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ORIGINAL ARTICLE

Examining safety knowledge and attitudinal factors related to unsafe conduct among lathe operators

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ABSTRACT

Background: Unsafe actions are a primary contributor to occupational accidents in industrial environments, yet the influence of worker-specific factors like knowledge and attitude requires continuous investigation. This study aimed to determine the association between Occupational Safety and Health (OSH) knowledge, attitude, and the prevalence of unsafe actions among lathe machine operators.
Methods: A cross-sectional study was conducted involving 33 lathe machine operators at CV. Melpura Jaya Teknik. Data on demographic characteristics, OSH knowledge, OSH attitude, and unsafe actions were collected using a structured questionnaire. The relationships between variables were analyzed using the Chi-Square test, with the significance level set at $p < 0.05$.
Results: The analysis revealed a highly significant association between OSH knowledge and unsafe actions ($p < .001$), as well as a significant association between OSH attitude and unsafe actions ($p = .031$). Notably, all participants with poor knowledge (100%) or an unsupportive attitude (100%) were found to engage in high-risk unsafe actions. Conversely, all workers with good knowledge or a supportive attitude were classified in the low-risk category.
Conclusion: OSH knowledge and attitude are critical determinants of safe behavior among lathe machine operators. Deficiencies in these areas are strongly correlated with high-risk actions. Therefore, workplace safety interventions should adopt a dual approach, focusing not only on comprehensive knowledge-based training but also on fostering a positive safety culture to shape supportive attitudes.

Keywords: unsafe actions, occupational health and safety, knowledge, attitude

Introduction

Work-related accidents are unforeseen and unwanted events that may result in losses, including injury or damage to property. One primary cause of occupational accidents is unsafe actions.[1,2] Unsafe actions refer to behaviors that endanger not only the worker themselves but also others, potentially leading to accidents.[3] The workforce constitutes a critical component in project implementation and represents a key asset for any company. Global data reveals a high number of work-related deaths, with over 2.78 million fatalities annually. Two-thirds of these deaths occur in Asia. In 2018, Indonesia had the highest number of workplace accidents in the world. That same year, the International Labour Organization (ILO) reported more than 1.8 million deaths in the Asia-Pacific region, along with 374 million work-related injuries and illnesses each year that lead to missed work.[4]

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Thus, occupational health and safety (OHS) management is essential within companies to address this issue. Safety and health at work are pivotal for uninterrupted production; therefore, OHS programs must be implemented in workplaces rather than remain mere theoretical concepts.[5] Occupational accidents typically occur within the work environment and are caused by various factors, with unsafe environmental conditions accounting for approximately 90% of minor accidents, 5% for moderate, and 5% for severe accidents. The causes can be broadly classified into two categories: mechanical and environmental factors (unsafe conditions) and human factors (unsafe actions). Several studies have highlighted the predominance of human factors as contributors to occupational accidents, accounting for 80-85% of incidents.[6] Unsafe actions are violations or deviations from established safe work standards that increase the likelihood of accidents. Examples include working at improper speeds, incorrect use of tools, failure to properly use personal protective equipment (PPE), repairing equipment while operational, engaging in horseplay during work, and similar behaviors.[7,8]

One critical factor influencing the frequency of unsafe actions within companies is workers' knowledge of occupational health and safety.[9] To ensure safe business operations, OHS practices must be consistently applied in accordance with Indonesian legislation, including Occupational Safety Law No. 1 of 1970 and Labor Law No. 13 of 2003, which mandate employer responsibility for protecting workers and managing potential hazards. Industrial accidents refer specifically to accidents occurring within industrial work environments.[10] Unsafe behaviors are hazardous acts committed by workers, often influenced by internal factors such as limited knowledge, negative attitudes, lack of motivation, and fatigue.[11] Behavior formation is influenced by predispositional factors (knowledge, attitudes, cultural values, individual characteristics), reinforcing factors (peer and supervisor support, rewards, punishments), and enabling factors (availability of PPE, regulatory adherence).[12]

In North Sumatra Province, various industries exist, including labor-intensive tool manufacturing, such as household appliance machinery. One such company is CV. Melpura Jaya Teknik, specializing in mechanical workshops, including lathe machining, milling, reconditioning, and welding services. The company provides technical engineering, spare part manufacturing, precision machining, and pump reconditioning services, with only two departments: office and workshop. CV. Melpura Jaya Teknik employs 33 workers, all lathe machine operators in the workshop. These workers generally have a high school education level, an average age of 40, and limited awareness of workplace hazards. Preliminary surveys indicate that various lathe machining tasks carry inherent risks. From 2022 to 2023, three occupational accidents involving lathe operators were recorded: finger amputations while operating machines with gloves, eye injuries due to the absence of protective eyewear from metal fragments, and injuries sustained from falling materials during crane operation. Unsafe behaviors identified include rushing work, engaging in horseplay, and smoking during operations. These habitual unsafe actions significantly increase the likelihood of occupational accidents. Therefore, this study aims to examine the relationship between workers' knowledge of occupational health and safety and the occurrence of unsafe actions among lathe machine operators at CV. Melpura Jaya Teknik.

Method

This study employed a descriptive-analytic correlational design with a quantitative cross-sectional approach. Its primary objective was to investigate the relationship between the independent variables—knowledge and attitudes regarding Occupational Health and Safety (OHS)—and the dependent variable, unsafe actions, among lathe machine operators at CV. Melpura Jaya Teknik. The cross-sectional design was chosen because it allows data collection at a single point in time, enabling the examination of correlations between risk factors and their impacts without longitudinal follow-up, as each subject is observed only once. The research was conducted at CV. Melpura Jaya Teknik, located on Jalan Madirsan, Lorong Mesjid No. 70, Tanjung Morawa District, Deli Serdang Regency, North Sumatra. Observations were focused on the workshop area where lathe machine operators perform their work. Data collection was scheduled to begin in May 2025 and continued until the study was completed. The target population comprised all lathe machine operators employed at CV. Melpura Jaya Teknik. Considering the limited population size, a total sampling technique was applied, whereby all members of the population were included as research subjects. Consequently, the study sample consisted of 33 lathe machine operators.

Data were collected using three main methods. First, direct field observation was conducted to record work accidents and to identify unsafe behaviors inconsistent with OHS principles. Second, a structured questionnaire was administered to measure the variables of knowledge, attitude, and unsafe action; this questionnaire served as the primary instrument for quantitative data collection. Third, a document review was performed on relevant internal company reports to supplement and validate the collected data.

All research variables were operationally defined to ensure consistent measurement. OHS knowledge was defined as respondents' understanding of OHS principles within the company and measured using a 10-item Guttman-scale questionnaire, where correct answers scored 1 and incorrect answers scored 0. Results were categorized as good (scores 8–10), moderate (scores 6–7), and poor (scores <6). OHS attitude was defined as respondents' responses toward OHS implementation and measured using 10 positive statements on a Likert scale ranging from 1 to 5. Scores were categorized as supportive (38–50), moderate (28–37), and unsupportive (<28). The dependent variable, unsafe action, was defined as risky behaviors that may lead to injury. It was assessed through 10 negative statements using a four-point Likert scale (1–4), categorized as high risk (scores ≤10) and low risk (scores >10).

Data analysis was conducted in two phases. First, univariate analysis described the characteristics of respondents (such as age, education, etc.) and the frequency distribution of each research variable (knowledge, attitude, and unsafe action), presented in frequency tables with percentages, means, and standard deviations. Second, bivariate analysis tested the hypotheses concerning the relationship between the independent variables (OHS knowledge and attitude) and the dependent variable (unsafe action). The Chi-Square statistical test was employed with a significance level (α) set at 0.05 to determine whether a statistically significant association existed among the variables.

Results

The study population consisted of 33 lathe machine operators employed at CV. Melpura Jaya Teknik. The demographic characteristics of the respondents and the distribution of the primary study variables are presented in Table 1. All participants (100%) were male. The age distribution was concentrated in two main groups: 20–29 years (36.4%) and 50–59 years (33.3%). A significant majority of respondents held a high school diploma as their highest level of education (84.8%). Regarding work tenure, the largest group (39.4%) had 1–5 years of experience, while those with 5–10 years and more than 11 years of experience were equally represented (30.3% each).

Table 1. Respondent characteristics and distribution of study variables (n=33)

Variable	n	%
Gender		
Male	33	100
20–29	12	36.4
30–39	1	3
40–49	8	24.2
50–59	11	33.3
> 60	1	3
Education		
High School	28	84.8
Bachelor's Degree	5	15.2
Work Tenure		
1–5 Years	13	39.4
5–10 Years	10	30.3
> 11 Years	10	30.3
OSH Knowledge		
Good	16	48.5
Fair	9	27.3
Poor	8	24.2
OSH Attitude		
Supportive	14	42.4
Fair	11	33.3
Unsupportive	8	24.2
Unsafe Action		
Low Risk	24	72.7
High Risk	9	27.3

Analysis of the key research variables indicated that concerning Occupational Safety and Health (OSH) knowledge, most respondents (48.5%) were categorized as having a "good" level of knowledge, followed by "fair" (27.3%) and "poor" (24.2%). In terms of attitude towards OSH, 42.4% of participants demonstrated a supportive attitude, while 33.3% had a fair attitude and 24.2% had an unsupportive attitude. For the primary outcome variable, unsafe actions, the majority of respondents (72.7%) were classified as low-risk. Nevertheless, a notable proportion (27.3%) engaged in actions categorized as high-risk.

To examine the relationship between the independent variables (knowledge and attitude) and the dependent variable (unsafe action), a bivariate analysis was performed using the Chi-Square test. The results of this analysis are summarized in Table 2.

Table 2. Association between osh knowledge, attitude, and unsafe actions

Predictor	*Unsafe Action*				Total		*p value*
	High Risk		Low Risk				
	n	%	n	%	n	%	
OSH Knowledge							
Good	0	0,0	16	100,0	16	100,0	0,000
Fair	1	11,1	8	88,9	9	100,0	
Poor	8	100,0	0	0,0	8	100,0	
OSH Attitude							
Supportive	0	0,0	14	100,0	14	100,0	0,031
Fair	1	9,1	10	90,9	11	100,0	
Unsupportive	8	100,0	0	0,0	8	100,0	

The statistical test revealed a highly significant association between the level of OSH knowledge and unsafe actions ($p < .001$). Specifically, all respondents (100%) with a good level of OSH knowledge were classified in the low-risk category for unsafe actions. Conversely, all respondents (100%) with poor knowledge were classified in the high-risk category. Furthermore, a significant association was also identified between OSH attitude and unsafe actions ($p = .031$). Following a similar pattern, all participants (100%) with a supportive attitude towards OSH performed low-risk actions, whereas all participants (100%) with an unsupportive attitude performed high-risk actions. These findings indicate that better knowledge and a more supportive attitude are significantly associated with safer behaviors in the workplace.

Discussion

This study identified a significant and robust association between Occupational Safety and Health (OSH) knowledge and attitude, and the prevalence of unsafe actions among lathe machine operators. This finding underscores the critical role of internal worker factors, such as cognitive understanding and affective disposition, in shaping workplace behavior. Specifically, the results demonstrate that workers with a good level of knowledge and a supportive attitude toward OSH consistently exhibit safer work practices. Conversely, deficient knowledge and an unsupportive attitude were directly correlated with high-risk actions. This implies that unsafe actions are not random occurrences but are rather the consequence of identifiable deficits in knowledge and attitude.

These findings are largely consistent with the existing literature in the field of occupational safety. A study found that knowledge and attitude simultaneously had a significant influence on the safety behavior of manufacturing workers. Adequate knowledge empowers workers to recognize hazards and understand correct work procedures, while a positive attitude fosters the internal motivation to adhere to safety protocols, even in the absence of direct supervision.[13] However, it is important to note that this relationship may not always be linear. A study by Setiyaningsih and Wartini[14] on veneer workers reported a significant association between attitude and unsafe actions, whereas knowledge showed no significant relationship. This discrepancy may suggest that in certain contexts, theoretical knowledge alone is insufficient to alter behavior if it is not internalized into a strong attitude or belief system. In the context of the lathe machine operators in the present study, where the risk of injury is immediate and tangible, both knowledge of consequences and a proactive attitude toward prevention appear to be equally critical.

Furthermore, the finding that 100% of workers with poor knowledge engaged in high-risk actions highlights the severe danger posed by information gaps in industrial settings. This aligns with established

accident causation theories, which posit that unsafe actions are often symptomatic of deeper systemic failures, including inadequate training.[15] When workers do not fully comprehend the risks associated with machine operation or are unaware of safe work methods, they inadvertently place themselves and their colleagues in peril. Similarly, the strong association between attitude and safe behavior underscores the importance of OSH culture. Attitudes are shaped not only by knowledge but also by perceptions of management commitment, peer norms, and the enforcement of regulations. An environment where safety is perceived as a shared priority will cultivate supportive attitudes, which in turn drive safe behaviors.[16,17]

The practical implications of these findings are clear. First, interventions aimed at reducing unsafe actions must focus on comprehensively improving OSH knowledge. Training should be more than a formality; it must be designed to be relevant, practical, and continuous, with an emphasis on identifying the specific hazards associated with lathe machine operation. The use of demonstrations, simulations, and case studies of accidents could enhance material retention and comprehension.[18] Second, organizations must actively build and sustain a positive OSH culture to shape worker attitudes. This can be achieved through visible leadership from management, involving workers in OSH committees, providing recognition and rewards for safe behavior, and enforcing policies consistently. Modifying attitudes is a long-term process that requires commitment from all organizational levels.[19,20]

Nevertheless, this study has several limitations that must be considered. First, the cross-sectional design can only identify associations between variables, not establish causality. While the theoretical basis is strong, it cannot be definitively concluded that knowledge and attitude cause unsafe actions. Second, the research was conducted at a single company (CV. Melpura Jaya Teknik) with a relatively small (N=33) and homogenous sample (all male). This limits the generalizability of the findings to other companies with different worker demographics or organizational cultures. Third, the reliance on self-reported questionnaire data introduces the potential for response bias, such as social desirability bias, where participants may answer in a manner they perceive to be correct rather than reflecting their actual behavior. Future research would benefit from a longitudinal design, larger and more diverse samples, and the incorporation of direct observational methods to validate self-reported behaviors.

Conclusion

In conclusion, this study demonstrates a definitive and statistically significant relationship between both knowledge and attitude regarding Occupational Safety and Health (OSH) and the occurrence of unsafe actions among lathe machine operators. Workers possessing higher levels of knowledge and more supportive attitudes consistently exhibited safer behaviors, whereas those with deficiencies in these areas were universally associated with high-risk actions. These findings strongly suggest that unsafe actions are not merely random events but are predictable outcomes linked to measurable internal factors. Therefore, to effectively mitigate workplace accidents, organizational strategies must extend beyond simple rule enforcement to include robust, targeted training programs that enhance worker knowledge and comprehensive initiatives aimed at cultivating a deeply ingrained culture of safety that positively shapes employee attitudes. Addressing both the cognitive and affective domains is essential for creating a sustainably safe work environment.

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