber tyred gantry</i>	70	67.3
<i>Containers cranes</i>	32	30.8
<i>Harbour mobile cranes</i>	2	1.9

Based on the distribution of worker characteristics, it can be divided based on the type of crane equipment, where the majority of crane operators use *rubber tyred gantry cranes*, 70 people with a percentage of 67.3%, then crane operators use *container crane cranes*, 32 people with a percentage of 30.8% and those who at least 2 crane operators using a *harbor mobile crane with a percentage of 1.9%*.

The Relationship between OSA Risk with Safety Performance Among Cranes Operator Workers in PT Terminal Container Belawan

Bivariate analysis was carried out to determine the relationship between the independent variable, namely OSA, and the dependent variable, namely safety performance.

Classic assumption test

The classical assumption testing carried out by researchers consists of: normality test, linearity test and heteroscedasticity test. The test results for the normality test using the Normal Probability Plot (P P-Plot) test state that the residual data for the OSA risk variable on safety performance is normally distributed. Furthermore, to test the linearity between the risk of OSA and safety performance, it can be concluded that these two variables meet the linearity



requirements. And the heteroscedasticity test tested using Scatterplot shows that there are no symptoms of heteroscedasticity.

Appropriateness Model Test

Coefficient of Determination (R^2) OSA Risk With Safety Performance Among Cranes Operator Workers In PT Terminal Container Belawan

The coefficient of determination shows the extent to which the contribution of the independent variable in the regression model is able to explain variations in the dependent variable. The coefficient of determination can be seen through the R-square (R^2) value in the Model Summary table. R squared is a number that ranges between 0-1 with the condition that the closer to 1 it means the better/stronger it is.

Table 3. *Coefficient determination (R^2) OSA risk with safety performance on Cranes Operator Workers in PT Terminal Container Belawan*

R	R Square	Adjusted Square
0.570 ^a	0.325	0.318

Based on table 3, it is known that the coefficient of determination/R Square value is 0.325, which means that the risk of OSA influences the safety performance variable (Y) by 32.5%. Meanwhile, 67.5% was influenced by other variables outside this regression equation or variables that were not studied. The magnitude of the influence of other variables is also called error. An R square value that is close to 1 indicates a stronger relationship, however, in research using primary data, an R square value of 0.325 is good enough to show the relationship between OSA risk and safety performance.

Coefficient Determination (R^2) Factor Unsafe Action With Safety Performance on Cranes Operator Workers in PT Terminal Container Belawan

Analysis with unsafe action variables is used to add moderating variables that can strengthen or weaken the relationship between the independent and dependent variables. Where in



this research, the *unsafe action variable* as a moderator was added to see the influence between OSA risk and safety performance.

Table 4. *Coefficient determination (R^2) factor unsafe action (Unsafe Action) with safety performance on Cranes Operator Workers in PT Terminal Container Belawan*

R	R Square	Adjusted Square
0.614	0.377	0.358

Based on table 4 above, it is known that the coefficient of determination/R Square value obtained is 0.377. It can be seen that in the previous table, OSA has a relationship with safety performance of 32.5%, so with the moderating variable *unsafe action*, the relationship between OSA and safety performance increases to 37.7%. This figure means that the moderating variable strengthens the relationship between OSA risk (X) and the safety performance variable (Y).

Test Hypothesis (t-Test) OSA Risk With Safety Performance Among Cranes Operator Workers In PT Terminal Container Belawan

Hypothesis testing, also called the t test, is one way to test the truth of the hypothesis proposed in this research. In this study, this test was carried out to prove the hypothesis that there is a relationship between OSA risk and safety performance.

Table 5. *Test results hypothesis (t test) of OSA risk with safety performance Among Cranes Operator Workers in PT Terminal Petikemas Belawan*

tcount	tTable	Hypothesis
7,010	1,983	Hypothesis accepted

Based on table 5, it is known that the t-count has a value of 7.010 which is greater than the t-table, namely 1.983. So it can be concluded that H_0 is rejected and H_a is accepted, which means the hypothesis is accepted where there is a relationship between the risk of OSA and the safety performance of crane operators in PT Terminal Petikemas Belawan.



Analysis Regression Linear Simple

Simple linear regression analysis is used to measure the magnitude of the influence of one independent variable on the dependent variable. In this study, simple linear regression analysis was used to see the relationship between OSA risk and safety performance in crane operators PT Terminal Petikemas Belawan.

Table 6. *Simple linear regression test results*

Variable	B	Sig.
(Constant)	39,924	0,000
OSA	1,904	0,000

Based on table 6 above, it is known that the constant value of 39.924 indicates the causal factor variable, namely the risk of OSA. If the value is 0 (none), then the safety performance for crane operators is 39.924. Based on the OSA risk coefficient (B1) value of 1.904 with a positive value. This means that for every 1 time increase in OSA risk, the safety performance of crane operators will increase by 1.904 assuming other variables are constant. Based on the results of the regression analysis, the risk of OSA has a positive effect on the safety performance of crane operators with a significance value of $0.000 < 0.05$. Therefore it can be concluded that the hypothesis is accepted. This means that there is a significant influence between the risk of OSA on the safety performance of crane operators.

Product Moment Correlation Test

Product Moment correlation test analysis technique , where this test is to see the correlative relationship with a confidence level of significance of 0.01. The following are the results of the analysis tests in this research:

Table 7. *Relationship OSA Risk with Safety Performance Among Cranes Operator Workers in PT Terminal Petikemas Belawan*

Variable	r count	pValue	Decision
OSA Risk	0.570 **	0,000	H0 is rejected



Based on table 7 above, it can be seen that the correlation between the risk of OSA and the safety performance of crane operator workers at PT Terminal Petikemas Belawan shows a positive correlation number of +0.570 with a p-value of 0.000, this shows that there is a fairly strong correlation between the risk of OSA and safety performance of crane operator workers at PT Terminal Petikemas Belawan. Therefore, it can be concluded that the hypothesis is accepted where there is a significant relationship between the risk of OSA and the safety performance of crane operators at PT Terminal Petikemas Belawan.

Discussion

Safety Performance Cranes Operator In PT Terminal Petikemas Belawan

Based on the results of the safety performance questionnaire, the majority of workers consistently participate in and adhere to safety compliance measures at work. Specifically, 48.4% of workers always participate and comply with safety regulations, 14.8% often do so, 26.4% rarely participate and comply, and 10.4% never do. This can undoubtedly impact safety performance at work, as poor safety performance can lead to workplace accidents.

There are four primary physiological determinants of alertness and performance in healthy individuals: 1) circadian phase (time of day); 2) the number of hours awake (acute sleep deprivation); 3) the duration of nighttime sleep (chronic sleep deprivation); and 4) sleep inertia (impaired performance upon awakening). Each of these factors has been independently associated with decreased neurobehavioral performance and an increased risk of accidents (Barger et al., 2009).

According to Gharibi et al. (2020), work incidents refer to undesirable events that disrupt normal operations and have adverse effects on task completion. These incidents vary in severity, from "fatal accidents" to "near misses" in terms of injury. Work incidents generally indicate deficiencies in the safety program and the need for intervention. Employee safety performance can be measured using both reactive and proactive methods.



These findings align with other studies that have reported that employees with sleep disorders and excessive daytime sleepiness (EDS) exhibit poorer safety behaviors, lower levels of safety participation, and a higher risk of non-compliance with safety regulations. This suggests that sleep disturbances can reduce safety compliance and participation by increasing fatigue, decreasing concentration, and impairing self-control, all of which are characteristic of EDS (Gharibi et al., 2020).

Further support for this explanation can be found in the safety compliance scale, which includes items related to adherence to safety rules, procedures, and instructions, as well as the use of appropriate equipment. Similarly, the safety participation scale includes items that assess activities such as assisting coworkers, promoting workplace safety initiatives, and voluntarily participating in workplace health and safety committees (Barger et al., 2009; Barnes et al., 2011; Gander et al., 2011; Gharibi et al., 2020).

Employee compliance with workplace safety is influenced by various factors within workers, such as their inclination to obey rules, organizational commitment, and job satisfaction. External factors, such as socialization and guidance provided by company leaders, can also contribute to compliance (Masial, 2011). OSHA (Occupational Safety and Health Administration) emphasizes the importance of worker compliance, which can be fostered through strong organizational commitment, including a sense of trust, alignment with the organization's goals and values (value commitment), a willingness to exert effort (business commitment), and a strong desire to remain a member of the organization (retention commitment) (Cuming et al., 2008).

Relationship between OSA Risk and Safety Performance Cranes Operator In PT Terminal Petikemas Belawan

Based on the research results, it is evident that there is a relationship between OSA risk and safety performance. The bivariate test reveals a positive correlation coefficient of 0.570 with a p-value of 0.000, leading to the rejection of the null hypothesis (H_0). The hypothesis test indicates that the t-value is 7.010, which is greater than the critical t-table value of 1.983. Consequently, H_0 is rejected, and H_a is accepted, signifying a relationship between the risk of



OSA and the safety performance of crane operators at PT Terminal Petikemas Belawan. This relationship may be attributed to the lack of sleep and poor-quality sleep resulting from sleep apnea, which can diminish a person's ability to concentrate. Additionally, working night shifts and inadequate rest in the morning can lead to worker fatigue. Fatigue and sleep deprivation can reduce work productivity, necessitate more frequent breaks, and result in less efficient work, which can be particularly hazardous for tasks requiring high alertness, such as driving or operating heavy machinery. The coefficient of determination (R Square) value of 0.325, or 32.5%, indicates that OSA risk accounts for 32.5% of the variance in safety performance.

This finding aligns with research by Gharibi et al. (2020), which suggests that OSA risk can lead to poor safety performance. Workers with abnormal daytime sleepiness assessments generally exhibited significantly worse safety performance. In essence, individuals experiencing sleep disorders had lower safety behavior scores and a higher frequency of work accidents or near misses.

Furthermore, previous research has consistently associated extended work shifts with diminished performance in various fields, including healthcare workers, resident doctors, and construction workers. Working 12-hour shifts and frequent overtime have been linked to an elevated risk of errors, work injuries, and medical accidents (Czeisler, 2015).

Another study supports the direct impact of sleep disorders on workplace incidents, particularly in construction workers. This trend aligns with findings in other sectors, and a meta-analysis concluded that workers at risk of OSA were nearly twice as likely to experience work-related incidents. The increased incident rate associated with excessive daytime sleepiness appears to result from fatigue, errors, slips, and impaired cognitive performance (Barnes et al., 2011; Gander et al., 2000).

According to the results of the regression analysis, OSA risk positively affects the safety performance of crane operators. This effect may be attributed to workers consuming caffeine, which helps them stay alert during the day despite experiencing nighttime sleep disturbances. This finding is consistent with research by Ker et al. (2010), which suggests that caffeine can be an



effective intervention to enhance the performance of shift workers. Caffeine, the most commonly used psychoactive drug, increases alertness by stimulating neurons responsible for maintaining arousal while inhibiting neurons involved in promoting sleep (Boutrel 2004). Caffeine can be found naturally in coffee and tea or consumed through 'stimulant drinks,' capsules, or tablets. It is a widely recommended intervention to combat cognitive deficits during military operations (CMNR 2001).

Moderating Variables for Unsafe Actions in Relation to OSA Risk and Safety Performance Variables of Crane Operators at PT Terminal Petikemas Belawan

Based on the research results, it is evident that the moderating variable of unsafe actions increases the influence on safety performance to 37.7%, compared to the previous level where the risk of OSA alone had a 32.5% influence on safety performance. This indicates that the moderating variable strengthens the relationship between OSA risk (X) and the safety performance variable (Y). Unsafe actions can lead to accidents and injuries in the workplace. For instance, neglecting safety procedures when operating machinery or heavy equipment, failing to use appropriate personal protective equipment, or disregarding safety warning signs can result in accidents that pose risks to workers' lives and health.

According to Heinrich (1941), 88% of work accidents result from unsafe acts, 10% are caused by unsafe conditions, and 2% are unavoidable (things that cannot be prevented). This research aligns with a study conducted by Ramdan and Handoko (2016) on the level of work accidents among informal construction workers in Sub-district X, Samarinda City. Their research found a relationship between unsafe actions and the incidence of work accidents with a p-value of 0.026. Similarly, this research corresponds with a study by Nkem et al. (2015) on the relationship between unsafe actions/conditions and work accidents in Nigerian construction companies. Their findings indicated a significant relationship between unsafe actions/unsafe conditions and the incidence of work accidents with a positive correlation.

Furthermore, this research is consistent with a study conducted by Irawati (2020), where the results of the chi-square test concluded that there was a relationship between the variable of



unsafe conditions and work accidents. The analysis of the relationship between unsafe actions and work accidents (involving foreign objects entering the eyes) revealed that 15 individuals (100%) who worked with unsafe actions experienced foreign objects entering their eyes, while 11 individuals (18.3%) who did not work with unsafe actions experienced foreign objects entering their eyes. Out of 60 total cases, 49 (81.7%) did not experience foreign objects entering their eyes. The chi-square test resulted in a p-value of 0.000, indicating a relationship between the variable of unsafe actions and work accidents (foreign objects entering the eye).

Conclusion

Based on research conducted at PT. Terminal Petikemas Belawan can be summarized as follows:

1. The characteristics of workers based on age are dominated by workers with an age range of 28-38 years totaling 97 people with a percentage of 93.3%. The characteristics of workers based on education level are dominated by workers with a vocational school education level, totaling 57 people with a percentage of 54.8% and a bachelor's level education, totaling 33 people with a percentage of 31.7%. The characteristics of workers based on length of service are dominated by workers with 11-20 years of service, totaling 85 people with a percentage of 81.7%. The characteristics of workers based on neck circumference are dominated by workers with a neck circumference of 43-51 cm, totaling 68 people with a percentage of 65.4%. The characteristics of workers based on blood pressure are dominated by workers with blood pressure of >140/90 mmHg, totaling 67 people with a percentage of 64.4%. The characteristics of workers based on smoking habits are dominated by workers with smoking habits totaling 60 people with a percentage of 57.7%, while for the length of work all 104 workers with a percentage of 100% have the same length of work time of 8 hours and the majority of crane operators use rubber tyred gantry crane equipment as many as 70 people with a percentage of 67.3%.



2. Based on the research results, it can be seen that there is a relationship between OSA and safety performance. Based on the results of the bivariate test, it can be seen that the positive correlation number is 0.570 with a p-value of 0.000 so that H_0 is rejected. Based on the hypothesis test, it is known that the t-count has a value of 7.010 which is greater than the t-table, namely 1.983. So it can be concluded that H_0 is rejected and H_a is accepted, which means there is a relationship between OSA and safety performance for crane operators PT Terminal Container Belawan.
3. Based on the research results, it can be seen that with the moderating variable *unsafe conditions*, the influence on safety performance increases to 37.7% from the previous level where OSA alone has an influence of 32.5% on safety performance. This figure means that the moderating variable strengthens the relationship between OSA risk (X) and the safety performance variable (Y).

Suggestion

Based on the conclusions obtained from the research results, the researcher suggests:

For Company Leaders:

1. Increased Awareness and Education: Company leaders can start by educating all employees about OSA, including the symptoms, impact, and importance of early detection. This can be done through seminars, online training, or informative materials that can be accessed by all employees.
2. Routine Health Checks: Provide regular health checks that include sleep checks and OSA screening for employees. This can help detect early health problems that may be associated with OSA and allow for further preventative or treatment measures.
3. Monitoring Safety Performance: Monitoring safety performance regularly, especially for employees who have a higher risk of OSA. Precautions can be taken if significant performance degradation occurs.

For Workers:



Based on research results, the majority of workers experience OSA or sleep disorders, so actions such as:

1. **Regular Sleep Pattern:** Try to have a regular sleep schedule, with enough sleep every day. For workers who get shifts at night, they should rest immediately in the morning with a sufficient number of rest hours and not do other physical activities that can cause workers to experience fatigue and lack of sleep.
2. **Avoid Smoking:** Smoking can cause inflammation of the upper airway and worsen OSA symptoms. Quitting smoking will have a positive impact on your sleep health.
3. **Regular Health Checks:** Have regular health check-ups, including sleep checks, to detect sleep-related health problems early.
4. **Open Communication:** If you have symptoms of OSA or feel like your night's sleep is being disturbed, talk to your boss or HR team to find a solution that will allow you to maintain good quality sleep.



Reference

- Barger, L. K., Lockley, S. W., Rajaratnam, S. M. W., & Landrigan, C. P. (2009). Neurobehavioral, Health, And Safety Consequences Associated With Shift Work In Safety-Sensitive Professions. *Current neurology and neuroscience reports*, 9(2), 155–164. <https://doi.org/10.1007/s11910-009-0024-7>
- Barnes, C. M., Schaubroeck, J., Huth, M., & Ghumman, S. (2011). Lack Of Sleep And Unethical Conduct. *Organizational Behavior And Human Decision Processes*, 115(2), 169–180. <https://doi.org/10.1016/j.obhdp.2011.01.009>
- Czeisler, C. A. (2015). Duration, Timing And Quality Of Sleep Are Each Vital For Health, Performance And Safety. *Sleep health*, 1, 5–8. <https://doi.org/10.1016/j.sleh.2014.12.008>
- Gander, P. H., Merry, A., Millar, M. M., & Weller, J. (2000). Hours of Work And Fatigue-Related Error: A Survey Of New Zealand Anaesthetists. *Anaesthesia And Intensive Care*, 28(2), 178–183. <https://doi.org/10.1177/0310057x.0002800209>
- Gharibi, V., Mokarami, H., Cousins, R., Jahangiri, M., & Eskandari, D. (2020). Excessive Daytime Sleepiness and Safety Performance: Comparing Proactive and Reactive Approaches. *The International Journal of Occupational and Environmental Medicine*, 11(2), 95. <https://doi.org/10.34172/IJOEM.2020.1872>
- ILO. (2019). Safety and Health at the Heart of the Future of Work: Building on 100 years of experience: ILO, 2019 Crowley K. Sleep and sleep disorders in older adults. *Neuropsychol Rev* 2011;21(1):41–53.
- Irawati, I. (2020). Hubungan Unsafe Condition Dan Unsafe Action Dengan Kecelakaan Kerja (Kemasukan Gram Pada Mata) Pekerja Pengelasan. *Jurnal kesehatan*, 9(2), 1167–1172. <https://doi.org/10.38165/jk.v9i2.83>
- Malhotra, A., Ayappa, I., Ayas, N., Collop, N., Kirsch, D., Mcardle, N., Mehra, R., Pack, A. I., Punjabi, N., White, D. P., Gottlieb, D. J., & Force, T. (2021). *Metrics Of Sleep Apnea Severity : Beyond The Apnea-Hypopnea Index. March*, 1–16. <https://doi.org/10.1093/sleep/zsab030>
- Masial, Uanda & Pienaar, Jacob. (2011). Unravelling Safety Compliance in the Mining Industry : Examining the Role of Work stress, Job Insecurity, Satisfaction and Commitment as Antecedents. SA Industrial Psychologi Journal. Potchefstroom South Africa : OASIS.
- Nkem, A. N., hassim, m. H., & kidam, k. (2015). Relationship Between Unsafe Acts/Condition And Accidents In Construction Company In Nigeria. *Jurnal teknologi*, 75(6), 73–77. <https://doi.org/10.11113/jt.v75.5189>



WHO. (2020). European Regional Obesity Report 2022. Copenhagen: WHO Regional Office for Europe; 2022. Licence: CC BY-NC-SA 3.0 IGO. ISBN: 978-92-890-5773-8

World Health Organization. (2018). Physical Activity. WHO. Retrieved from <http://www.who.int/en/news-room/fact-sheets/detail/physical-activity>