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Path Analysis on the Factors Affecting the Use of Personal Protection Equipment among Airport Construction Workers in Yogyakarta

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ABSTRACT

Background: Occupational accidents in the construction sector are still a major problem in every infrastructure development in Indonesia. The lack of supervision in the use of personal protective equipment (PPE) is one reason for the high number of occupational accidents. This study aimed to determine the factors that influence the implementation of the use of PPE.
Subjects and Method: A cross sectional study was conducted at Yogyakarta International Airport, Kulon Progo, Yogyakarta, Indonesia, in March 2019. A sample of 200 active field workers was selected by proportional random sampling. The dependent variable was the use of PPE. The independent variables were age, education, working experience, knowledge, perception of vulnerability, perceived benefit, perceived severity, and cues to action. The data were collected by questionnaire and analyzed by path analysis.
Results: The use of PPE was directly and positively affected by high knowledge (b= 2.14; 95% CI= 1.17 to 3.10; p<0.001), high perceived susceptibility (b= 1.94; 95% CI= 0.95 to 2.93; p< 0.001), high perceived severity (b= 1.33; 95% CI= 0.42 to 2.24; p= 0.004), high perceived benefit (b= 1.79; 95% CI= 0.85 to 2.73; p<0.001), and high cues to action (b= 1.64; 95% CI= 0.67 to 2.61; p= 0.001). The use of PPE was indirectly affected by age, work experience, and education.
Conclusion: The use of PPE is directly and positively affected by knowledge, perceived susceptibility, perceived severity, perceived benefit, and cues to action. The use of personal protective equipment is indirectly affected by age, work experience, and education.

Keywords: personal protective equipment, construction workers, path analysis

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BACKGROUND

Hazards in the workplace are usually defined as working conditions that have the potential to cause injury and / or disease to workers. Examples of hazards are exposure to hazardous substances, working with dangerous tools and equipment, or carrying out potentially harmful tasks such as repetitive movements and heavy lifting (Yanaret al., 2018).

Based on data from BPJS Employment quoted by the Republic of Indonesia Health Office, the number of occupational accident cases in 2015 was 110,285 cases, while in 2016 there were 105,182 cases, which decreased by 4.6%. Whereas until August 2017, there were 80,392 cases. Occupational accidents and work-related diseases not only cause material losses or fatalities and health problems for workers but can disrupt the production process as a whole and even damage the environment which ultimately affects the wider community. One of the causes of workplace accidents is the lack of optimal supervision and implementation of OSH and OSH behavior

in the workplace. Therefore, it is necessary to make concrete efforts to prevent and reduce the occurrence of accidents and diseases due to work optimally (Ministry of Health, 2018).

The Director General of Manpower Inspection and Occupational Safety and Health, stated that the high number of occupational accidents was caused by a lack of maximum labor inspection due to a lack of labor inspectors. In 2018, the number of labor inspectors throughout Indonesia amounted to 2,676 active duty oversees 268,282 companies. Supervisors conducted a survey of 5 companies per month or around 60 companies per year (Ministry of Labor Republic of Indonesia, 2018).

The policy on occupational safety in Indonesia is regulated in Act No. 1 of 1970. The law imposes three elements, including the place where the work is carried out for a business, elements of labor, and elements of danger of work in the workplace. The dangers of the work environment are divided into chemical, physical, biological, physiological, and psychological hazards (Irzal, 2016).

Data of PT. PP (Persero) TBK in November 2018 recorded 1500 employees and will increase to 3000 to 3500 workers in January. The addition of employees is done to be able to pursue the target of completion of the planned runaway in 2019.

At the New Yogyakarta International Airport (NYIA) development project, the author found several workers who neglected to use primary PPE such as helmets, masks, and safety shoes. It can be influenced by various factors including age, work experience, knowledge, perceived susceptibility, perceived seriousness to use PPE, perceived benefit to use PPE, perceived barriers to use PPE, cues to action, self-efficacy, age, and tenure/ working experience.

This study aimed to determine the factors that influence the implementation of the use of personal protective equipment using health belief model (HBM) theory.

SUBJECTS AND METHOD

a. Study Design

This was an analytic observational study with a cross sectional design. The study was conducted at the construction project of the New Yogyakarta International Airport, Kulon Progo, Yogyakarta, Indonesia, in March 2019.

b. Population and Samples

The target population of this study was all field workers (5,472 workers) involved in the New Yogyakarta International Airport development project. A sample of 200 active field workers was selected by proportional random sampling.

c. Study Variables

The dependent variable was the use of PPE. The independent variables were age, knowledge, education, work experience, perceived susceptibility, perceived severity, perceived benefit, and cues of action.

d. Operational Definition of Variables

Age was defined the age of the workers based on birth date/ year of birth when the workers were interviewed. Age was measured by questionnaire and produced continous data.

Working experience was defined as the length of time or period of work that has been taken by the workers.

Knowledge was the result of "knowing". It happens after people have sensed a certain object. Sensing occurs through the human senses, namely: the senses of sight, hearing, feeling and touch.

Education was defined as the highest formal education attained by the workers.

Perceived susceptibility was defined as worker's perception about the risk of con-

tracting the disease, or about how their behavior might affect their health.

Perceived severity was defined as worker's perception about the deleterious consequences of a serious health event or outcome.

Perceived benefit was defined as worker's motives to perform PPE use behavior. The measurement scale was continous.

Cues to action were defined as internal or external stimulus that influenced worker's desire to use PPE.

e. Data Analysis

Univariate analysis aimed to explain and describe the sample characteristics. Bivariate analysis was conducted to determine the relationship between the independent variables and the dependent variable using Chi square test. Multivariate analysis was conducted by path analysis run on Stata 13.

f. Research Ethics

Research ethics in this study included anonymity, confidentiality, and informed consent. Research ethics approval was granted by the Research Ethics Committee at Dr. Moewardi hospital, Surakarta with number: 251/III/HREC/2019.

RESULTS

1. Sample Characteristics

Table 1 showed the sample characteristics. Table 1 showed that there were 124 workers (62%) aged <30 years and 76 workers (38%) aged ≥30 years.

Table 1. Sample characteristics (categorical data)

Characteristics	N	%
Age		
<30 years	124	62
≥30 years	76	38
Education		
<JHS	116	58
≥JHS	84	42
Working experience		
< 2 years	118	59
> 2 years	82	41
Education		
Poor	120	60
Good	80	40
Vulnerability perception		
Low	106	53
High	94	47
Severity perception		
Low	111	55.5
High	89	44.5
Benefit perception		
Low	103	51.5
High	97	48.5
Cues to act		
Low	102	51
High	98	49
The use of PPE		
Incomplete PEE	150	75
Complete PEE	50	25

A total of 116 workers (58%) with education <junior high school and as many as 84 workers (42.0%) with education ≥Junior high school, the number of workers with <2 years work experience amounting to 118 people (59%) and working experience >2 years amounting to 82 people (41%). Workers with low benefit perceptions were 103 people (51%) and workers with high perceptions of benefits were 97 people (48.5%).

The number of workers with low-acting signals was 102 people (51%) and 98 people (49%) workers had a signal to act high. In the use of PPE as many as 150 workers (75%) were incomplete and 50 workers (25%) had used complete PPE.

2. Bivariate Analysis

Table 2 shows the results of bivariate analysis. Table 2 shows that age >30 years (OR= 7.07; p <0.001), education ≥junior high school (OR= 8.27; p <0.001), working experience >2 years (OR= 8.82; p <0.001), high knowledge (OR= 7.08; p <0.001), high perceived susceptibility (OR= 7.11; p <0.001), high perceived severity (OR= 5.36; p<0.001), high perceived benefit (OR= 3.75; p <0.001), and high cues of action (OR= 5.46; p<0.001) increased the use of PPE.

Table 2. Bivariate analysis

Independent Variables	Use of PPE				Total		OR	P
	Incomplete		Complete					
	N	%	N	%	N	%		
Age								
<30 years	110	88.71	14	11.29	124	100	7.07	<0.001
≥30 years	40	52.63	36	47.37	76	100		
Education								
<Junior high school	105	90.52	11	9.48	116	100	8.27	<0.001
≥ Junior high school	45	53.57	39	46.43	84	100		
Working experience								
< 2 years	107	90.68	11	9.32	118	100	8.82	<0.001
> 2 years	43	52.44	39	47.56	82	100		
Knowledge								
Lacking	107	89.17	13	10.83	120	100	7.08	<0.001
Good	43	53.75	37	46.25	80	100		
Perceived susceptibility								
Low	96	90.57	10	9.43	106	100	7.11	<0.001
High	54	57.45	40	42.55	94	100		
Perceived severity								
Low	98	88.29	13	11.71	111	100	5.36	<0.001
High	52	58.43	37	41.57	89	100		
Perceived benefit								
Low	89	86.41	14	13.59	103	100	3.75	<0.001
High	61	62.89	36	37.11	97	100		
Cues to action								
Low	91	89.22	11	10.78	102	100	5.46	<0.001
High	59	60.2	39	39.8	98	100		

3. Path Analysis

a. Model Specification

This study consisted of 9 observed variables (age, education, work experience, knowledge, perceived susceptibility, perceived severity, perceived benefit, cues to action, and the use of PPE).

b. Model Identification

This stage would identify the number of measured variables, the number of endogenous variables, exogenous variables, and parameters to be estimated. At this stage, a degree of freedom (df) was calculated which indicated whether path analysis can be done

or not as follows:
Measured variable : 9
Endogenous variables : 7
Exogenous variables : 2
The degree of freedom formula was:
df= (number of measured variables x (number of measured variables + 1) / 2-(endogenous variables + exogenous variables + number of parameters)
= (9x(9+1)/2-(7+2+9)= (90/2)-18
= 45-18 = 27

Path analysis can be done if df ≥ 0, while in the identification of models in the over identified path analysis which mean that path analysis can be done. Figure 1 depicted the structural model of factors affecting the use of PPE.

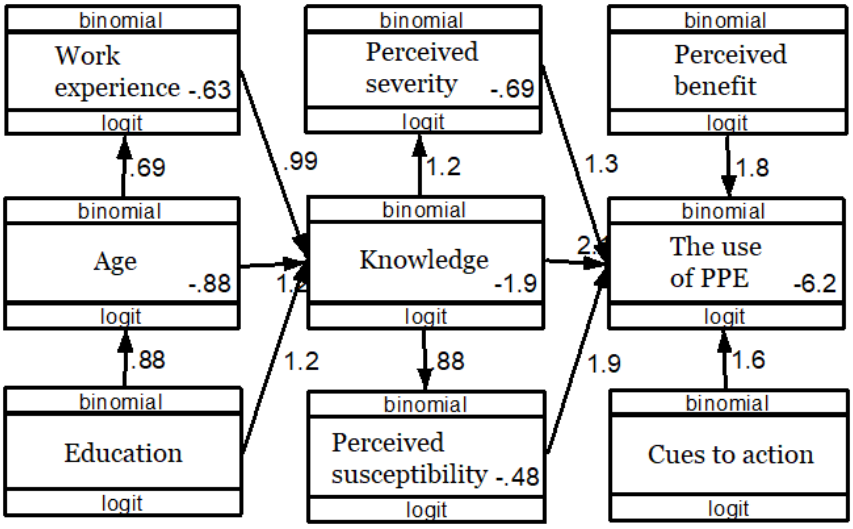

Figure 1. Structural model of factors affecting the use of PPE

Table 3 showed that the use of PPE was directly positively affected by knowledge, perceived susceptibility, perceived severity, perceived benefit, and cues to action.

Workers who have good knowledge have logodd to use PPE by 2.14 units higher than workers with less knowledge (b= 2.14; 95% CI= 1.17 to 3.10; p<0.001).

Workers with high perceived susceptibility have logodd to use PPE by 1.94 units higher than those with low perceived susceptibility (b= 1.94; 95% CI= 0.95 to 2.93; p<0.001).

Workers with high perceived severity have logodd to use PPE by 1.33 units higher than those with low perceived severity (1.33; 95% CI= 0.42 to 2.24; p= 0.004).

Workers with high perceived benefit have logodd to use PPE by 1.79 units higher than those with low perceived benefit (b= 1.79; 95% CI= 0.85 to 2.73; p<0.001).

Workers with high cues to action have a logodd to use PPE by 1.64 units higher than those with low cues to action (b= 1.64; 95% CI= 0.67 to 2.61; p= 0.001).

The use of PPE was indirectly affected by work experience, age, and education.

Work experience was affected by age (b= 0.68; 95% CI= 0.10 to 1.26; p= 0.021). Knowledge was affected by age (b= 1.18; 95% CI= 0.53 to 1.83; p<0.001), work experience (b= 0.99; 95% CI= 0.34 to 1.63; p= 0.003), and education (b= 1.16; 95% CI= 0.52 to 1.81; p<0.001).

Perceived susceptibility was affected by knowledge (b= 0.88; 95% CI= 0.30 to 1.46; p= 0.003).

Perceived susceptibility was affected by knowledge (b= 1.15; 95% CI= 0.56 to 1.73; p<0.001).

Table 3. Path analysis on the factors affecting the use of PPE

Dependent Variable		Independent Variable	(b)	CI 95%		p
				Lower Limit	Upper Limit	
Direct effect						
Complete PPE use	←	Knowledge (good)	2.14	1.17	3.10	<0.001
		Perceived susceptibility (high)	1.94	0.95	2.93	<0.001
		Perceived severity (high)	1.33	0.42	2.24	0.004
		Perceived benefit (high)	1.79	0.85	2.73	<0.001
		Cues to action (high)	1.64	0.67	2.61	0.001
Indirect effect						
Work experience	←	Age (>30 years old)	0.68	0.10	1.26	0.021
Knowledge	←	Age (>30 years old)	1.18	0.53	1.83	<0.001
		Work experience (>2 years)	0.99	0.34	1.63	0.003
		Education (≥junior high school)	1.16	0.52	1.81	<0.001
Perceived susceptibility	←	Knowledge (good)	0.88	0.30	1.46	0.003
Perceived severity	←	Knowledge (good)	1.15	0.56	1.73	<0.001
Age	←	Education (≥junior high school)	0.88	0.29	1.46	0.003
N Observation=200						
Log likelihood= -700.15						
AIC = 1436.3						
BIC = 1495.7						

DISCUSSION

1. The effect of knowledge on the use of PPE

The results of this study indicated that knowledge has a direct and positive effect on the use of PPE and the effect was statistically significant. Knowledge of workers influenced the implementation of the use of PPE. Less knowledge was caused by lack of experience of workers in the construction sector.

Anizar (2014) stated that knowledge can give confidence to someone to determine the attitude to act. The results of the study by Hussain et al. (2019) showed that lack of knowledge on workers can reduce the use of PPE. Piai-Morais et al. (2015) reported that knowledge has a major influence on compliance in using PPE (b= 4.69). Based on the description above, the author concluded that workers with good knowledge would use PPE properly compared to workers with insufficient knowledge so that the implementation of the use of PPE was low.

2. The effect of perceived susceptibility on the use of PPE

The results of this study indicate that there was a direct and positive influence of perceived susceptibility with the use of PPE. Worker's perceived susceptibility affected the use of PPE. Low perceived susceptibility was caused by a lack of workers' knowledge of the disease, the dangers of work, and the importance of PPE use. So they did not feel that they were vulnerable to work-related illnesses and ignore the importance of using PPE.

Setyaningsih et al. (2017) showed that there was an influence of perceived susceptibility. The study reported that high perceived susceptibility increased the use of PPE by 0.39 times higher (b= 0.39; p<0.001). Herrmann et al. (2018), also stated that perceived susceptibility effected on health-related preventive behavior.

This was in accordance with Health Belief Model theory that developed by Rosenstock (1994) that the assumption that an individual was affected by an illness would

make themselves aware of a prevention and protection (Murti, 2018).

Based on the results of this study, it can conclude that workers who have a high perceived vulnerability to occupational diseases and occupational hazards, would make efforts to prevent the occurrence of occupational diseases and occupational hazards by using PPE.

3. The effect of perceived severity on the use of PPE

The results of this study indicated that there was a direct and positive effect of perceived severity on the use of PPE.

Wulandari et al. (2016), stated that there was a positive effect between perceived severity and preventive behavior (p= 0.031). Gholampouretal (2018), stated that individuals with high perceived severity increased prevention behavior compared to individuals with low perceived severity.

Based on the description above, the writer can conclude that workers who have high perceived severity would make the worker willing to use PPE to prevent work-related illness. This was because they did not want to get serious illness so they would make an effort to prevent the occurrence of disease.

4. The Effect of Perceived Benefit on the Use of PPE

The results of this study indicated that there was a direct and positive effect of perceived benefits on the implementation of the use of PPE and it was statistically significant.

The results of this study were in line with Obirikorang et al. (2018) which stated that high perceived benefits of using drugs were significantly correlated with the reduced chance of non-compliance of the study subject to an action.

The reduction in the non-compliance rate of the subject of this study was based on evaluation using the health belief model method that was not used in the previous evaluation. This study was in line with Støle et al. (2019) who stated that there was a relationship of perceived benefit on an action and it became one of the variables in this study with the highest correlation with behavior in both bivariate and multivariate analysis.

Based on the description above, the writer can conclude that individuals who have a high perceived benefit of using PPE, then the individual would make an effort to prevent work accidents and prevention of occupational hazards by using PPE.

5. The Effect of Cues to Action on the Use of PPE

This study indicated that there was a direct and positive influence of high cues to action on the implementation of the use of PPE and it was statistically significant.

This study was in line with that of Puspita et al. (2009) which proved that cues to action influenced behavior in preventive behavior. The Patterson et al. (2018) study stated that the cues to action can increase prevention efforts.

Based on the description above, the writer can conclude that individuals who have high cues to action on the use of PPE, then the individual would make an effort to prevent work accidents and prevent work hazards by using PPE.

6. The Effect of Age on the Use of PPE

The results of this study indicated that there was an indirect and positive influence between the age and the use of PPE through knowledge and experience and it was statistically significant. Workers who were ≥30 years old have the possibility to use a PPE greater.

The results of this study were also in line with the study of Holte KA. and Kjestveit (2012) who explained that construction workers aged <30 years old were more likely to experience work accidents due to negligence in the use of PPE. How-

ever, the results of this study were not in line to the study of Abdollahzadeh and Damalas (2016), which stated that older age has a significant negative influence on the use of PPE.

Based on the description above, the writer can conclude that workers aged ≥30 years old have better knowledge of occupational hazards and work-related diseases, so these workers would make efforts to prevent occupational hazards and work-related diseases, using PPE.

7. The Effect of Experience on the Use of PPE

The results of this study indicated that there was an indirect and positive effect of experience on the use of PPE through knowledge and it was statistically significant. Workers who have >2 years of work experience have the possibility to use PPE more.

The results of this study were in line with Low et al. (2018) which proved that changes in attitudes and perceptions of construction workers were influenced by previous experience. This statement was reinforced by a study from Navarro et al. (2018) which stated that groups of study subjects with work experience of 2-5 years would show a higher level of achievement compared to groups of study subjects who have work experience < 2 years.

Based on the description above, the writer can conclude that workers who have work experience or a longer working period (>2 years) have better knowledge about occupational hazards and work-related diseases, so that these workers would make efforts to prevent occupational hazards and occupational diseases, using PPE.

8. The Effect of Education on the Use of PPE

The results of this study indicated that there was an indirect and positive effect of education on the use of PPE through knowledge and age and it was statistically significant. Employees who were ≥JHS have the possibility to use PPE higher. This study was in line with Khodaminasab et al. (2019) which stated that the results of the study showed that self-care behavior waas significantly related to educational level (p= 0.003). Participants who were employed and have higher education showed better self-care behavior than others. Uchmanowicz et al. (2018), stated that education levels significantly influenced action.

Based on the description above, the writer can conclude that workers who were junior high school graduate or above have better knowledge of occupational hazards and occupational diseases. Therefore, these workers would make an effort to prevent occupational hazards and work-related diseases. One of the effeort was by using PPE.

AUTHOR CONTRIBUTION

Ristamaya Danar Dewi collected data and wrote the paper. Setyo Sri Rahardjo examined the conceptual framework and study method. Bhisma Murti ran statistical analysis and interpreted the results of analysis.

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This study used the authors' independent costs.

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CONFLICT OF INTEREST

There was no conflict of interest.

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