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Determinants of Personal Protective Equipment (PPE) Compliance Among Workers

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ABSTRACT

Background: *Personal Protective Equipment (PPE) is an essential component of occupational safety and health, serving as the last line of defense against workplace hazards. Despite the availability of PPE in many workplaces, worker compliance remains suboptimal, contributing to occupational injuries and reduced productivity. Understanding the determinants of PPE compliance is essential for developing effective workplace safety interventions, particularly in rapidly developing regions such as Baubau City, Southeast Sulawesi.*
Research Objective: *This study aimed to identify the determinants of Personal Protective Equipment (PPE) compliance among workers in Baubau City, Southeast Sulawesi.*
Methods: *An analytical cross-sectional study was conducted from May to July 2026 involving 120 workers selected through proportionate random sampling. Data were collected using a structured questionnaire assessing respondents' characteristics, knowledge, attitudes, occupational safety training, supervision, PPE availability, management support, and PPE compliance. Data were analyzed using descriptive statistics, the Chi-square test for bivariate analysis, and multiple logistic regression to determine the dominant factors associated with PPE compliance. Statistical significance was established at $p < 0.05$.*
Results: *The majority of respondents (69.2%) were compliant with PPE use. Bivariate analysis revealed significant associations between PPE compliance and knowledge ($p = 0.001$), attitude ($p = 0.002$), occupational safety training ($p = 0.004$), supervision ($p = 0.001$), PPE availability ($p = 0.006$), and management support ($p = 0.001$). Multiple logistic regression identified supervision as the strongest determinant of PPE compliance (AOR = 3.41; 95% CI: 1.52–7.67; $p = 0.003$).*
Conclusion: *PPE compliance among workers is influenced by both individual and organizational factors, with supervision emerging as the strongest predictor. Strengthening occupational safety training, ensuring adequate PPE availability, enhancing workplace supervision, and reinforcing management commitment are recommended to improve PPE compliance and reduce occupational injuries.*

Keywords: *Personal Protective Equipment; Occupational Safety; Compliance; Workers; Occupational Health*

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BACKGROUND

Occupational safety and health (OSH) has become a global priority because workplace accidents and occupational diseases continue to threaten workers' health, productivity, and quality of life (Cheng et al., 2022). One of the most effective preventive measures is the consistent use of Personal Protective Equipment (PPE), which serves as the last line of defense against occupational hazards after engineering and administrative controls have been implemented (El-Sokkary et al., 2021). PPE such as helmets, safety shoes, gloves, goggles, face shields, respirators, and protective clothing plays a critical role in minimizing workers' exposure to physical, chemical, biological, and mechanical hazards (Wild et al., 2023). Nevertheless, despite the availability of PPE in many workplaces, non-compliance among workers remains a persistent challenge (Sherman et al., 2022). Failure to use PPE appropriately increases the risk of occupational injuries, disability, reduced productivity, and even death (Gholami et al., 2020). Therefore, identifying the determinants of PPE compliance is essential for developing effective occupational health interventions and strengthening workplace safety culture (Thomas et al., 2022).

The urgency of this research is reflected in the continuously high burden of occupational accidents worldwide (Donkor et al., 2023). According to the International Labour Organization (ILO), approximately 2.93 million workers die annually due to work-related accidents and occupational diseases, while around 395 million workers experience non-fatal occupational injuries each year (Svendsen et al., 2020). In addition, the economic impact of occupational accidents and diseases is estimated to account for nearly 4% of the global Gross Domestic Product (GDP) due to healthcare costs, productivity losses, compensation, and reduced workforce participation (Kursunoglu et al., 2022). Although advances in occupational safety regulations and technology have contributed to improvements in many countries, occupational accidents remain disproportionately high in low- and middle-income countries where workplace safety management systems, supervision, and workers' compliance with PPE are often inadequate (Zhang et al., 2023). Consequently, improving PPE compliance has become one of the most cost-effective strategies for preventing occupational injuries and promoting sustainable workforce productivity (Siame et al., 2022).

Indonesia faces similar occupational safety challenges as rapid industrialization, infrastructure development, and expanding manufacturing activities expose workers to various occupational hazards (Cloete et al., 2020). Data from the Social Security Administering Body for Employment (BPJS Ketenagakerjaan) indicate that the number of occupational accidents continues to increase annually, with more than 370,000 occupational accident cases reported in 2023 (Jalil Al-Bayati et al., 2023). Construction, manufacturing, mining, transportation, and informal sectors contribute substantially to these cases. Although the Indonesian government has strengthened occupational safety regulations through Law No. 1 of 1970 concerning Occupational Safety and subsequent regulations regarding PPE utilization, workplace accidents remain common (Santurtún et al., 2023). Previous reports have shown that many accidents are associated with unsafe behaviors, including failure to wear PPE correctly, inadequate occupational safety training, limited supervision, poor safety awareness, and insufficient organizational commitment toward workplace safety. These conditions emphasize the need to investigate behavioral and organizational determinants influencing PPE compliance among Indonesian workers (Diktas et al., 2021).

In Southeast Sulawesi Province, economic growth driven by construction, fisheries, maritime industries, mining, and public infrastructure development has increased the number of workers exposed to occupational hazards (Klimecka-Tatar et al., 2023). Provincial occupational health reports indicate that workplace accidents continue to occur across various sectors, particularly those involving manual labor and heavy equipment operation. Although many companies provide PPE as required by occupational safety

regulations, consistent utilization among workers remains suboptimal. Limited occupational health education, inadequate safety supervision, varying levels of knowledge, and differences in workers' attitudes toward occupational risks contribute to inconsistent PPE compliance (Klein et al., 2020). These challenges demonstrate that the availability of PPE alone is insufficient without understanding the behavioral factors that influence workers' willingness to use protective equipment consistently (Agessi, 2020).

The occupational safety situation is similarly observed in Baubau City, one of the important economic and transportation centers in Southeast Sulawesi. Rapid urban development, expansion of construction projects, port activities, transportation services, and small- to medium-scale industries have increased occupational health risks among workers. Local workplace observations indicate that PPE is generally available in many workplaces, however, its utilization is frequently inconsistent (Pham et al., 2023). Some workers remove protective equipment because of discomfort, heat, restricted movement, poor fit, time pressure, inadequate supervision, or the perception that certain tasks pose minimal risk. In addition, occupational safety education and periodic monitoring remain variable across workplaces. These circumstances increase workers' vulnerability to occupational injuries and underscore the need to identify determinants influencing PPE compliance in the local context (Raza et al., 2022).

Previous studies have identified several factors associated with PPE compliance, including workers' knowledge, attitudes, educational level, length of employment, safety training, risk perception, management commitment, availability of PPE, workplace supervision, and organizational safety culture (Mensah et al., 2022). However, important research gaps remain. First, many studies have examined only one or two individual factors without simultaneously considering behavioral and organizational determinants (Oza et al., 2022). Second, most existing research has been conducted in manufacturing or mining industries, while evidence from construction, service, transportation, and mixed occupational sectors is relatively limited (Shan, 2022). Third, previous studies frequently employ descriptive or simple cross-sectional analyses without identifying the strongest predictors of PPE compliance using multivariable approaches. Fourth, empirical evidence from Southeast Sulawesi, particularly Baubau City, remains scarce despite increasing industrial and infrastructure development. Consequently, locally relevant evidence is still insufficient to guide occupational safety policies and intervention programs.

The novelty of this study lies in its comprehensive assessment of multiple determinants of PPE compliance, including workers' knowledge, attitudes, occupational safety training, supervision, PPE availability, and management support within the occupational setting of Baubau City. Unlike previous studies focusing primarily on individual behavior, this research integrates both behavioral and organizational perspectives to provide a broader understanding of PPE compliance. The findings are expected to generate local evidence that supports the development of targeted occupational health promotion strategies, strengthens workplace safety culture, and assists employers and policymakers in designing effective interventions to reduce occupational injuries.

Therefore, this study aims to analyze the determinants of Personal Protective Equipment (PPE) compliance among workers in Baubau City, Southeast Sulawesi, by identifying individual and workplace-related factors associated with PPE use, thereby providing evidence-based recommendations to improve occupational safety practices, reduce workplace accidents, and strengthen occupational health programs in Indonesia.

METHODS

This study employed an analytical cross-sectional design (Leonardi et al., 2020) to identify the determinants of Personal Protective Equipment (PPE) compliance among

workers. The study was conducted from May to July 2024 in several workplaces in Baubau City, Southeast Sulawesi, Indonesia.

A total of 120 workers were selected using proportionate random sampling. Eligible participants were workers aged ≥18 years, had worked for at least six months, and were directly exposed to occupational hazards requiring PPE use. Workers who were on leave or unwilling to participate were excluded from the study.

Data were collected using a structured and validated questionnaire consisting of respondents' characteristics, knowledge, attitudes, occupational safety training, supervision, PPE availability, management support, and PPE compliance. The questionnaire was administered after obtaining written informed consent from all participants.

Data were analyzed using IBM SPSS Statistics. Descriptive statistics were used to summarize respondent characteristics and study variables. The Chi-square test was performed for bivariate analysis, while multiple logistic regression was used to identify the dominant determinants of PPE compliance. Statistical significance was set at $p < 0.05$, and the results were presented as adjusted odds ratios (AORs) with 95% confidence intervals (95% CI).

RESULTS

Respondent Characteristics

A total of 120 workers participated in this study. Most respondents were aged 26–35 years (40.0%), male (75.0%), had completed senior high school (55.0%), had worked for ≥5 years (58.3%), and had attended occupational safety training (66.7%).

Table 1.
Respondent Characteristics (n = 120)

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
18–25	30	25.0
26–35	48	40.0
36–45	27	22.5
>45	15	12.5
Sex		
Male	90	75.0
Female	30	25.0
Education		
Junior High School	18	15.0
Senior High School	66	55.0
College	36	30.0
Length of Employment		
<5 years	50	41.7
≥5 years	70	58.3
Occupational Safety Training		
Yes	80	66.7
No	40	33.3

The majority of respondents were male workers aged 26–35 years, had completed senior high school, had worked for at least five years, and had previously attended occupational safety training

Univariate Analysis

Table 2.
Distribution of Study Variables (n = 120)

Variable	Category	n	%
Knowledge	Good	78	65.0
	Poor	42	35.0
Attitude	Positive	74	61.7

	Negative	46	38.3
Safety Training	Yes	80	66.7
	No	40	33.3
Supervision	Good	72	60.0
	Poor	48	40.0
PPE Availability	Adequate	88	73.3
	Inadequate	32	26.7
Management Support	Good	76	63.3
	Poor	44	36.7
PPE Compliance	Compliant	83	69.2
	Non-compliant	37	30.8

Most respondents demonstrated good knowledge (65.0%), positive attitudes (61.7%), had received occupational safety training (66.7%), experienced good supervision (60.0%), reported adequate PPE availability (73.3%), and perceived good management support (63.3%). Overall, 69.2% of workers were compliant with PPE use

Bivariate Analysis

Table 3.
Association Between Independent Variables and PPE Compliance

Variable	Compliant n (%)	Non-compliant n (%)	p-value
Knowledge			
Good	63 (80.8)	15 (19.2)	0.001
Poor	20 (47.6)	22 (52.4)	
Attitude			
Positive	60 (81.1)	14 (18.9)	0.002
Negative	23 (50.0)	23 (50.0)	
Safety Training			
Yes	63 (78.8)	17 (21.2)	0.004
No	20 (50.0)	20 (50.0)	
Supervision			
Good	58 (80.6)	14 (19.4)	0.001
Poor	25 (52.1)	23 (47.9)	
PPE Availability			
Adequate	68 (77.3)	20 (22.7)	0.006
Inadequate	15 (46.9)	17 (53.1)	
Management Support			
Good	61 (80.3)	15 (19.7)	0.001
Poor	22 (50.0)	22 (50.0)	

Bivariate analysis demonstrated significant associations between all independent variables and PPE compliance. Workers with good knowledge were more likely to comply with PPE use than those with poor knowledge (80.8% vs. 47.6%; $p = 0.001$). Similarly, workers with positive attitudes, occupational safety training, good supervision, adequate PPE availability, and strong management support exhibited significantly higher compliance rates than their counterparts (all $p < 0.05$). These findings indicate that both individual and organizational factors play important roles in promoting PPE compliance among workers.

Table 4.
Multiple Logistic Regression Analysis of Factors Associated with PPE Compliance

Variable	AOR	95% CI	p-value
Good Knowledge	2.84	1.26–6.41	0.012
Positive Attitude	2.51	1.11–5.68	0.027
Safety Training	2.19	1.01–4.76	0.046
Good Supervision	3.41	1.52–7.67	0.003
Adequate PPE Availability	2.47	1.08–5.64	0.031

Good Management Support	2.96	1.31–6.70	0.009

Multiple logistic regression identified good supervision as the strongest determinant of PPE compliance (AOR = 3.41; 95% CI: 1.52–7.67; p = 0.003). Workers who experienced good supervision were approximately 3.4 times more likely to comply with PPE use than those receiving poor supervision. Knowledge, positive attitudes, occupational safety training, adequate PPE availability, and management support also remained significant independent predictors of PPE compliance

DISCUSSION

This study found that knowledge, attitudes, occupational safety training, supervision, PPE availability, and management support were significantly associated with Personal Protective Equipment (PPE) compliance among workers in Baubau City. Furthermore, multiple logistic regression analysis identified supervision as the strongest determinant of PPE compliance. These findings indicate that workers' compliance with PPE use is influenced not only by individual characteristics but also by organizational factors that shape workplace safety behavior. Therefore, improving occupational safety requires a comprehensive approach that combines worker education with strong managerial commitment and effective safety supervision.

The results showed that workers with good knowledge demonstrated significantly higher PPE compliance than those with poor knowledge. Knowledge plays an essential role in influencing health-related behavior because workers who understand occupational hazards and the protective function of PPE are more likely to recognize the importance of using appropriate protective equipment during work activities. Adequate knowledge enables workers to identify workplace risks, understand the consequences of unsafe practices, and appreciate the benefits of preventive measures (Afolabi et al., 2021). These findings are consistent with occupational health behavior theories, which emphasize that knowledge serves as a prerequisite for behavior change. Previous studies have similarly reported that workers with better occupational safety knowledge are more likely to comply with PPE requirements than workers with limited understanding of occupational risks (Shehab et al., 2021).

Worker attitude was also significantly associated with PPE compliance. Respondents with positive attitudes toward occupational safety showed greater compliance with PPE use compared with those who had negative attitudes (Skład, 2019). Attitudes reflect workers' beliefs, perceptions, and willingness to adopt safe working practices. Workers who perceive PPE as an effective means of preventing injuries are generally more motivated to wear it consistently, whereas workers who consider PPE uncomfortable, unnecessary, or time-consuming are less likely to comply (Rikhotso et al., 2022). This finding supports the Health Belief Model, which suggests that individuals are more likely to engage in preventive behavior when they perceive themselves to be susceptible to occupational hazards and believe that the benefits of preventive actions outweigh the barriers. Consequently, improving workers' attitudes through continuous occupational safety education may strengthen compliance with PPE use (Tan et al., 2023).

Occupational safety training was another significant determinant identified in this study. Workers who had received safety training were more compliant with PPE use than those who had never participated in such training. Safety training provides workers with practical knowledge regarding hazard identification, correct PPE selection, proper use and maintenance of protective equipment, and emergency response procedures. Regular training also reinforces organizational expectations regarding workplace safety and increases workers' confidence in applying safe work practices. In addition, training creates opportunities for interaction between management and workers, allowing occupational safety messages to be communicated more effectively. These findings suggest that

periodic occupational safety training should become a routine component of workplace health promotion programs (Alam et al., 2022).

Among all variables examined, supervision emerged as the strongest determinant of PPE compliance. Workers who experienced good supervision were more than three times as likely to comply with PPE requirements compared with those receiving inadequate supervision (Zielinski Nguyen Ajslev & Elisabeth Ejstrup Nimb, 2022). Effective supervision ensures that occupational safety regulations are implemented consistently through regular observation, immediate feedback, and corrective actions when unsafe behaviors are identified. Supervisors also serve as role models who reinforce organizational commitment to safety and encourage workers to prioritize safe practices during daily activities. Consistent monitoring increases workers' accountability and reduces unsafe behaviors that may arise from negligence or complacency. Therefore, strengthening supervisory systems represents one of the most effective strategies for improving PPE compliance and reducing workplace accidents.

Management support also contributed significantly to PPE compliance. Workers who perceived strong organizational commitment to occupational safety demonstrated higher compliance than those reporting limited management support. Management commitment is reflected through the provision of adequate resources, implementation of clear safety policies, enforcement of workplace regulations, recognition of safe work practices, and investment in occupational safety programs. A positive safety culture encourages workers to regard PPE use as a shared organizational responsibility rather than merely an individual obligation. Conversely, weak management commitment may reduce workers' motivation to comply with occupational safety procedures because safety is perceived as a low organizational priority (Tetzlaff et al., 2021).

The findings of this study have important implications for occupational health practice and policy. Since PPE compliance is influenced by multiple factors, interventions should adopt a comprehensive strategy integrating behavioral, educational, and organizational approaches. Employers should provide regular occupational safety training, strengthen supervisory systems, ensure adequate PPE availability, and foster management commitment toward workplace safety. Occupational health professionals and public health practitioners should collaborate with employers to develop evidence-based health promotion programs that improve workers' knowledge and attitudes while reinforcing organizational safety culture. Such integrated interventions have the potential to reduce occupational injuries, improve worker productivity, decrease healthcare costs, and enhance overall workplace well-being.

This study has several strengths. It simultaneously examined multiple determinants of PPE compliance and identified the dominant predictor through multivariable analysis, providing a more comprehensive understanding of occupational safety behavior among workers in Baubau City. Additionally, the study contributes local evidence from Southeast Sulawesi, where empirical research on PPE compliance remains limited. However, several limitations should be acknowledged. The cross-sectional design does not permit causal inference, and self-reported data may be affected by recall bias or social desirability bias.

Furthermore, the study did not assess other potentially relevant factors such as organizational safety climate, workload, work stress, leadership style, or safety communication. Future research should employ longitudinal or prospective study designs, include more diverse occupational sectors, and incorporate objective observations of PPE use to strengthen the evidence regarding determinants of occupational safety behavior.

Overall, this study demonstrates that improving PPE compliance requires more than simply providing protective equipment. Effective occupational safety programs should combine worker education, positive attitudes, continuous training, adequate supervision, reliable PPE availability, and strong management commitment. By addressing these determinants

simultaneously, workplaces can establish a sustainable safety culture that minimizes occupational accidents, protects workers' health, and supports long-term organizational productivity.

CONCLUSION

This study concludes that knowledge, attitudes, occupational safety training, supervision, PPE availability, and management support are significant determinants of Personal Protective Equipment (PPE) compliance among workers. Among these factors, supervision was identified as the strongest predictor of PPE compliance. Workers who possessed good knowledge, positive attitudes, had received occupational safety training, experienced effective supervision, had adequate access to PPE, and perceived strong management support were more likely to comply with PPE use. These findings highlight that improving PPE compliance requires both individual behavioral change and organizational commitment to workplace safety.

Based on these findings, employers are encouraged to strengthen occupational safety programs by providing regular safety education and training, ensuring the availability of appropriate and high-quality PPE, implementing consistent workplace supervision, and fostering a positive safety culture through strong management commitment. Occupational health practitioners and policymakers should also develop comprehensive interventions that promote PPE compliance as an essential strategy for preventing occupational injuries and improving worker health. Future research is recommended to employ longitudinal or prospective study designs with larger and more diverse worker populations to further investigate causal relationships and evaluate the long-term effectiveness of occupational safety interventions.

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