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AN ANALYSIS OF THE EFFECT OF INDIVIDUAL CHARACTERISTICS AND PHYSICAL WORKLOAD ON SAFETY BEHAVIOR AMONG CEMENT INDUSTRY PRODUCTION WORKERS

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ABSTRACT

Background: Cement industry has a high risk that affects workers' health and safety in carrying out its production activity. We analyzed the effect of age, working period, and work load on production workers' safety behavior.

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Materials and Methods: The design of this study was cross sectional with observational study type. The subjects were 35 production workers. The independent variables were consisted of age, working period, and physical workload. The dependent variable of this study was safety behavior. Data collection technique used questionnaire to discover the age, working period, safety behavior, and direct measurement used calorimeter to discover the work load.

Result: The study revealed no significant association between age and working periods with safety behaviour (The p value of age = 0.6), p value of 2 years working period = 0.937, p value of 3 years working period = 0.999, the p value of working period > 4 years = 0.718. Significant association between level of physical workload with safety behaviour (p value = 0.037).

Conclusion: Age and working period have no effect on safety behavior. However, the level of physical workload significantly affects the safety behavior of production workers.

Keywords: age, working period, physical workload, safety behavior

1.0 Introduction

A labor is a population that is closely related to work and productivity in the workplace. The amount of manpower enhancement is often not balanced with health, safety, and welfare, leading to the emergence of potential workplace hazard¹⁶. Work accident is the final result of causal sequences caused by unsafe behavior. According to the International Loss Control Institute (ILCI), work accident is caused by basic causes that are identified consisting of inadequate physical ability, excessive workload fatigue, injury, lack of knowledge, skill, and motivation Bird³. Bird theory stated that unsafe act or unsafe behavior causes near miss that keeps repeating and can increase the risk of more serious accident. Prasetyawati (2016) stated that 88% of unsafe act, 10% of unsafe condition, and 2% of unknown cause are leading to work accident¹⁰.

Work accident brings harm to the workplace, both in terms of cost, time, productivity, and energy¹⁶. Sarter and Amalberti's (2000) study stated that fatigue causes worker error in doing production work that indirectly impact on the worker and company productivity¹². Work fatigue can cause work accident¹². Physical work load is one of the causes of work fatigue¹. Work accident is also caused by the age and working period factor of the worker¹⁶.

Worker behavior is the root cause of work accident that should be the main focus. Changes in behavioral safety are essential in the development of safe condition¹¹. In manufacturing industry, the behavior-based health is widely used for the development of safe condition in the workplace and effective in reducing the number of work accident⁴. Cement industry has a high risk that affects the health and safety of its worker in carrying out its production activity²⁰.

2.0 Materials and Methods

We used observational analytical study type. The design of this study was cross sectional study where the researcher do observation on dependent and independent variables at one time. The population in this study was all production workers. The sampling technique was determined by simple random sampling. The sample in this study were 35 people. Data collection was conducted in March 2018.

The independent variables in this study were individual characteristics (age, working period) and workload. While the dependent variable was the safety behavior of production workers. Primary data collection was done by using questionnaire and for workload, direct measurement using calorimeter was done. We obtained the secondary data through the documents and archives documented by the company's Health and Safety Department.

Data processing was presented in the frequency distribution table. Overall data were analyzed descriptively. Hypothesis testing used simple logistic regression statistic test.

3.0 Result

3.1 Frequency Distribution of Study Variables

Table 1 Frequency Distribution of Study Variables

Study Variables	Category	N	%
Age	< 28 years old	22	62.9
	≥ 28 years old	13	37.1
	Total	35	100
Working period	2 years	7	20
	3 years	8	22.9
	> 4 years	20	57.1
	Total	35	100
Workload	Moderate	22	62.9
	Heavy	13	37.1
	Total	35	100
Safety Behavior	Less secure	16	45.7
	Secure	19	54.3
	Total	35	100

(Source: Primary Data of Cement Industry Production Workers, 2018)

Data collection used questionnaire to obtain age, working period, and worker safety behavior data. To get the workload data, we used the calorimeter gauge. Table 1 shows that most production workers are < 28 years old with 62.9% and the most working period is > 4 years with 57.1%. Most workers have a moderate workload of 62.9% and the most worker's safety behavior indicates 54.3% of safe category.

3.2 Cross-tabulation of individual characteristics and workload on safety behavior

Table 2 Results of individual characteristics and workload cross tabulation on safety behavior

Variables		Safety Behavior				Total	
		Secure		Less Secure			
		N	%	N	%	N	%
Age	< 28 years old	11	57.9	8	42.1	19	100
	≥ 28 years old	8	50.0	8	50.0	16	100
	Total	19	54.3	16	45.7	35	100
Working Period	2 years	7	100	0	0	7	100
	3 years	3	37.5	5	62.5	8	100
	> 4 years	9	45.0	11	55.0	20	100
	Total	19	54.3	16	45.7	35	100
Work Load	Moderate	15	68.2	7	31.8	22	100
	Heavy	4	30.8	9	69.2	13	100
	Total	19	54.3	16	45.7	35	100

Table 2 shows that the worker with age < 28 years old, most widely have safety behavior of 57.9%. Work that requires a lot of personnel, choose worker with younger age because he/she has a strong physical. Younger worker is less likely to experience work accident than the older worker¹⁶. When viewed from the working period, worker with working period of 2 years, most widely have safety behavior that is equal to 100%. Workers with safety behavior are mostly owned by workers with a heavy workload of 69.2%. Workload is influenced by several factors that are age somatic, gender, body size, nutritional status and health condition⁵.

3.3 The Effect of Age, Working Period, Workload on Safety Behavior

Table 3 The influence of age, working period, workload on safety behavior

Variables		p-Value	Prevalence Ratio (PR)
Age		0.641	-
Working Period	2 years	0.937	-
	3 years	0.999	-
	>4 years	0.718	-
Workload		0.037	2.176

The study result which has been obtained then would be tested statistically using simple logistic regression test ($p < 0.25$) with enter method to discover the influence of age, working period, and workload on safety behavior of cement industry production workers. Table 3 shows that age ($p = 0.641$), 2 years of working period ($p = 0.937$), 3 years of working period (0.999) have no significant influence on safety behavior. Workload ($p =$

0.037) has a significant influence on safety behavior. Worker with heavy workload will be at risk of having unsafe safety behavior of 2.176 times greater than those with moderate workload.

4.0 Discussion

4.1 Age

The age range of cement industry production workers is 23-47 years old. Workers who aged ≥ 28 years as much as 50.0% have less safety behavior. Based on the result of statistical test, we found that age has no significant influence on safety behavior. This is in line with the study of Septiana and Mulyono (2014) which stated that there is no correlation between age and worker's unsafe behavior¹³. This study is also supported by Aminatuzzuhriyah (2017) which stated that there is no influence of age on safety behavior performed on workers with age group ≤ 24 years old and > 24 years old¹. Another study conducted by Frinanda and Paskarini (2014) concluded that the worker's age shows a very low correlation level with safe behavior⁵.

This study is in accordance with the theory of Suma'mur (2009) which explained that the older worker experiences work accident more compared with the younger worker¹⁴. Physical capacity decreases after 30 years old or more. In a job that requires a lot of energy, many companies choose young people because of their strong physical. However, people at the young age is usually still full of emotion, careless, and less experienced so it can lead to the action that endanger the safety and health.

There is no influence between age and safety behavior in this study because maybe there are workers with age ≥ 28 years old who also have safety behavior. When people aged, they tend to show the maturity of their soul, wiser, think more rationally, can control their emotion more, more tolerant to the viewpoint and behavior which differ from themselves, and other traits that indicate the maturity of people's intellectual and psychology⁹.

4.2 Working Period

The percentage of the workers who have less safety behavior are most found in workers with 3 years of working period by 5 (62.5%) workers. Based on the result of statistical test, we found that the working period does not have an influence on the safety behavior of production workers. This study is in line with Aminatuzzuhriyah (2017) who said that there is no effect of working period on worker behavior with category of working period < 5 years, 5-10 years, and > 10 years¹.

Theoretically, Suma'mur (2009) stated that the longer the working period will be more capable to recognize potential workplace hazard based on his/her experience¹⁶. This is also supported by study of Patria (2017) which explained that the longer the working period of the workers, they tend to behaved more safely⁷. Long working period accompanied by continuous knowledge application will be able to improve worker's skill so that the assignment will be done quickly with satisfactory results⁵.

In contrast with the theory, it can be seen in this study that some workers with long working period have less safety behavior. Workers with long working period tend to feel familiar and understand the assignment better so their alertness decrease and unconsciously behave less safely. Thus showing that the working period is not a determinant factor that can affect safety behavior.

4.3 Workload

The worker percentage who has safety behavior is more common in workers with heavy workload of 9 (69.2%). Based on the result of statistical test, we found that heavy workload has a significant influence on the safety behavior of production patroller workers. This study is in line with Bancin (2017) which concluded that there is a significant correlation between workload and unsafe behavior of rubber industry workers². Previous study by Syam (2016) stated that the workload has a weak correlation on workers' safety performance. Workers with mild workload experience boredom and tend to not implement good safety performance¹⁷.

Theoretically, Suma'mur (2009) explained that if the workload is excessive, it will causes physical or mental fatigue and emotional reactions such as headache, indigestion, and irritability¹⁶. For every people, fatigue has its own meaning and subjective. Working fatigue according to Setyawati (2010) is a feeling of tiredness and decrease the alertness. Fatigue tends to reduce the achievement and motivation of the worker up to increase the work accident¹⁴.

The physical workload of cement industry production workers is moderate to severe. Based on the observation result, the main task of the production worker is patrolling the supervision of equipment which supporting the production process. Production worker must ensures that none of the equipment is abnormal, if he/she finds something is not suitable and considered abnormal then the maintenance will be carried out. Production workers admit that they feel quite tired when doing work. The highest calories released by cement industry production workers with workload of four (4) hours work that is equal to 471.59 cal / hour. According to the Decree of *Permenaker* No 5 Year 2018, it is classified as a heavy work load⁸. Physical work environment factors (heat stress and noise) can also affect the fatigue which felt by production patroller workers.

High work pressure will have an adverse impact on workers. Workload is considered as one of the working pressures¹⁵. Thus the workload can be concluded to affect the safety behavior of production patroller workers.

5.0 Conclusion and Recommendation

There is no influence of working period to safety behavior of cement industry production workers. There is influence of work load with safety behavior of cement industry production workers. It is expected that patroller workers exercise routinely to maintain physical fitness. It is also expected that the company will facilitate the fitness program by organizing a healthy gym program once a week to all workers.

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Declaration

Author's declared that no plagiarism in writing this publication and the manuscript not sent to other journal for publication.

Author contribution

Author 1: Novryanti Isa: Data collection, analysis and writing manuscript

Author 2: Noeroel Widajati: Review manuscript

Author 3: Hari Basuki Notobroto: Review manuscript

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