International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 7,
2020 ISSN: 1475-7192

Contributing Factors of Personal Protection Equipment (PPE) Utilization among Sand and Gravel (SSG) Mine Workers

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Abstract--- *The low utilization of personal protection equipment (PPE) can cause a high rate of work accidents. The contributing factors related to PPE utilization need to be explored. This study aimed to explore the contributing factors of personal protection equipment utilization among sand and gravel mine workers. This study was cross-sectional. A total of 118 respondents participated in this study. The independent variables were belief, knowledge and the attitude of the sand and gravel miners, the availability of PPE and employee attitude. The dependent variable was the sand workers' behavior in using the PPE. The data were collected using a questionnaire, and tested using Spearman Rho test with a significance level of p <.05. The results showed that the workers' belief affected their preference related to using PPE (p=.029; r=.202). The workers' good understanding was also shown to have a positive effect on using PPE (p=.000; r=* 0,669*). On the other hand, the availability of PPE (p=.000; r=*.328*), the site owners' awareness, and peer support were known to have no significant effect on influencing the workers' behavior in using PPE while at the mining sites (p=0.917). Knowledge was the strongest influencing factor. Counseling, training, and motivation regarding the use of PPE should be conducted in order to improve the sand and gravel miners' knowledge and positive attitude toward using PPE.*

Keywords--- *Attitude; Knowledge; Personal Protection Equipment; Sand and Gravel Mine Workers*

I. INTRODUCTION

Workplace accidents are the main cause of substantial disabilities globally. The International Labor Organization (ILO) in 2013 recorded that the death rate due to accidents around the world has reached 2 million cases each year due to workplace accidents and those suffering from work-related illness [1]. In Indonesia, the number of workplace accidents in 2015 reached 105,182 cases and as many as 2,375 people died. The Manpower and Transmigration Office of East Java recorded that, by 2015, the number of work accidents in East Java totaled 10,392 cases [2]. Sand mining companies are the largest type of company among the industrial and construction mining companies in Indonesia, which was around 112,392 units in 2015[3].

Manual sand dredging involves the mining of sand manually from the riverbed and transporting it to the trucks for delivery to construction sites. The job involves workers utilizing country boats and hand tools for rowing,

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underwater diving, dredging and manual material handling, thereby increasing the risk of work-related disorders [4]. The working environment, being river water and sand, might warrant there being a risk of exposure to hazardous materials [5]. Furthermore, the unavailability of Personal Protection Equipment (PPE) and social security measures may increase the exposure to occupational hazards [6]. Thus, an onsite assessment of manual sand dredgers requires multisystem screening for the identification of the health risks.

A high number of workplace accidents have a serious health impact. Health problems that can arise from workplace accidents, especially for sand and gravel mining workers, include silicosis, pneumoconiosis and ear barotrauma. Silicosis is caused by free silica dust in the lungs. Pneumoconiosis is a lung tissue reaction to dust or sand [7]. Ear barotrauma is the most common injury in divers. Long-term ear bone marrow damage can result in irreversible hearing loss [8]. Other factors that can lead to increased workplace accidents are the human and environmental factors. Human factors determine the perceptions of each worker who feels uncomfortable, who is not alert and who has a lack of knowledge. The environmental factors consist of a lack of available facilities, low social impulses, such as how they act around their co-workers, and the workplace owners' perspective [7].

Accidents at the workplace can be reduced by using PPE as a personal protective device during work. The use of PPE is one of the risk controls for accidents and it can decrease the incidence of accidents in the workplace [9]. However, the facts found in the sand and gravel mining location showed that the frequency of PPE being used by the workers was still low and the number of work accidents was still high. A preliminary study was held on March 18th, 2017, which obtained as many as 167 workers from six sand and gravel mining sites who did not use standardized PPE. The workers only used their full clothes, headgear and a face cover to prevent sand from entering their ears while working in the exploitation group, while, for the transport group, they only wore clothes and hats. Other PPE, such as eye protection, and feet, nose and hand covers, were not used. The use of less standard PPE resulted in increased workplace accidents every day, and there was one worker who died in January 2017.

The use of PPE is also regulated in the Act, but it is not well-implemented by all sand and gravel workers. Some of the reasons that cause PPE to be used improperly are the discomfort of PPE being used at work, the low awareness of the workers, a lack of supervision from local policy makers (workplace owners), and that the workers perceive that the use of PPE is slowing down their work speed [10]. Worker behavior in relation to PPE use is very important to prevent accidents in the workplace. This study aimed to understand the determinant factors of behavior, in addition to the predisposing factors, supporting factors, and the driving factors involved in the behavior of PPE use among sand and gravel mining workers.

II. METHOD

The design used in this study was a descriptive correlation with a cross-sectional approach. The total population in this study consisted of 167 people, totaling 94 people in the sand and gravel dredging group and 73 people in the sand and gravel transporting group. The respondents were collected from six sand and gravel mining sites. The inclusion criteria for respondents were age >18 years, have been working minimum two years, and were still actively working. The sample size in this study was 118 respondents consisting of 66 respondents in the sand and gravel dredging group and 52 respondents in the sand and gravel transporting group.

This study was conducted by approaching the respondents one by one because it was not possible to do a group approach. This was because the situation and conditions in the field were not very conducive to that method. The data collection was carried out over 60 minutes in the lunch break. Before filling out the questionnaire, the respondents

were given an explanation of the study and then signed the inform consent. After agreeing to participate in the study, the respondents were asked to fill out the questionnaire honestly.

The study used a questionnaire that was developed from the previous questionnaire. It was tested for validity and reliability on 15 respondents. The questionnaire was used to measure knowledge [11], consisting of two answers, namely: Yes= 1 and No= 0. To measure attitude [12], we used a Likert scale consisting of 10 questions with four answers, namely: strongly agree = 4, agree = 3, disagree = 2, strongly disagree = 1 for the positive questions and for the negative questions, there was strongly agree = 1, agree = 2, disagree = 3, strongly disagree = 4, its validity test is .690. We measured worker confidence [13] in relation to the use of personal protective equipment through six statements in the form of a Likert scale consisting of four answers, namely: very trusting = 4, believe = 3, do not believe = 2, strongly do not believe = 1 for the positive statements and for the negative statements, it was very trusting = 1, believe = 2, do not believe = 3, strongly do not believe = 4, its validity test in range of .635 till .885. Measuring the availability of facilities and infrastructure for personal protective equipment [14] consisted of nine questions. Each "Yes" answer was given a score of 1 and every "No" answer was given a score of 0, its validity test is .775. Measuring the driving factors of the workers' perceptions of the owners' attitude and actions [15] consisted of seven questions with the form of the answers being Yes = 1 and No = 0. To measure behavior [12], we used an observation sheet consisting of six points, using the answer format of "Yes" with a value of 1 and "No" with a value of 0, its validity test in range of .613 till .861. The data analysis used in this research was the Spearman Rho test, which is variable relation analysis with an ordinal data scale with significance level was <.05. This study was approved by the Health Research Ethics Commission of the Faculty of Nursing of Universitas Airlangga number 371-KEPK.

III. RESULTS

The results of this study include demographic and specific data used to analyze the relationship between the variables. Table 1 shows that the age that dominates in the sand and gravel dredging group was 26-35 years, and that, in the sand and gravel transporting group where most were over the age range of> 45 years, most of the respondents had worked for 10-15 years. The level of education of both groups was junior high school, and both groups had never received any previous PPE training.

Table 1. Respondents' characteristics in the sand and gravel dredging and transporting group.

Characteristic	Exploitation Group	Transportation Group
	n (%)	n (%)
Age (year)		
19-25	3 (4.5)	6 (11.5)
26-35	26 (39.4)	15 (28.8)
36-45	18 (27.3)	11 (21.2)
>45	19 (28.8)	20 (38.5)
Work Duration (years)		
5-9	33 (50)	24 (46.2)
10-15	33 (50)	28 (53.8)
Educational background		
No Education	6 (9.1)	5 (9.6)
Elementary school	12 (18.2)	15 (28.8)
Junior High School	30 (45.5)	21 (40.4)
Senior High School	18 (27.3)	11 (21.2)

Table 2. Determinant factor related to the sand and gravel mining workers' behavior in terms of PPE usage

Variable	n (%)	p-value	r
Beliefs		0.029	0.202
Positive	72 (61.0)		
Negative	46 (39.0)		
Knowledge		0.000	0.669
Good	41 (34.7)		
Fair	59 (50.0)		
Less	18 (15.3)		
Attitude		0.607	0.048
Positive	62 (52.5)		
Negative	56 (47.5)		
PPE availability		0.000	0.328
Good	40 (33.9)		
Fair	20 (16.9)		
Poor	58 (49.2)		
Owners' attitude toward PPE usage		0.917	- 0.010
Good	0		
Fair	18 (15.3)		
Poor	100 (84.7)		
Behavior			
Good	34 (28.8)		
Poor	84 (71,2)		

Most of the respondents have a positive belief about the importance of using PPE, enough knowledge about PPE benefit usage, they perceive there to be good enough PPE availability in the workplace and they consider that the workplace owner has a low attitude towards PPE usage for their workers (Table 2).

The statistical analysis show that the worker's beliefs (p=0.029; r=0.202), the worker's knowledge (p=0.000; r=0.669) and PPE availability (p=0.000; r=0.328) were significantly correlated with the worker behavior in terms of PPE usage. Worker attitude (p=0.607) and the workplace owner's attitude toward PPE usage (p=0.917) were not significantly correlated with worker behavior in PPE usage.

IV. DISCUSSION

This study found there to be a low use of PPE (71.2%) among the sand and gravel mining workers in Indonesia. This result contrasts with several factors related to the use of PPE by the sand and stone workers. This study showed that most of the sand and gravel mining workers had positive beliefs in relation to the importance of PPE usage, but they still did not use it. The workers have the belief that PPE usage slows down their work and disrupts the work process. This belief has led to the avoidance of PPE usage. A previous study also highlighted the workers' ignorance as contributing to poor safety practices and low PPE usage [16].

Most of the sand and gravel mining workers have a low educational background and they have not received information about PPE usage. The workers' ignorance of PPE usage could be affected by their beliefs and prior experience of PPE usage [17,18]. Other studies showed that a lack of general knowledge or knowledge about safety training also reduced PPE usage [19,20]. Environmental factors and supporting factors, such as the availability of facilities for PPE and the attitude of the workplace towards PPE usage, also influenced the workers in terms of PPE usage [21].

This study results showed that the sand and gravel mining workers had an average age of 45 years with a work duration that varied from 5 to 15 years. The results of this study indicated that there is no relationship between attitude with the employee's behavior in terms of PPE usage. In general, the sand and gravel mining workers have a positive attitude, but show negative behaviors. The same result was found by another study in that attitudinal ambivalence was

present as a partial mediating factor of safety attitude and safety behavior [22]. The condition of ambivalence could come from the conflicts in cognitive and affective attitudes of sand and gravel mining workers.

Workers conflicts might happen in several ways, namely; the priority of safety could be conflicting with an emphasis on schedule or cost; sand and gravel mining workers may change their safety acts when they choose to enjoy the convenience or are under stress, anger, and difficult operating conditions; safety trainings can be conflicting with habitual unsafe behavior in sand and gravel mining workers groups, which may lead to unsafe behavioral intent when the habitual unsafe behavior prevails; safety attitudes and safety behavior can be inconsistent among different team members, and the influence from their coworkers can be greater than that from the project organization's higher safety management, which makes it harder for safety leadership to be effective in construction crews [22,23]. This condition is supported by the unavailability of PPE facilities, the lack of supervision and attention from the owners, and less support from the owner when it comes to using PPE. The workers' attitude is influenced by several factors, such as the availability of PPE facilities, the owner's supervision, and the workers' beliefs in the importance of PPE usage. The sand and mining owners in this study explained that they provided PPE for the sand and mining workers, but that they never supervised the PPE usage.

Small-scale sand and mining locations have provided employment to many people around the site in Indonesia. The sector plays a role in the government and society in terms of development. However, the benefits are not accompanied by the safety issue in terms of site location. The role of the local government regarding the policy of PPE usage and the owners' role in increasing the workers' knowledge of PPE usage at the sand and mining sites is very important and needs to be improved. Other study found need to encourage supervision to ensure that PPE is comfortable, and to always check, maintain, and replace PPE to improve the practice of wearing PPE and also emphasized the importance of enforcing employees to comply with the use of PPE through disciplinary action, incentives, and education [24].

However, this study has limitations that should be considered in the interpretation. We used a cross-sectional design where PPE usage was assessed once. An observational study on site for a longer period would have been a strength, but this requires more resources. Besides this, there is the possibility of reporting bias during the interviews. In addition, our findings are limited to sand and mining in one site in Indonesia and the application of these results to other sites in Indonesia or other industries may not be valid. This study gave a description of sand and gravel mining workers in PPE usage which is not greatly studied, so the finding of this study should be meaningful information.

V. CONCLUSION

PPE usage by the sand and mining workers can be influenced by the workers' beliefs about PPE usage importance. Other factors that contribute to PPE usage include motivation, social support and PPE facility availability. The role of the local government regarding the policy related to PPE usage and the owners' role in increasing the workers' knowledge of PPE usage is also important.

CONFLICT OF INTEREST

No conflicts of interest have been declared.

ACKNOWLEDGMENT

All authors of this study would like to thank to Universitas Airlangga.

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