

Safety climate as a risk factor of occupational accidents in a textile industry

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Abstract

Purpose: This study aimed to analyze several risk factors of safety climate e.g. management safety priority and commitment, management safety empowerment, management safety justice, workers' safety commitment, workers' safety priority, safety in learning, communication, and innovation, and worker's trust in the efficacy of safety system with occupational accidents in a spinning. **Method:** This case-control study involved 120 workers divided into two groups, the control group (80 subjects) and the case group (40 subjects). The case group consisted of spinning workers who had experienced occupational accidents in the last two years in the textile industry in Bandung. The bivariate analysis uses a chi-squared, while multivariable analysis with multiple logistic regression. **Results:** The results show that PPE use and management safety empowerment influenced occupational safety, becoming a risk factor for occupational accidents. Management safety empowerment was considered the primary factor of occupational accidents with an adjusted odds ratio of 5.52 (CI 95% 2.26–13.44). **Conclusions:** Management safety empowerment that influenced occupational safety programs can improve social exchanges and support workplace safety to encourage occupational safety behavior.

Keywords: PPE; safety climate; occupational accidents; spinning

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INTRODUCTION

The International Labour Organization (ILO) explained that two workers per day or more than 2.78 million workers per year died due to occupational accidents or occupational diseases [1]. The Indonesian Worker Social Security Agency (BPJS Ketenagakerjaan) reported high incidences of occupational accidents that occurred in Indonesia during these years such as in 2015 (110,285 cases), in 2016 (105,182 cases), and until

August 2017 (80,392 cases) [2]. The Ministry of Manpower of the Republic Indonesia 2015 released data that 86,693 occupational accidents occurred in Indonesia. Occupational accidents have been frequently discovered in many working sectors such as 31.9% in constructions, 31.6% in manufactures, 9.3% in transportation, 3.6% in forestry, 2.6% in mining, and 20% in other sectors [2]. Accident risks can be anticipated by applying work safety systems [3][4].

The application of a work safety system is an obligation that must be carried out by each company in order to protect the safety of workers [5]. Work safety is needed by the workforce to provide assurance for comfort and safety in the work environment [6]. Safety climate is an effective and efficient measurement and can reflect safety culture [7][8]. A Study on the safety climate in textile industries in Bandung, Indonesia is still unknown so that a study on safety climate as a risk factor of occupational accidents could be remarkable to be conducted. Validity and reliability tests are carried out using the Rasch model, which other researchers have not done.

The study aimed to analyze the risk factor of a safe climate which consists of seven dimensions. The dimensions are management safety priority and commitment, management safety empowerment, management safety justice, workers' safety commitment, workers' safety priority without tolerance of any dangerous risk, safety in learning, communication, and innovation, and worker's trust in the efficacy of safety systems with occupational accidents in the textile industry.

METHODS

This study was conducted in November 2018 and took place in one of many leading. It involved 120 workers of textile industries in Bandung, divided into two groups, the control group (80 subjects) and the case group (40 subjects). The subjects in the case group were spinning workers who had experienced occupational accidents in the last two years in the textile industry in Bandung. Spinning selected as the place research because it has the highest work accident rate compared to other departments. Data collected in the study were primary data obtained from the respondents by distributing questionnaire NOSACQ-50 (Nordic Safety Climate Questionnaire) and Questionnaire workplace accidents. The questionnaire workplace accident consists of three questions, namely about events, injuries, and causes of workplace accidents.

The measurement results of the seven safety climate variables were analyzed through Rasch modeling and categorization based on strata values, used equation:

$$H = \frac{(4 \times Separation) + 1}{3}$$

The calculation of strata values for each safety climate variable can be grouped into two categories, good and poor. The assessment results of each safety climate variable are interpreted using the Rasch model

by looking at the average logit value, as in Table 1. Data analysis in the study included univariable, bivariable, and multivariable analysis. Univariable analysis for work accident variables was conducted to see the frequency of events, types, and trauma locations from workplace accidents in the spinning department. Univariable analysis of the safety climate looking at the logit value of each variable.

The bivariable analysis was conducted to see the risk factors between the independent variables (management safety priority and commitment, management safety empowerment, management safety justice, workers' safety commitment, workers' safety priority without tolerance of any dangerous risk, safety in learning, communication, and innovation, and worker's trust in the efficacy of safety system) and confounding variables (gender, age, working time, use of PPE, and first aid simulation training) with the dependent variable (work accidents). The Chi-Square test aims to interpret the risk factors of worker characteristics and seven variable safety climate with the incidence of workplace accidents using Odds Ratio (OR). The multivariable analysis used is multiple logistic regression to explain which variables are most at risk at workplace accidents. The bivariable analysis results with a p-value of less than 0.25 were put together in multiple logistic regression using the backward method.

The NOSACQ had been translated into Indonesian. Validity and reliability studies were first conducted in November 2018. Results of validity and reliability studies were obtained using the Rasch model, which described that all questionnaire items were valid and reliable. Measurement results use an interval scale by seizing the average log odds of each variable. Bivariate analysis was performed using the chi-squared test, and multivariate analysis was carried out using multiple logistic regression.

Table 1. The result interpretation of the safety climate questionnaire

Variable	Logit Value
Management safety priority and commitment	0,77
Management safety empowerment	1,20
Management safety justice	1,06
Workers' safety commitment	1,41
Workers' safety priority without tolerance of any dangerous risk	1,50
Safety in learning, communication, and innovation	1,95
Worker's trust in the efficacy of the safety system	1,32

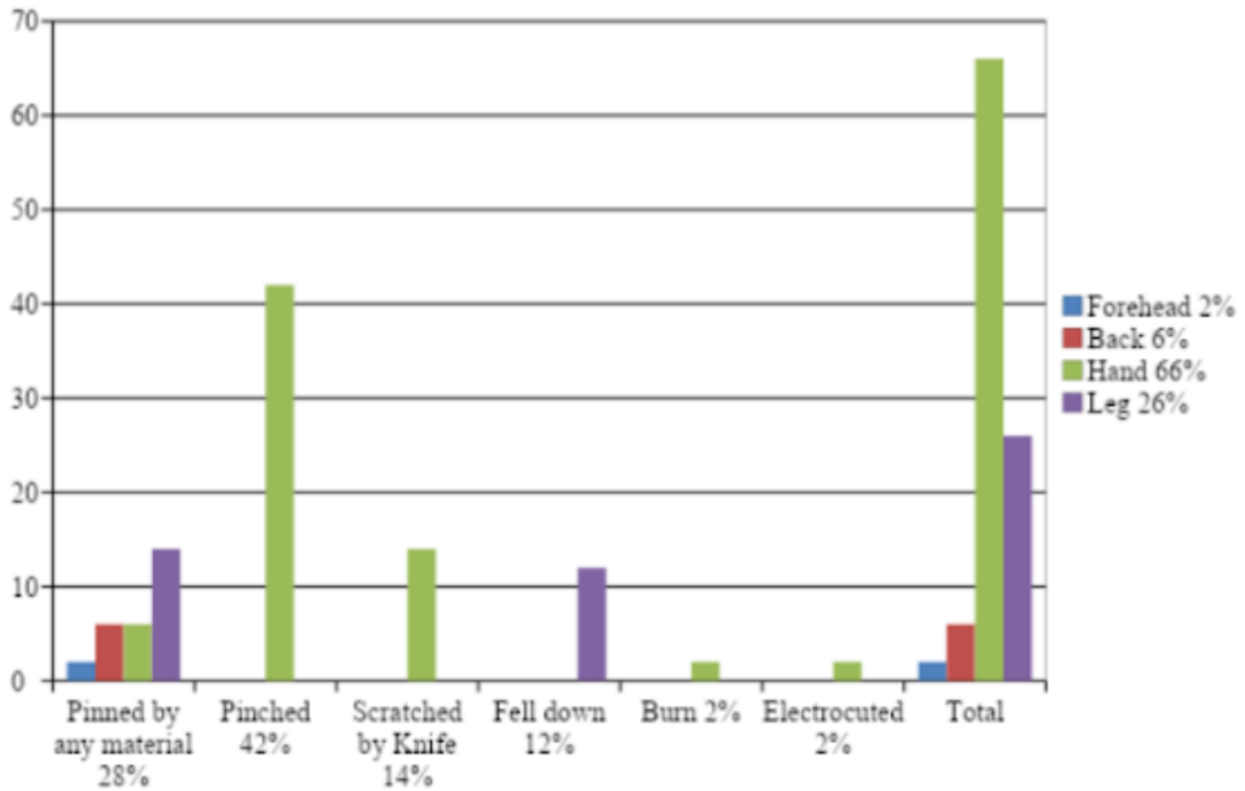


Figure 1. Factors of Occupational Accidents and Locations of Injuries

RESULTS

Results in the study would be described as follows. In Figure 1, accidents were pinched and pinned by any material. Pinches found in the study were caused by several circumstances such as cleaning dirt on a filter of the thread without using PPE, opening the engine cover, and an unanticipated event when the engine cover suddenly closed and hit the back of the hand.

Table 2 described that PPE use influenced occupational accidents with an odds ratio of 3.00. It determined that workers who did not use PPE had three times of occupational accident risk than those who wore PPE. The Results of observation use PPE showed that of the 40 workers only 10 of them used complete PPE (headcover, mask, earplugs, apron, and closed shoes). Another 30 workers were not wearing aprons, masks, and earplugs.

Table 2. Human Errors Associated with Occupational Accidents

Variables	Occupational Accidents		p-Value	Crude OR (CI 95%)	
	Case n (%)	Control n (%)			
Gender	Male	25 (62.5)	40 (50.0)	0.195**	1.66 (0.76–3.62)
	Female	15 (37.5)	40 (50.0)		
Age	17–45	31 (77.5)	63 (78.8)	0.875	0.92 (0.37–2.32)
	46–65	9 (22.5)	17 (21.2)		
Years working	Junior ≤3	6 (15.0)	8 (10.0)	0.421	1.588 (0.51–4.93)
	Senior >3	34 (85.0)	72 (90.0)		
Use of PPE	No	12 (30.0)	10 (12.5)	0.020**	3.00 (1.16–7.73)
	Yes	28 (70.0)	70 (87.5)		
First aid simulation training	No	15 (37.5)	29 (36.2)	0.893	1.055 (0.4–2.31)
	Yes	25 (62.5)	51 (63.8)		

Note: ** p<0.25 was included in multivariate analysis, multiple logistic regression

Some workers were not comfortable using PPE during working hours. Masks that are used for a long

period of time interfere with their breathing and using earplugs hurts the ear if it is used for a long time.

Management needs to review again the types of PPE used by workers, and management must reprimand or sanctions if workers not following safety rules in the workplace.

Table 3 in the last model presented that no use of PPE and poor management safety empowerment were the major risk factors of occupational accidents because have a range of value more than 1.00 and significant p-value compared to the related variables: gender, improper safety climate, inadequate management safety priority and commitment, improper management safety justice, inadequate workers' safety commitment, fewer workers' safety

priority, incorrect safety in learning, communication, and innovation, and inappropriate worker's trust in the efficacy of safety system. Poor management empowerment is the biggest risk factor for occupational accidents compared to the noncompliance of PPE. Workers think that management has struggled well in designing work safety, but worker interactions in decision making can be optimized again. Workers assume that sometimes management does not care about workers' suggestions and does not involve workers in making decisions about safety.

Table 3. Correlation between Risk Factor and Occupational Accidents Based on Multiple Logistic Regression

Variables	β	SE (β)	p-Value	OR Adj (C.I 95%)
First model				
Gender	-0.25	0.45	0.569	0.77 (0.31–1.87)
Use of Personal Protective Equipment (No wear)	0.98	0.56	0.078	2.68 (0.89–8.07)
Safety climate (Improper)	-0.28	0.85	0.743	0.75 (0.14–4.02)
Management safety priority and commitment (Inadequate)	0.79	0.84	0.344	2.21 (0.42–11.53)
Management safety empowerment (Poor)	1.41	0.54	0.009	4.13 (1.43–11.91)
Management safety justice (Improper)	0.51	0.55	0.355	1.66 (0.56–4.94)
Workers' safety commitment (Inadequate)	0.99	0.82	0.255	2.71 (0.54–13.60)
Less Workers' safety priority and no tolerance for any dangerous risk	0.41	0.49	0.394	1.51 (0.58–3.96)
Safety in learning, communication, and innovation (Incorrect)	-0.09	0.68	0.888	0.90 (0.24–3.44)
Worker's trust in the efficacy of safety system (Inappropriate)	-0.68	0.81	0.396	0.50 (0.10–2.45)
Last Model				
Use of Personal Protective Equipment (No wear)	1.04	0.52	0.045	2.84 (1.02–7.88)
Management safety empowerment (Poor)	1.7	0.45	0.001	5.52 (2.26–13.44)

Note: *) $R^2_{Nagel} = 21.4\%$

OR Adj (CI 95%) = Odds Ratio Adjusted (Confidence Interval 95%)

DISCUSSIONS

This study showed that human errors had become risk factors of occupational accidents, including the use of Personal Protective Equipment while working. The study also conveyed that injuries caused by occupational accidents were mostly found in hand or fingers followed by leg, back, shoulder, and forehead. The accidents were pinched and pinned by any material followed by scratched by engine knife, fell down, electrocuted, and burnt. Pinned by heavy materials frequently injured legs because the workers only wore ordinary shoes which could not protect the workers from accidents.

Low workers' safety commitment can increase the risk of occupational accidents. Spinning workers must

wear PPE such as masks, earplugs, hair covers, and safety boots. Use of Personal Protective Equipment (PPE) while working as a risk factor of occupational accidents. Moreover, the workers in the spinning do not usually wear earplugs, safety boots and some workers do not wear masks, during the whole working hours. The workers only wear PPE if they particularly need protection. They may not recognize that it can increase the risk of occupational accidents. This finding is supported by some previous studies conducted by Eka Swaputri, Prihatiningsih, and Wisnu which stated that discipline and compliance of the workers in wearing Personal Protective Equipment (PPE) can influence the numbers of occupational accidents [3][9].

Most workers had a good perception of many things in the working space related to management's

safety policy. The study described an excellent safety climate performed by the workers because the manufacturer worked optimally due to supervising working systems to reach the target maximally. This finding follows by Destilya and Hamaideh, which reported that the safety climate could influence the workers' attitude and behavior and positively contribute to the number of occupational accidents [10-12]. Each aspect related to the risk factor of safety climate was described in the study in the following.

Management safety priority and commitment is a risk factor of occupational accidents. This study's result is similar to Bailey's which stated that workers who have a positive perception of management commitment would lower numbers of occupational accidents [10-11]. The worker's good perception of management safety priority and commitment, therefore, needs to optimize management tolerance in treating dangerous situations. The workers assumed that the management gave tolerance to them to perform dangerous actions only during peak hours. Continuous changes in conducting supervision can be a suitable effort due to improved management safety working.

This study discovered that management safety empowerment is regarded as a leading risk factor of occupational accidents. Involvement in decision-making can affect the safety of the working environment. This condition is similar to a study by Shanon which reported that there is a relationship between management safety empowerment and decreased numbers of occupational accidents [13].

The workers' perception of management safety justice is a risk factor of occupational accidents. The workers' anxiety about management punishment forced them not to report the near-miss accidents. The workers assumed that in some accidents the management often blamed them. This condition forced the workers to hold the reports relating to the accidents. "Blaming the workers" attitude had become an inhibition in the learning process. Wachter and Yurio found similar results that management injustice in governing employees could increase workplace injuries and illnesses. Management justice was considered as being a potentially important mechanism in the safety management-organizational safety performance relationship [14].

Workers' safety commitment is a risk factor for occupational accidents. The workers' less attention to safety causes higher numbers of occupational accidents in spinning. The management plays an important role

in involving the workers in every event which is related to safe working. This can be an encouragement for the workers and improve their commitment to safe working which can reduce the numbers of occupational accidents.

The study result described that workers' safety priority without tolerance of any dangerous risk was not considered as a risk factor of occupational accidents. This finding is in contrast to Huang et al, study. Workers' safety priority and acceptance or non-acceptance related to any risk by the management can influence the possibility of occupational accidents [15]. This situation occurs because the workers might have a misperception of the risk of danger in the workspace. The workers considered that risk of danger is something which cannot be prevented and minor accidents are usual while working. The workers may break the rules due to finish the target immediately.

Safety in learning, communication, and innovation is not a risk factor of occupational accidents. Participation of the workers due to report dangerous incidents and accidents in the workspace was poor. The management has to conduct safety innovation so that the workers will be willing to report any dangerous incidents in the workspace. Moreover, the learning aspect is very important in order to establish a positive safety culture [16].

The result showed that the worker's trust in safety systems is not regarded as a risk factor of occupational accidents. This finding contrasts with Raharjo and Zohar's study: the efficacy of safety systems could anticipate the risk of unexpected occupational accidents [16]. This condition occurred because most of the workers considered that the efficacy of the safety system was excellent so that it could not influence occupational accidents.

CONCLUSIONS

Among the seven safety climate variables, four variables were considered risk factors of occupational accidents. The variables were safety priority and commitment, management safety empowerment, management safety justice, and workers' safety commitment. The Safety climate and occupational accidents need particular treatments. The management should include the workers when making decisions related to safe working. Simultaneously, the company's first aid team should reconsider the safety program in the workspace. Safety workshops and supervision in wearing PPE can be conducted to reduce accidents.

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