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The Relationship Between Individual Factors and Work Environment Factors with Work Stress in Workers in the Residue Catalytic Cracking Complex (RCC) Area of PT Kilang Pertamina Internasional (Persero) Refinery Unit VI Balongan

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ABSTRACT

The significant work stress trend in the RCC Complex Area, with a percentage in May 2022 of 55.56% in the RCU Unit and 66.67% in the LEU Unit experiencing severe stress which then in June 2023 strengthened this finding where 13.3% of workers experienced high stress and 10% experienced very high stress indicating an urgent need for intervention strategies to overcome stress in the work environment. This study aims to determine the relationship between individual factors and work environment factors on work stress in the RCC Complex Area. The type of research used is an analytical quantitative method with a cross-sectional approach. The sample set was 73 respondents with a purposive sampling technique. The instruments used were the Perceive Stress Scale (PSS) questionnaire and a sound level meter noise measuring device. Data were analyzed using Chi-Square analysis. Based on the Chi-Square test of the Relationship Between Individual Factors and Work Environment Factors with Work Stress in Workers in the RCC Complex Area of PT Kilang Pertamina Internasional (Persero) RU VI Balongan, the results showed that those that had a relationship with work stress ($p<0.05$) were age ($p=0.000$), length of service ($p=0.016$), level of education ($p=0.002$), and noise ($p=0.001$). While those that were not related to work stress were marital status ($p=0.573$). From the results of this study, it can be concluded that there is a significant relationship between age, length of service, level of education, noise with work stress in workers in the RCC Complex Area of PT Kilang Pertamina Internasional (Persero) RU VI Balongan.

Keywords: Job Stress, Individual Factors, Work Environment Factors, Noise

INTRODUCTION

Work stress is a condition of tension that causes an imbalance in the psychological state of workers, which can affect their thought patterns, emotions, and conditions. Stress can arise from external factors originating from environmental pressure, or from the individual's own internal

perception10Top of FormBottom of Form[19[. These individual (interpersonal) factors include age, length of service, gender, education level, and marital status11. According to Marliani15, factors causing work stress also include work environment factors, such as temperatures that are too hot or cold, noise, and lack of lighting15. According to data from the Health and Safety Executive (HSE) in 2020, the average prevalence of work-related stress, depression, and anxiety in the industrial sector was recorded at 1,579 cases per 100,000 workers. Based on the 2018 Basic Health Research, the level of work stress reached 35%, which can have fatal consequences, and it is estimated that around 43% of work days are lost due to this condition.

PT. Kilang Pertamina Internasional Refinery Unit VI Balongan is a Processing Directorate owned by PT. Pertamina (Persero) which has the task of processing and mining Indonesian oil and natural gas. One of the areas in RU VI is the Residue Catalytic Cracker Complex (RCC), the function of this unit is to process oil residue into several high-value products, such as: Gasoline, LPG, Decant Oil, Light Cycle Oil, Propylene, and Poly Gasoline. (Overview of PT KPI Internasional RU VI Balongan, 2022). Based on data from the May 2022 Occupational Health Monthly Report, it shows that the RCC Complex unit experiences high levels of work stress, with a percentage of severe stress of 55.56% in the RCU Unit and 66.67% in the LEU Unit. The latest survey in June 2023 reinforces this finding, showing that 13.3% of workers experience high stress and 10% experience very high stress. These findings indicate a continuing trend of work stress in the RCC Complex Area.

Based on researchHsu[7], the group of workers aged 55-64 years, have superior psychological health7. Older workers may face more obstacles and stress at work, such as in dealing with physical strength limitations and health problems, gaps related to the use of new technologies, and engagement in work. Research byZulkifli et al.[17], shows that respondents with a work period of > 3 years who experience work stress amounted to 19 respondents (47.5%). This is because the higher the routine carried out, the easier it is for workers to experience work stress. Workers with longer work periods tend to have better abilities and understanding of their work compared to workers with shorter work periods. Marital status according to its influence can be positive or negative depending on how a person assesses a problem. Research by Rambe & Bahri showed a significant relationship between marital status and work stress, with a p value of 0.00411. However, the research conductedHakiki et al. 6shows that there is no relationship between marital status and work stress with a p value of 0.3316. Based on the researchMualim & Adeko[8] found

that there is a significant relationship between education level and work stress8. Individuals with higher education tend to be more able to cope with stress wisely compared to those with diploma education. In the oil and gas processing industry, in the work environment factor, noise is one of the health problems that often arise. Research by6, found that there is a significant relationship between noise intensity and work stress levels with a p-value = 0.042, where workers who are in noisy locations above the NAB experience higher stress levels than workers in noisy locations below the NAB16.

Based on the Occupational Health Hazard Monitoring Report for Quarter III of 2022, the RCC Complex Area has the highest potential hazard, namely noise hazards. Monitoring of potential noise hazards conducted in November 2022 with a total of 157 measurements, it was found that the total noise measurement points exceeding the NAB were 80 points or 50% of the 160 measurement points. Noise sources exceeding the NAB come from Compressors, Vessels, Pumps, Heat Exchangers, COBs, Furnaces. In addition to causing temporary or permanent hearing loss, noise is also a source of stress that triggers increased alertness and psychological imbalance1.

This study is important because there is still a trend of work stress in the RCC Complex Area that is ongoing which is followed by noise hazard factors that exceed the NAB, and there has been no further research to find factors that cause high work stress levels in the RCC Complex Area. Therefore, after seeing the conditions in the field, a more in-depth study is needed regarding "The Relationship between Individual Factors and Work Environment Factors with Work Stress in Workers in the Residue Catalytic Cracking Complex (RCC) Area of PT Kilang Pertamina Internasional (Persero) Refinery Unit VI Balongan".

METHOD

This study uses a quantitative analytical method with a cross-sectional approach. The dependent variable in this study is work stress, while the independent variables are age, length of service, marital status, education level, and noise. This study was conducted in May - July 2024 in the Residue Catalytic Cracking Complex (RCC) area covering the Residue Catalytic Cracking Unit (RCU) and Light End Unit (LEU) units at PT. Kilang Pertamina Internasional Refinery Unit VI Balongan. In this study, the population was all workers in the Residue Catalytic Cracking Complex (RCC) area, namely 89 workers with a sample size of 73 people using a purposive sampling technique based on inclusion and exclusion criteria. The primary data in this study is noise data in

the RCC Complex area, which was collected through measurements using a 3M SE-402 Type 2 Sound Level Meter. Secondary data in this study include the results of work stress measurements and individual worker data using the Perceive Stress Scale (PSS) questionnaire in the RCC Complex area in May - June by a company psychologist. Data analysis was carried out using the SPSS version 25 computer program, namely univariate and bivariate analysis. Bivariate statistical analysis used the Chi-Square Test with an alternative test of the 2Xk table Kolmogorov Smirnov Test.

RESULTS

The results of the univariate analysis of the independent variables of individual factors (age, length of service, marital status, level of education) and work environment factors (noise), as well as the dependent variable, namely work stress, are as follows:

Table 1. Univariate Analysis Results of Age, Length of Service, Education Level, Marital Status, Noise, and Work Stress of RCC Complex Area Workers

Variables	Frequency	Presentation
	N=73	(%)
Age		
Early Adulthood (20 – 30 years)	29	39.7
Middle Adult (30 – 60 years)	44	60.3
Years of service		
New (5 years)≤	12	16.4
Old (5 years)>	61	83.6
Marital status		
Not Married	6	8.2
Marry	67	91.8
Level of education		
Secondary Education (SMA/SMK/MA or equivalent)	20	27.4

Higher Education (Diploma, Bachelor)	53	72.6
Noise		
Noise (> 85 dBA)	48	65.8
Noise Free (≤ 85 dBA)	25	34.2
Job Stress		
High Stress	2	2.7
Moderate Stress	41	56.2
Low Stress	22	30.1
No Stress	8	11.0

Source: Secondary Data Division of Occupational Health May – June 2024

The presentation table of the bivariate analysis of the relationship between the independent variables of individual factors (age, length of service, marital status, level of education) and work environment factors (noise) with the dependent variable, namely work stress, can be seen in the following table.

Table 2. Bivariate Analysis of the Relationship between Age, Length of Service, Marital Status, Education Level, and Noise with Work Stress inRCC Complex Area

Variables	Job Stress								Total		P Value	Results
	High Work Stress		Moderate Job Stress		Low Work Stress		No Stress		N	%		
	N	%	N	%	N	%	N	%				
Age												
Early Adulthood (20 – 30 years)	2	6.9	27	93.1	0	0.0	0	0.0	29	39.7	0,000	There is a Relationship
Middle Adult (30 – 60 years)	0	0.0	14	31.8	22	50	8	18.2	44	60.3		
Years of service												

New (5 years)≤	2	16.7	10	83.3	0	0.0	0	0.0	2	16.7	0.016	There is a Relationship
Old (5 years)>	0	0.0	31	50.8	22	36.1	8	13.1	61	83.6		
Marital status												
Not Married	2	33.3	3	50.0	1	16.7	0	0.0	6	8.2	0.573	No connection
Marry	0	0.0	38	56.7	21	31.3	8	11.9	67	91.7		
Level of education												
Secondary Education (SMA/SMK/MA or equivalent)	0	0.0	19	95.0	0	0.0	1	5.0	20	27.4	0.002	There is a Relationship
Higher Education (Diploma, Bachelor)	2	3.8	22	41.5	22	41.5	7	13.2	53	72.6		
Noise												
Noise (> 85 dBA)	2	4.2	34	70.8	11	22.9	1	2.1	48	65.8	0,000	There is a Relationship
Noise Free (≤ 85 dBA)	0	0.0	7	28.0	11	44.0	7	28.0	25	34.2		

*p-value < 0.05

Source: Secondary Data Division of Occupational Health May – June 2024

Table 2 results of bivariate statistical tests show that there is a relationship between age, length of service, education level, and noise with work stress. Meanwhile, there was also no relationship between marital status and work stress in workers in the RCC Complex Area of PT Kilang Pertamina Internasional RU VI Balongan.

DISCUSSION

The Relationship between Age and Work Stress

Age is one of the factors that influence the extent to which individuals can tolerate stress and the most dominant type of stressor. In this study, 2 categories were obtained, namely early adulthood aged between 20 and 30 years, and middle adulthood aged between 31 and 60 years.

The results of the study on 73 respondents in the RCC Complex area showed that in Early Adulthood, 2 people (7.1%) experienced high stress levels, 27 people (93.1%) experienced moderate stress, no respondents (0%) experienced low stress, and none (0%) were not stressed. Meanwhile, in Middle Adulthood, no one experienced high stress (0%), 14 people (31.8%) experienced moderate stress, 22 people (50%) experienced low stress, and 8 people (18.2%) were not stressed. From the results of this study, it was found that respondents in the Early Adult age category had significantly higher stress levels compared to the Middle Adult age category. The majority of respondents in the Early Adult age category experienced moderate stress. Conversely, in the Middle Adult age category, the proportion of respondents who experienced low stress and no stress was higher. Based on the Chi-Square statistical test with the alternative test of the 2xK table, the Kolmogorov Smirnov test obtained a significant value of $p = 0.000 < 0.05$ which proves that there is a relationship between age and work stress in workers in the RCC Complex area of PT Kilang Pertamina RU VI Balongan. This finding indicates that the early adult age group has a higher level of stress.

The results of the study on the relationship between age and work stress in the RCC Complex area are in line with researchHsu, which shows a relationship between age and work stress in the Taiwan Worker Population in 2015 with a significant p value = 0.035 [7]. Another study that supports these results is a study byCarwadi & Juwitawho found a significant relationship between age and work stress in production workers at PT. B during the period March – May 2018 with a significance p value = 0.000 [3].

This is in line with existing theories. For ages that are classified as teenagers or early adults, their level of maturity is generally not optimal, they tend to change their minds easily, and their ability to have low realistic thinking makes it difficult for them to accept the tasks given. Conversely, for ages that are included in the older category. The older a person is, the more capable they are in carrying out responsibilities and tasks. As a person's age increases, the ability to make decisions,

think rationally, control emotions, and accept other people's views also increases, so that resistance to stress becomes better. The older the respondent is, the lower their work stress level will be.

The Relationship between Work Period and Job Stress

According to Law Number 13 of 2003 concerning Manpower, the length of service or length of employment of employees is calculated from the first time an official employment relationship occurs between the company and the employee, which is based on an employment agreement. Long work experience can increase a person's ability to cope with stress. A person with a longer work period has become accustomed to various situations and has developed mechanisms for dealing with situations that make coping with stress effective, compared to individuals with a newer work period due to the lack of experience they have.

The results of the study on 73 respondents in the RCC Complex area showed that in the new work period, 2 people (16.7%) had high stress, 10 people (83.3%) had moderate stress, no one (0%) had low stress, and no one (0%) was not stressed. Meanwhile, in the old work period, no one (0%) had high stress, 31 people (50.8%) had moderate stress, 22 people (36.1%) had low stress, and 8 people (13.1%) were not stressed. From the results of this study, it can be seen that respondents in the new work period have significantly higher stress levels compared to those in the old work period. The majority of respondents in the new work period category are at the moderate stress level. Conversely, in the group of respondents in the old work period category, the proportion of respondents at low stress and no stress levels is higher. Based on the Chi-Square statistical test with the alternative test of the 2xK table, the Kolmogorov Smirnov test obtained a significant value of $p = 0.016 < 0.05$ which proves that there is a relationship between work period and work stress in workers in the RCC Complex area of PT Kilang Pertamina RU VI Balongan. This finding indicates that new workers tend to experience higher levels of stress. The results of the study on the relationship between work period and work stress in the RCC Complex area are in line with research byZulkifli et al.who found that there was a relationship between length of service and work stress in employees of the Service Well Company PT. Elnusa Tbk Muara Badak Region in 2018, with a p value = 0.017 [17].

This is in line with existing theory. The more senior a person is in a company, the lower the risk of experiencing work stress. Adaptation to a new work environment, pressure to prove oneself, and concerns about promotion opportunities or career development can be sources of stress for

new workers. And shows that as the length of service increases, workers tend to be better able to manage stress, both through increased skills and a better understanding of the job and work environment.

The Relationship between Marital Status and Work Stress

Based on Law Number 16 of 2019, marital status is defined as a legal condition recognized by the state, which indicates a legal relationship between a man and a woman as husband and wife. This relationship is based on a legal marriage bond and is protected by law. Marital status is divided into 2 categories, namely married and unmarried.

The results of the study on 73 respondents in the RCC Complex area showed that in the unmarried marital status, 2 people (33.3%) had high stress, 3 people (50.0%) had moderate stress, 1 person (16.7%) had low stress, and no respondents (0%) were not stressed. While in the married marital status, no respondents (0%) had high stress, 38 people (56.7%) had moderate stress, 21 respondents (30.9%) had low stress, and 8 respondents (11.9%) were not stressed. From the results of this study, it can be seen that respondents with unmarried marital status had significantly higher stress levels compared to those who were married. The majority of unmarried respondents experienced moderate stress. Conversely, in the group of respondents who were married, the proportion of those who experienced low stress and no stress was higher. Based on the Chi-Square statistical test with the alternative test of the 2xK table, the Kolmogorov Smirnov test obtained a significant value of $p = 0.573 < 0.05$ which proves that there is a relationship between marital status and work stress in workers in the RCC Complex area of PT Kilang Pertamina RU VI Balongan. This finding indicates that other factors such as age, length of service, education level, and noise have a stronger influence on work stress levels.

The results of the study on marital status and work stress in the RCC Complex area are in line with research that...Muallivasari et al.who found that there was no significant relationship between marital statuswith work stress of workers at PT. Maruki Internasional Indonesia Makassar with a significant p value = 0.451 [9]. Other research that supports these results is a study byGayen & Lakhotia (2021) which shows no significant difference between married and unmarried men in their job stress levels with a p value = 0.602 [5].

Marital status can have a positive or negative effect depending on how an individual assesses the problems they experience. Studies show that someone who is married tends to have a higher level

of life satisfaction. This can be attributed to the existence of a strong social support system in the family, which allows individuals to focus more on self-development and career. Social support from partners and family can be an effective buffer factor in dealing with work pressure. Meanwhile, for unmarried respondents, more complex life burdens, such as personal responsibilities and careers that are being built, have the potential to be a significant source of stress for workers with unmarried marital status.

On pthis researchinterpretedthat statusweddingNobe a causal factorwork stress. Results stratificationif you look at the variables of age, length of service, level of education, and noise. It can be foundthat both workers with statusMarryor not yetMarry, if they havecategories in early adulthood, new work period, secondary education level and working in noisy workplacesthen manyfrom themexperiencing moderate stress andtall.While both workers with statusMarryand alsonot married, if they havemiddle adulthood, long service life, high education level and working in a quiet workplacesomany workers whoexperiencing stresslow or no stress.So, it can be concludedstatusweddingnot to befactorcauses of stressWork but rather the work stresscan influenced byother variables, such as age, length of service, education level, and noise.

The Relationship between Education Level and Work Stress

According to Law Number 20 of 2003, education can be interpreted as a conscious effort and a person's plan to create a learning atmosphere and learning process so that students can actively develop their potential. In this study, 2 categories of education levels were obtained, namely secondary education level (SMA/SMK/MA Equivalent) and higher education level. (Diploma, Bachelor) [16]. Higher education levels have better skills and knowledge of work methods compared to workers with lower education levels.

The results of the study on 73 respondents in the RCC Complex area showed that at the secondary education level, none experienced high stress (0%), 19 people (95.0%) experienced moderate stress, none experienced low stress (0%), and 1 person (5.0%) was not stressed. Meanwhile, at the higher education level, 2 people (3.8%) experienced high stress, 22 respondents (41.5%) experienced moderate stress, 22 respondents (41.5%) experienced low stress, and 7 respondents (13.2%) were not stressed. From the results of this study, it can be seen that respondents with secondary education tend to experience higher levels of stress when compared to respondents with higher education. The majority experience moderate stress. Conversely, in the group of

respondents with higher education, the distribution of stress levels is more even. Based on the Chi-Square statistical test with the alternative test of the 2xK table, the Kolmogorov-Smirnov test obtained a p-value = 0.002 <0.05 proving a relationship between noise and work stress in workers in the RCC Complex area of PT Kilang Pertamina RU VI Balongan. This finding indicates that workers with secondary education tend to experience higher levels of stress.

The results of the study on the relationship between education level and work stress in the RCC Complex area are in line with researchMualim & Adekowhich shows that there is a relationship between education level and work stress in dryer workers at PT. Bukit Angkasa Makmur in Central Bengkulu Regency in 2019 where the significant p value = 0.025[8].

This is in line with existing theories. Indicating that individuals with secondary education may face greater challenges in meeting job demands, thus potentially experiencing higher stress. And it can be seen that individuals with higher education tend to be superior in terms of skills and knowledge to overcome challenges in the workplace, thus reducing their stress levels.

The Relationship between Noise and Work Stress

Noise is anything unwanted that comes from production equipment and/or work tools, which at a certain level can cause hearing loss. Excessive noise can damage our physical and mental health. In addition to causing hearing loss, noise can also trigger stress, disrupt sleep quality, and reduce productivity.

The results of the study on 73 respondents in the RCC Complex area showed that in workers working in noisy areas, 2 people (4.2%) experienced high stress, 34 people (70.8%) experienced moderate stress, 11 people (22.9%) experienced low stress, 1 person (2.1%) was not stressed. Meanwhile, in workers working in quiet areas, no one experienced high stress (0%), 7 people (28.0%) experienced moderate stress, 11 people (44.0%) experienced low stress, and 7 people (28.0%) were not stressed. From the results of this study, it can be seen that respondents working in noisy areas have significantly higher stress levels compared to respondents working in quiet areas. The majority of respondents with noisy work areas experience moderate stress. Conversely, in respondents with quiet work areas, the proportion of those experiencing low stress and no stress is higher. Based on the Chi-Square statistical test with the alternative test of the 2xK table, the Kolmogorov Smirnov test obtained a significant value of p = 0.001 <0.05 which proves that there is a relationship between noise and work stress in workers in the RCC Complex area of PT Kilang

Pertamina RU VI Balongan. This finding indicates that workers in noisy areas have higher levels of stress.

The results of the study on the relationship between noise and work stress in the RCC Complex area are in line with researchSillehu et al. (2022) that there is an influence of noise on work stress where employees who work in noisy areas tend to experience work stress compared to employees who are outside noisy areas at PT PLN (Persero) Kairatu[14].Another study that supports these results is a study conducted byArdiyansyah et al.who found that there was a significant relationship between noise intensity and work stress levels in workers at the Gotri Gentong Factory in Semarang, p value = 0.000 [3].

Noise exposure, noise disturbance, and noise sensitivity lead to increased job stress and decreased job satisfaction. Noise has a significant positive effect on job stress and the opposite effect on job satisfaction [1].

CONCLUSION

From the results obtained from the study of the Relationship between Individual Factors and Work Environment Factors with Work Stress in Workers in the Residue Catalytic Cracking Complex (RCC) Area of PT Kilang Pertamina Internasional (Persero) Refinery Unit VI Balongan, it was concluded that variables that have a significant relationship with work stress are age (p = 0.000), length of service (p = 0.016), education level (p = 0.002), and noise (p = 0.001). While those that are not related to work stress are marital status (p = 0.573).

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