FACTORS AFFECTING PERSONAL PROTECTIVE EQUIPMENT USE BEHAVIOR IN WELDING WORKSHOP WORKERS

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ABSTRACT

Welding workshops are informal sector businesses with a high risk of hazards that require occupational safety and health (OSH) efforts, such as the use of personal protective equipment (PPE). Some welding accidents are caused by PPE factors. The purpose of this study was to analyze the factors that influence the behavior of wearing PPE in welding workshop workers. This study used an observational analytic type with a cross-sectional design. The population of this study was 41 welding workshop workers, all of whom were used as samples (total sampling). The variables measured were age, length of service, education, knowledge about PPE, attitude towards PPE, availability of PPE, and behavior of wearing PPE. Statistical analysis used Multiple Binary Logistic Regression using SPSS 27 software, at $\alpha = 5\%$. The results of the analysis showed that the factors that influence the behavior of wearing PPE are knowledge about PPE (OR = 2.12; p = 0.040), attitude towards PPE (OR = 2.37; p = 0.034), and availability of PPE (OR = 4.27; p = 0.038). The regression coefficient shows a positive value, which means that an increase in knowledge about PPE ($\beta = 0.754$), attitude towards PPE ($\beta = 0.865$), and availability of PPE ($\beta = 1.453$) will increase the behavior of wearing PPE.

Keywords: Personal Protective Equipment, Welding Workshop

INTRODUCTION

The use of personal protective equipment (PPE) is one of the efforts to minimize the occurrence of work accidents and occupational diseases. In the welding process, various hazards can threaten worker safety, such as sparks, ultraviolet radiation, and dust. The results of previous research showed that welding workshop workers at the Welding Workshop Business in Bandar Klippa Village, Percut Sei Tuan District, North Sumatra, had 30 workers who experienced work accidents due to workers not wearing complete PPE (Tanjung *et al.*, 2022). Therefore, the use of PPE that is appropriate and following work safety standards is very important for welding workers (Rahayu, Effendi and Andriyani, 2020; Yenni, 2020). Based on the results of research conducted by Mualim (2021) the prevalence of welding workers who did not use PPE completely in Bengkulu city is still quite high, which is 69.6%. This shows that there were still many welding workers who did not understand the importance of using PPE and were not accustomed to using it. Based on the results of previous research, it was found that out of 36 welders who used incomplete PPE, 25 respondents (69.4%) had experienced work accidents (Tanjung *et al.*, 2022). Several factors can influence the behavior of PPE use in welding workers, namely individual factors and environmental factors. Individual factors include age, length of service, education, knowledge of PPE, attitudes toward PPE, and environmental factors including the availability of PPE (Azizah *et al.*, 2021; Kurnia, Asparian and Nurdini, 2021; Aprilianti *et al.*, 2022).

One of the informal industry sectors that has working conditions that are at risk of accidents and occupational diseases is the welding workshop. These conditions are formed from welding processes that are associated with fire and flammable or explosive materials. Welding workshop working conditions with various hazards can threaten the safety

and health of welding workers (Suparmi, Khairat and Krisdiyanta, 2018; Tanjung *et al.*, 2022; Ananda *et al.*, 2023). Work accidents in workers that result in injury can be caused by negligence or unsafe actions taken (Zulkarnaen and Ramdhan, 2023). Unsafe actions that are often taken are ignoring and considering the use of personal protective equipment (PPE) is not important (Sulistyowati and Sukwika, 2022). Whereas PPE is an effort to control risks and protect part or all of the workers' bodies from risks that can threaten safety and health (Anggraeni, Saleh and Darwis, 2021).

Everyone's PPE usage behavior is different and can be influenced by various factors (Putriyona, 2020). In theory, several factors can determine a person's behavior, including predisposing factors (knowledge, attitudes, beliefs values, etc), supporting factors (availability of facilities), and driving factors (supervision, policies, sanctions, and rewards) (Mahendra, Jaya, and Lumban, 2020). The number of factors that can influence a person's behavior, making the behavior of using PPE on welding workers needs to be considered because paying attention to the behavior of workers can prevent work accidents (Sultan, 2021). With a variety of potential hazards and risks, welding work requires PPE to be able to protect workers doing work (Joniarta *et al.*, 2022; Ledoh, Nayoan and Salmun, 2023). PPE needed in welding are headgear, glasses or face shields, masks or respirators, gloves, work clothes, earmuffs or earplugs, and shoes (Solichin, Endarto, and Ariwianti, 2014).

The selection of research locations in welding workshops in Selogiri Subdistrict, Wonogiri Regency was based on several considerations, namely: 1) Welding workshops are businesses in the informal sector that have high potential hazards. Welding is a process that produces various hazards, such as ultraviolet radiation, infrared radiation, sparks, and smoke. These hazards can cause various occupational diseases and

accidents, such as eye, skin, and respiratory tract irritation, and burns; 2) Work accidents among welding workers in Indonesia are still quite high, and not many studies have been conducted in Indonesia on the factors that influence the behavior of PPE use among welding workshop workers; and 3) PPE is one of the efforts to control hazards in the workplace in protecting workers from hazards that exist in the workplace.

Based on this background, the purpose of this study is to analyze the factors that influence the behavior of wearing personal protective equipment in welding workshop workers.

METHODS

The type of research used in this study is analytic observational with a cross-sectional approach. This research was conducted at 15 welding workshops in Selogiri sub-district, Wonogiri district. The study population amounted to 41 welding workshop workers, all of whom were taken as research samples using a total sampling technique, with inclusion criteria: welding workshop workers in the Selogiri sub-district, Wonogiri district and willing to become respondents, while exclusion criteria: not willing to become respondents and not present when data collection. The measuring instrument has been tested for validity and reliability so that it is valid and reliable, knowledge about PPE is measured by a test (Knowledge: $p < 0.05$; Cronbach's Alpha> 0.7) and attitudes towards PPE are measured by an attitude questionnaire towards PPE (Attitude: $p < 0.05$; Cronbach's Alpha = 0.7). The measurement scale of knowledge about PPE is ordinal (Good, Medium, and Less), attitude towards PPE is ordinal scale (Good, Medium, and Less).

PPE availability and PPE-wearing behavior were measured using a checklist filled out by respondents once at the time of data collection. Statistical analysis used multiple binary logistic regression to test the relationship between variables simultaneously and partially.

Statistical *software* used SPSS 27, testing at a significance level of 5%.

RESULTS AND DISCUSSION

1. Respondent Characteristics

The characteristics of the research respondents are shown in Table 1, which presents avariable decryption of age, length of service, education level, knowledge about PPE, attitudes towards PPE, availability of PPE, and PPE usage behavior.

Table 1. Respondent Characteristics

Variables	n	%
Age		
< 20 years	2	4,9
20 - 40 years	11	26,8
> 40 years	28	68,3
Length of Service		
< 5 years	19	44,3
5 - 10 years	12	29,3
> 10 years	10	24,4
Education Level		
SMP	31	75,6
SMA/K	6	14,6
Higher Education	4	9,8
Knowledge of PPE		
Good	15	48,8
Medium	6	14,6
Less	20	36,6
Attitude towards PPE		
Good	22	53,7
Medium	6	14.6
Less	13	31,7
PPE Availability		
Available in Full	14	34.1
Available Incomplete	27	65.9
PPE Usage Behavior		
Good	17	41.5
Poor	24	58.5

The results of the statistical description of the measured variables as presented in Table 1 show that the dominant age is in the category of more than 40 years (68.8%), the dominant working period is less than 5 years (44.3%), the dominant education level is junior high school (75.6%), knowledge about PPE is dominant in the good category (48.8%), attitudes towards PPE are dominant in the good category (53.7%), the availability of PPE is more available but incomplete (65.9%), and PPE usage behavior

is more in the poor category (58.5%). Furthermore, in accordance with the research objectives, namely analyzing the factors that influence the behavior of wearing personal protective equipment in welding workshop workers, multiple binary logistic regression analysis was carried out with the results shown in Table 2.

Table 2. Multiple Binary Logistic Regression Analysis Results

Methods	Variables	β	p	aOR (IK95%)
Enter	Age	0,863	0,138	2,37 (0,75 - 7,41)
	Length of Service	0,195	0,621	1,21 (0,56 - 2,63)
	Education Level	0,783	0,190	2,18 (0,67 - 7,05)
	Knowledge of PPE	0,754	0,040	2,12 (1,03 - 4,36)
	Attitude towards PPE	0,865	0,034	2,37 (1,07 - 5,26)
	PPE Availability	1,453	0,038	4,27 (1,08 - 16,82)
	Constant	-11,853		

Dependent variable: PPE Usage Behavior

Multiple binary logistic regression analyses at the 5% significance level, obtained output information including the Omnibus Test of Model Coefficients obtained X^2 = 17.752 and p=0.007. The results of the Omnibus Test of Model Coefficients analysis show that there is a simultaneous influence of all independent variables (age, length of service, education level, knowledge of PPE, attitude towards PPE, and availability of PPE) which has a significant effect on PPE usage behavior ($p < 0.05$). In the Model Summary output, the Nagelkerke R Square value =0.473 was obtained. This Nagelkerke R Square value indicates the influence of the independent variables together of 0.473 x 100% = 47.3%. In the Hosmer and Lemeshow Test output, the p-value = 0.259 is obtained. Because the p-value = 0.259 in the Hosmer and Lemeshow Test output is greater than 0.05 ($p > 0.05$), the resulting regression model is fit.

In the main variables studied, without the variables of age, length of service and level of education; the effect of knowledge about PPE, attitudes towards PPE, and availability of PPE on PPE-wearing behavior is shown in Table 3.

Table 3. Results of Multiple Binary Logistic Regression Analysis without Age, Length of Service and Education Level Variables

Method	Variable	β	p	aOR (IK95%)
Enter	Knowledge of PPE	0,087	0,858	1,09 (0,42 - 2,84)
	Attitude towards PPE	0,885	0,047	2,35 (0,83 - 6,62)
	PPE Availability	1,527	0,043	4,60 (0,92 - 23,02)
	Konstanta	-4,525		

Dependent variable: PPE Usage Behavior

The results were different when multiple binary logistic regression analysis was conducted without involving the variables of age, length of service, and education level. The test results showed the Omnibus Test of Model Coefficients obtained X^2 = 9.779 and p = 0.021. These results stillshow the simultaneous influence of the variables of knowledge about PPE, attitudes towards PPE, and availability of PPE ($p < 0.05$). In the Model Summary output, the Nagelkerke R Square value = 0.286 is obtained, which means that the influence of the variables of knowledge about PPE, attitudes towards PPE, and PPE availability together is 28.6%. In the Hosmer and Lemeshow Test output, the p-value = 0.078 is obtained, which means that the resulting regression model remains fit. In this case, there was a decrease in the amount of influence on PPE usage behavior from 47.3% (all variables involved) to 28.6% (only involving variables of knowledge about PPE, attitudes towards PPE, and availability of PPE).

The results of multiple binary logistic regression analysis, shown in the SPSS output "Variables in the Equation", describe the partial relationship of each independent variable to PPE usage behavior (see Tables 2 and 3). The positive regression coefficients for all independent variables (age, length of service, level of education, knowledge about PPE, attitude towards PPE, and availability of PPE) indicate that increases in these variables are associated with increases in PPE usage behavior.

In the partial analysis, knowledge about PPE showed no

statistically significant relationship (p = 0.858) with PPE usage behavior, while both attitudes towards PPE (p = 0.047) and availability of PPE (p = 0.043) were significantly related. This suggests that the effect of knowledge on PPE usage may depend on the presence of age, length of service, and level of education.

The partial analysis of each independent variable on PPE wearing behavior (Table 2) revealed Odds Ratio (OR) exceeding 1. After controlling for other variables, these OR became adjusted Odds Ratio (aOR), indicating that all independent variables were associated with PPE wearing behavior. The availability of PPE had the largest aOR (4.27), while length of service had the smallest (1.21). However, based on p-values, only knowledge about PPE, attitude towards PPE, and availability of PPE were statistically significant ($p < 0.05$), while age, length of service, and education level were not ($p > 0.05$).

Although the nature of the relationship between knowledge about PPE and PPE use behavior is influenced by age, length of service, and education level, knowledge remains statistically significant (aOR = 2.12). This indicates that for welding workers with good knowledge, the likelihood of good PPE use behavior is 2.12 times higher compared to those with poor knowledge. This aligns with the understanding that good knowledge facilitates the adoption and lasting development of positive behavior (Romdhona et al., 2022). Furthermore, our findings reinforce Lawrence Green's theory that knowledge acts as a predisposing factor for behavior change (Hendriansyah et al., 2019). They also concur with previous research demonstrating a significant association between knowledge and PPE use among welding workshop workers (Rahayu, Effendi, & Andriyani, 2020; Rahayu, Effendi, & Andriyani, 2018). However, some inconsistencies with other studies exist (Fambayu, Miftakhuluddin, & Prasetio, 2018). The latter found no link between knowledge and PPE use, attributing it to

workers already possessing adequate knowledge but lacking access to complete PPE due to workplace limitations.

A positive attitude towards PPE demonstrably influences PPE usage behavior (aOR=2.37). This signifies that welding workers with positive attitudes are 2.37 times more likely to exhibit consistent PPE use compared to those with less positive attitudes. Attitude can shape behavior because it represents a collection of tendencies influencing a person's response to stimuli before it translates into action. In simpler terms, attitude reflects one's readiness or willingness to act. Therefore, a more positive attitude corresponds to a greater inclination to act (Abd Latif, Mukhzarudfa, & Friyani, 2023). Our findings support Lawrence Green's theory, which posits that attitude serves as a predisposing factor, facilitating the formation of behavior. This aligns with previous research demonstrating a significant association between positive attitudes and PPE use among welding workshop workers (Mualim, 2021). As Mualim (2021) observed, respondents with positive attitudes towards PPE were more compliant with wearing it during work. However, contrasting research exists (Parawansa et al., 2022). They found no link between attitude and PPE use, attributing it to workers already possessing positive attitudes but lacking access to complete PPE due to workplace limitations.

Although statistically significant, the availability of PPE has a complex relationship with PPE use behavior. Our data reveals that 65.9% of workers reported incomplete PPE availability. Notably, respondents with access to complete PPE (at least four mandatory items) demonstrated higher compliance with consistent PPE use (64.3%) compared to those with incomplete PPE (35.7%). This highlights the crucial role of workplace compliance with regulations like Law No. 1 of 1970, which mandates complete PPE provision. In our study, "complete PPE" refers to having at least four mandatory items, while "incomplete PPE" indicates

having fewer than four. Ample evidence suggests that providing PPE tailored to workers' needs not only influences their PPE use behavior but also reduces work-related risks (Naiem et al., 2019). Moreover, complete PPE provision reflects a company's commitment to protecting its workforce, valuable assets vulnerable to work accidents and occupational diseases (Sulistyowati & Sukwika, 2022).

In this study, the availability of PPE significantly influences PPE usage behavior, as demonstrated by an adjusted odds ratio (aOR) of 4.27. This indicates that welding workers with access to complete PPE are 4.27 times more likely to consistently use PPE compared to those without it. The availability of PPE can influence a person's PPE use behavior because access to comprehensive safety equipment provides the necessary support and reinforcement for adopting and maintaining positive behavior (Naiem et al., 2019). This finding aligns with Lawrence Green's theory, which posits that readily available resources, such as PPE, act as facilitating factors in shaping behavior. Further supporting this notion, previous research has established a clear connection between complete PPE availability and consistent PPE use among welding workshop workers (Mongkau, Rattu, & Suoth, 2020). Mongkau et al. (2020) observed that access to complete PPE significantly increased the likelihood of proper PPE use compared to situations with incomplete PPE. However, some studies show divergent findings. For example, Amini, Baharuddin, and Syam (2022) found no association between PPE availability and PPE use in welding workshops. The reasons for this discrepancy may lie in factors such as PPE incompatibility with business owner standards or the perception within the informal welding industry of minimal risk and hazard potential, as proposed by Ferisya, Sabilu, and Pratiwi (2023).

CONCLUSIONS

The study revealed simultaneous associations between all six variables (age, length of service, education level, knowledge about PPE, attitudes towards PPE, and availability of PPE) and PPE-wearing behavior. Notably, age, length of service, and education level, despite not having direct effects themselves, act as moderators of the indirect impact of partial PPE knowledge. This moderating effect indicates that these variables can either heighten or weaken the influence of partial knowledge on PPE use.

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