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Relationship of Occupational Accidents to OHS Knowledge, OHS Training, and Use of Personal Protective Equipment in the Welding Process

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Abstract

The swift advancement of science and technology brings convenience to the industrial sector, such as enhancing productivity and increasing the workforce. However, technological development also presents challenges, one of which is the issue of occupational safety and health that can endanger both workers and organizations. Welders frequently overlook the use of personal protective equipment, which may lead to accidents during welding operations. Consequently, this study was conducted to explore the connection between workplace accidents and knowledge of occupational safety and health (OSH), OSH training, and the application of personal protective equipment in the welding process. The employed methods include univariate and bivariate analysis. The findings indicated a significant correlation between OSH knowledge and workplace accidents within the welding process (sig. 0.001 < 0.005). Conversely, there was no notable relationship between OSH training (sig. 0.235 > 0.005) and the use of personal protective equipment (sig. 0.187 > 0.005) concerning welding-related accidents.

Keywords: K3; work accident; welding

1. Introduction

Indonesia's industrial sector is growing at a very quick pace, which encourages the use of machinery and chemicals to support sustainable industry. In the industrial sector, the quick advancement of science and technology offers conveniences like higher worker numbers and increased productivity. However, there are issues with technological advancement, such as the issue of occupational safety and health, which can hurt both businesses and employees.

The main causes of work accidents are unsafe behaviour (88%) and unsafe working conditions (10%) [1]. Three factors cause work accidents in the industrial world: environmental factors, human factors, and equipment factors. Environmental factors related to safety standards in the work environment are inappropriate, such as workplace location, workplace design, slippery floors, air temperature and noise—equipment factors related to tool design, tool condition, and tool position. The human factor is related to human behaviour, worker health, safety training and the use of personal protective equipment. Common causes of work accidents are company operational

standards (SOP) that do not pay attention to worker safety, lack of occupational health safety training to reduce work damage and accidents, and lack of awareness of using personal protective equipment (PPE).

Based on the Minister of Manpower Regulation Number 5 of 2018 concerning Occupational Health Safety in the Work Environment, handling in the workplace is carried out according to the handling hierarchy, including efforts of elimination, substitution, technological engineering, administration or use of Personal Protective Equipment. Personal Protective Equipment (PPE) is used to provide security for workers from the hazards that can occur while working. The use of PPE is very important to protect part or all of the worker's body from potential hazards in the workplace. Based on the Regulation of the Minister of Manpower and Transmigration Number 8 of 2010 concerning Personal Protective Equipment Article 2, employers or management must provide PPE for all workers in the workplace according to Indonesian National Standards or applicable standards.

A safe and healthy work environment will help workers improve efficiency and productivity. However, on the contrary, if the workplace environment is not conducive and there are many dangerous factors, this will cause bad things for workers. In general, companies must strive for the health and safety of workers by increasing the company's operational standards. However, many companies still ignore occupational health safety because of high costs.

According to the International Labor Organization (ILO), around 250 million work accidents occur yearly, 160 million people are disabled due to hazards in the work environment, and 1.2 million workers die due to work accidents. This should be a reference for reducing work accidents by creating a work environment that complies with Occupational Health Safety (K3) standards.

According to the Basic Health Law of the Republic of Indonesia, Number 9 of 1960 Chapter 1 Article II, occupational health is where people obtain the highest degree of physical, spiritual and social health by preventing and treating diseases caused by work and work environment.

Along with advances in industrial technology and the increasing occurrence of work accidents, companies must improve the safety of workers, especially in welding work. Welding is a job that has a high risk of work accidents, so every job is always followed by the potential for accidents. To avoid or minimize accidents, one must master work safety knowledge and know the actions that must be taken so that occupational safety and health can function properly.

From the discussion above, it is necessary to research the Relationship of Occupational Accidents to K3 Knowledge, K3 Training, and Use of Personal Protective Equipment in the Welding Process.

2. Materials and Methods

This research method is the steps that will be taken to obtain sequential and structured research results. Data collection in this study was carried out by making direct observations at the research site and conducting interviews with several informants to determine the conditions in the welding workshop.

In this study, data was collected by conducting interviews and asking written questions to be answered in writing by the respondents. To reflect the conditions, provided alternative answers accompanied the questions, and the respondents only needed to provide the available answers.

Table 1. Survey on the Connection Between K3 Knowledge, K3 Training, and PPE Use in Welding and Occupational Accidents

No	Question	Alternative Answers		
		Less	Enough	Good
1	Have you ever been injured because you didn't use personal protective equipment?	0	6	24
2	Have you ever experienced eye pain because you didn't use welding goggles?	0	12	18
3	Have you ever had respiratory problems while working?	0	7	23

The questions asked to the resource person are by the overall conditions developed. Before being used by researchers, these questions were tested on similar subjects to determine whether

the instrument was appropriate.

2.1 Test of Validity

To ascertain the degree to which the measuring device employed in a measurement can measure what is being measured, a data validity test is conducted. To ascertain the validity of a questionnaire, a validity test was performed. If the questions indicate something that the questionnaire will measure, then the questionnaire is valid [2].

2.2 Reliability Test

The purpose of the reliability test is to ascertain whether a set of measurements or a set of measuring devices are consistent when repeated [3]. The degree to which the test consistently measures the target is determined by the reliability test [4].

2.3 Test Univariate Analysis and Bivariate Analysis using SPSS

Every variable from the study findings is examined using univariate analysis. The measurement data set is summarized by the univariate analysis so that it becomes information that may be used. Bivariate analysis, on the other hand, searches for connections or correlations among the variables under investigation.

3. Results

To ascertain the degree to which the measuring device employed in a measurement can measure what is being measured, a data validity test is conducted. To ascertain the validity of a questionnaire, a validity test was performed. If the questions can provide information that the questionnaire will use to assess something, then the questionnaire is legitimate [2].

The tests used in this study are displayed in the table below based on the findings of the validity test conducted with SPSS.

Table 2. Validity Test Results Using SPSS

Knowledge of K3			
No Questions	R Table	R Count	Information
1	0.361	0.760	Valid
2	0.361	0.618	Valid
3	0.361	0.599	Valid
Occupational Health Safety (K3) Training			
4	0.361	0.542	Valid
5	0.361	0.370	Valid
Use of Personal Protective Equipment (PPE)			
6	0.361	0.599	Valid
7	0.361	0.618	Valid
Work accident			
8	0.361	0.717	Valid
9	0.361	0.737	Valid
10	0.361	0.752	Valid

Based on the results of the validity test that has been carried out, it was found that all data showed validity, where no data value was smaller than the R table value.

Table 3. Reliability Testing Using SPSS

No	Variable	R table	Alpha	Information
1	K3 knowledge	0.6	0.816	Reliable
2	K3 training	0.6	0.842	Reliable
3	PD use	0.6	0.801	Reliable
4	Work Accident	0.6	0.816	Reliable

Reliability testing is carried out to find out whether the questionnaire has consistency if the test is carried out repeatedly with the questionnaire. Based on the tests carried out, it is known that

Cronbach's alpha value is > 0.6, which indicates that the data is reliable. The questionnaire is reliable if Cronbach's alpha value is > 0.6 [5].

1. Univariate analysis

Table 4. Univariate Analysis Test Results Using SPSS on Occupational Health Safety Knowledge

Knowledge of Occupational Health Safety (K3)		
	Frequency	Percent
Enough	4	13.3%
Good	26	86.7%
Total	30	100.0%

Based on Table 4 above, it can be seen that occupational health safety (K3) knowledge of welding workers has a percentage value of 13.3% who have sufficient knowledge and 86.7% who have good occupational health safety knowledge.

Table 5. Univariate Analysis Test Results Using SPSS in Occupational Health Safety Training

Occupational Health Safety (K3) Training		
	Frequency	Percent
Enough	6	20.0%
Good	24	80.0%
Total	30	100.0%

Based on Table 5 above, it can be seen from the occupational health safety (K3) training for workers; it is known that there are six workers with a percentage value of 20.0% who have sufficient training and 80.0% who have good occupational health safety training.

Table 6. Univariate Analysis Test Results Using SPSS on the Use of Personal Protective Equipment

Use of Personal Protective Equipment (PPE)		
	Frequency	Percent
Enough	9	30.0%
Good	21	70.0%
Total	30	100.0%

Based on Table 6 above, it can be seen in the knowledge of using personal protective equipment (PPE) among workers that there are nine workers with a percentage value of 30.0% who have sufficient knowledge about using personal protective equipment (PPE) and 70.0% who know using good personal protective equipment (PPE).

Table 7. Univariate Analysis Test Results Using SPSS in Work Accidents

Work accident		
	Frequency	Percent
Potential for a work accident	7	23.3%
No potential for work accidents	23	76.7%
Total	30	100.0%

Based on Table 7 above, it can be seen that there are seven welding workers with a percentage value of 23.3% who have the potential to experience work accidents, and there are 23 workers with a percentage value of 76.7% who do not have the potential to experience work accidents.

2. Bivariate Analysis

Table 8. Bivariate Analysis of Occupational Health Safety Knowledge on the Occurrence of Work Accidents

Knowledge_K3	Work accident	
	There is no potential for a Work Accident	Potential for a work accident
Enough	3	4
Good	23	0
Total	26	4

Based on Table 8 bivariate analysis of occupational health safety knowledge on the occurrence of work accidents, it is known that the sig. (P-Value) of 0.001 (<0.005), it can be concluded that there is a significant relationship between knowledge of occupational health safety (K3) and work accidents in the welding process. After conducting a bivariate analysis, a probability test was carried out to measure the possibility of work accidents.

Probability Formula:

$$P(A) = \frac{n(A)}{n(S)} \quad (1)$$

$$P(\text{Work Accident}) = \frac{23}{26} = 0.8846$$

From the results of the probability calculation, the percentage value of work accidents when welding is 0.89%.

Table 9 Bivariate Analysis of K3 Training on Occurrence of Work Accidents

K3 training	There is no potential for a Work Accident	Potential for a work accident
Enough	4	3
Good	20	3
Total	24	6

Based on Table 9 bivariate analysis of occupational health safety training on the occurrence of work accidents, it is known that the sig. (P-Value) of 0.235 (> 0.005), it can be concluded that there is no significant relationship between occupational health safety (K3) training and work accidents in the welding process. After conducting a bivariate analysis, a probability test was carried out to measure the possibility of work accidents.

Probability Formula:

$$P(A) = \frac{n(A)}{n(S)} \quad (1)$$

$$P(\text{Work Accident}) = \frac{20}{24} = 0.8333$$

From the results of the probability calculation, the percentage value of work accidents when welding is 0.83%.

Table 10 Bivariate analysis of use (PPE) of work accidents

Use of Personal Protective Equipment (PPE)	There is no potential for a Work Accident	Potential for a work accident
Enough	3	4
Good	18	5
Total	21	9

Table 10, bivariate analysis of personal protective equipment (PPE) used for work accidents, shows that the sig. (P-Value) of 0.187 (> 0.005), it can be concluded that there is no significant relationship between the use of personal protective equipment (PPE) and work accidents in the welding process. After conducting a bivariate analysis, a probability test was carried out to measure the possibility of work accidents.

Probability Formula:

$$P(A) = \frac{n(A)}{n(S)} \quad (1)$$

$$P(\text{Work Accident}) = \frac{18}{21} = 0.8571$$

The Probability Formula P(A) = n(A)/n(S) P(Work Accident) = 18/21 = 0.8571 From the results of the probability calculation, the percentage value of work accidents when carrying out welding is 0.85%.

4. Discussion

According to the findings of the conducted bivariate analysis, there is a substantial correlation between the incidence of work accidents during the welding process and knowledge of occupational health safety (K3). This demonstrates that work accidents during the welding process are less likely to occur when employees have a higher level of K3 expertise.

However, the frequency of work accidents during the welding process is not significantly correlated with K3 training or personal protective equipment (PPE). This demonstrates that OHS training and personal protective equipment (PPE) by themselves are insufficient to avoid welding-related workplace mishaps. Other initiatives, like efficient outreach and counseling, are required to improve K3's understanding of workers.

In addition, companies must also ensure that the work environment is safe and healthy and meets occupational health safety (K3) standards. This can be done by conducting periodic inspections and correcting unsafe working conditions. Thus, companies can improve their workers' occupational safety and health and prevent work accidents in welding.

5. Conclusions

Based on the results of the research that has been done, it can be concluded that there is a significant relationship between work accidents in the welding process and knowledge of occupational health safety, with a sig. (P-Value) of 0.001 (< 0.005). Based on the probability test that has been carried out, a fairly high probability value is obtained for each variable. Occupational health safety knowledge has a probability value of 0.89%, occupational health safety training has a probability value of 0.83%, and the use of personal protective equipment has a probability value of 0.85%.

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