



## Analysis of Occupational Accidents in Various Informal Sectors in Indonesia

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### Abstract

Occupational Safety and Health (OSH) protection is the fundamental right of every worker and a legal component that should be implemented in the workplace, including the informal sector. Many informal sectors in Indonesia still have high potential hazards; including those related to the work environment, chemical substance management, inadequate knowledge of employers and workers, non-compliance with OSH standards, and suboptimal prevention of work-related accidents and illnesses. This study aims to analyze the OSH conditions in the informal sector and their influence on occupational accidents in various informal sectors in Indonesia. The study adopts an analytical observational design with a cross-sectional design, using purposive sampling technique. The selected informal sectors include paint workshops, batik, furniture and salons. An interesting finding from this research indicates that the variable influencing occupational accidents in the informal sector is chemical hazards, with a significance value  $<0.05$ , i.e.,  $0.035$ , and  $Exp(B)$  of  $64.188$ , meaning that workplace chemical hazards affect the occurrence of occupational accidents  $64.188$  times more. Therefore, intensive supervision and guidance regarding the work environment, especially chemical substance management, must be continuously enhanced.

### INTRODUCTION

The Occupational Safety and Health (OSH) standards in the informal sector need to be implemented because informal sector workers also face the same level of occupational safety and health risks as formal workers (Sepadi and Nkosi, 2021). Many informal sector workers live below the poverty line; demographic and socio-economic factors are considered in formulating

and implementing OSH policies because 60.6 % of work-related illnesses occur in individuals aged 50 years and above. Not using Personal Protective Equipment (PPE) increases the risk of work-related diseases (Adei, Agyemang-Duah and Mensah, 2022). In addition, informal sector workers are often exposed to traffic emissions and biomass fuel smoke (pollutants), and women exposed to workplace pollutants are associated

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with increased infertility and low birth weight babies (Hariparsad and Naidoo, 2019).

In addition to occupational illnesses, workplace accidents in the informal sector in Indonesia still tend to be relatively high (Madya and Nurwahyuni, 2019). However, many workplace accidents in the informal sector in Indonesia remain unrecorded and unrecognized (Alayyannur and Arini, 2021). Work-related accidents cause significant losses for the country; therefore, enforcing OSH standards, especially for informal sector workers, should be a priority that needs to be implemented (Alayyannur and Arini, 2021). One of the causes of workplace accidents is the lack of awareness of OSH and low compliance with the use of Personal Protective Equipment (Bentum et al., 2022), especially concerning the use of respiratory protective equipment and the duration of exposure to pollutants among informal sector workers (Sepadi and Nkosi, 2021), because local pollution can increase the risk of respiratory disorders (Weyant et al., 2022).

Not only in Indonesia, but the active economic population in Mexico is also dominated by 57.3 % of informal workers, where regulations related to OSH in the informal sector are still very low. Over the past 6 years, there has been an increase in health issues among informal workers, especially related to work-related illnesses, such as hearing loss and musculoskeletal disorders (Palacios Nava et al., 2018). This happens because informal workers often underestimate health risks and safety measures that should be taken while performing their tasks (Ohajinwa et al., 2017). One issue concerns the discipline in using PPE. They believe that using PPE during work can slow down their tasks and cause discomfort, and the majority state that they cannot afford to buy Personal Protective Equipment (Okwabi, Agyemang, and Nyanor, 2016). Therefore, increasing commitment to OSH, including through OSH awareness campaigns in the informal sector, is crucial. This will enable owners and workers in the informal sector to obtain adequate information about workplace safety and health, fostering a culture of OSH in the workplace (Duma and Nuryanto, 2018).

The Occupational Safety and Health (OSH) risks in the informal sector are not smaller than those in the formal sector; in fact, the informal sector often carries significant risks due to poor or non-standard compliance with OSH regulations (Bonafede et al., 2016), this often results in numerous workplace accidents occurring in the informal sector (Adei, Agyemang-Duah and Mensah, 2022) or work-related illnesses such

as Musculoskeletal Disorders (MSDs), Carpal Tunnel Syndrome (CTS) and others (Agustin, 2012; Septiawan, 2013; Barley and Aribowo, 2015; Dwiseptianto and Wahyuningsih, 2022). However, in reality, the informal sector, which absorbs a larger portion of Indonesia's workforce, remains lagging behind significantly in implementing OSH regulations, surveillance, providing OSH benefit programs, or social security guarantees for workers, despite numerous limitations such as limited capital, safe and appropriate technology, commitment, knowledge, awareness, ability to implement OSH norms, OSH facilities, OSH program implementation, surveillance systems, reporting, auditing and supervision (Widowati, 2018; Adei, Agyemang-Duah and Mensah, 2022). Therefore, establishing a baseline to describe the OSH conditions in the informal sector and identifying factors related to and influencing occupational health status in various informal sectors in Indonesia is crucial. One of the ways to achieve this is through safety campaigns via the publication of scientific articles that can present a snapshot of OSH in various informal sectors with important factors affecting the degree of occupational health and productivity in the informal sector. The hope is that relevant stakeholders can consider this information in developing strategies, OSH programs, and enhancing OSH culture in Indonesia.

With a significant portion of Indonesia's workforce engaged in the informal sector, coupled with the high risks of workplace accidents and occupational illnesses, low levels of OSH knowledge and awareness, and high exposure to multiple hazards in the workplace, so the aim of this research is to analyze the OSH conditions in the informal sector and their influence on workplace accidents across various informal sectors in Indonesia.

## METHOD

This study employs an analytical observational design to examine the relationships and influences among research variables without intervention. With a cross-sectional design, measurements between independent and dependent variables are conducted once a single time. The dependent variable in this study is workplace accidents, while the independent variables include complaints of muscle and bone, visual complaints, respiratory complaints, compliance with PPE usage, physical hazards, biological hazards, chemical hazards, ergonomic hazards, hygiene and sanitation, psychosocial factors, participation in OSH training, availability of OSH signs,

health examinations, the presence of OSH committees (P2K3), and the implementation of OSH surveillance.

This research was conducted in Semarang City, Central Java Province, Indonesia in 2023. Determining the locus and selection of informal sectors in this study was conducted using a purposive sampling technique, considering specific criteria such as having a high potential for safety and health hazards and using chemicals in their work processes. The chosen informal sectors include those engaged in the fields of paint workshops, batik, furniture and salons because this sector has quite high potential hazards, namely chemical, biological, ergonomic, physical and psycho-social hazards, apart from that this type of informal sector is often found in Indonesia. The population in this study consisted of 218 workers, distributed as follows: 149 workers from furniture businesses, 10 workers from salons, 10 workers from the batik group, and 49 workers from paint workshops. The sampling technique used was total sampling, but the total number of participants who fully participated in the study was only 72 individuals. Data collection techniques in this study involved direct workplace observation using hazard identification and assessment observation sheets and direct interviews for filling out questionnaires. Data analysis to examine the relationships between variables utilized non-parametric chi-square tests, while logistic regression tests were used to assess the influence

between variables. This study has received approval from the Health Research Ethics Committee of Universitas Negeri Semarang with approval number 191/KEPK/EC/2023.

## RESULT AND DISCUSSION

The number of male respondents was 88%, while female respondents accounted for 12% of the total. In terms of age, 66% of respondents were aged  $\leq 40$  years, while 34% were over 40 years old. Regarding education level, 2% of respondents had no formal education, 13% had completed primary school (SD), 24% had completed junior high school (SMP), 50% had completed senior high school (SMA), 6% had tertiary education, and 5% chose not to disclose their educational level. In terms of job position/division, respondents were distributed as follows: 19 respondents were welders, 4 were entrepreneurs/owners, 19 were staff members, 2 were drivers, 3 were in putty division, 1 worked in the warehouse, 4 were painters, 9 were carpenters, 2 were hairstylists, 2 were stylists, 4 were in finishing division, 1 was a mechanic, and 2 were production operators. They represent a variety of sectors, including paint workshops, batik, furniture and salons. For a bivariate analysis overview as presented in Table 1, multivariate analysis is provided in Table 2, and the chi-square test of chemical hazard exposure with workplace accidents is shown in Table 3 below.

Table 3 presents a detailed analysis of 72

Table 1. Bivariate Analysis Results of Factors with Workplace Accidents

Variable	P Value	Chi Square P Value (<0,05)
Muscle and Bone Complaints*	0,101	Unrelated
Vision Complaints	0,286	Unrelated
Respiratory Complaints	0,845	Unrelated
Compliance with the use of PPE	0,615	Unrelated
Physical hazards*	0,052	Unrelated
Biological hazards	0,811	Unrelated
Chemical hazards*	0,001	Related
Ergonomic hazards	0,350	Unrelated
Hygiene and sanitation	0,732	Unrelated
Psycho-social factors*	0,031	Related
Participation in Occupational Safety and Health (OSH) training	0,884	Unrelated
Availability of OSH signs	0,866	Unrelated
Health examinations	0,254	Unrelated
Existence of OSH committees	0,303	Unrelated
Implementation of OSH surveillance*	0,243	Unrelated

\* p value < 0,25 satisfies the conditions for multiple logistic regression testing

Table 2. Multivariate Analysis Results of Factors Associated with Workplace Accidents

Independent Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI	
							Lower	Upper
Musculoskeletal complaints	1.166	.664	3.084	1	.079	3.208	.873	11.782
Physical hazards	-.832	1.880	.196	1	.658	.435	.011	17.327
Chemical hazards*	4.162	1.979	4.423	1	.035	64.188	1.327	3103.774
Psychosocial factors	.543	1.602	.115	1	.735	1.721	.075	39.750
Implementation of OHS surveillance	.491	.892	.303	1	.582	1.635	.284	9.394

\* Sig < 0,05 Variables that influence the occurrence of work accidents

Table 3. Chi-Square Test of Chemical Hazard Exposure with Work Accident Occurrence

Chemical Exposure Hazard	Workplace Accident						P value	PR (95% CI)
	Incident		Amount		Σ	%		
	Occur	Not Occur	Σ	%				
Heavy	35	48,6	22	30,6	57	79,2	10,341 (3,917-50,917)	
Light	2	2,8	13	18	15	20,8	0,001	
Total	37	51,4	35	48,6	72	100		

respondents regarding exposure to chemical substances in the workplace with workplace accident incidents. Table 3 indicates that respondents whose workplaces have heavy chemical exposure tend to experience more workplace accidents compared to respondents whose units or workplaces have light chemical exposure hazards. Based on the Chi-Square test calculation results, a p-value of 0.001 was obtained;  $p < 0.05$ , meaning that chemical exposure hazards in the workplace are associated with workplace accident incidents, with a Prevalence Ratio (PR) value of 10.341 and a Confidence Interval (CI) range at a 95% confidence level of 3.917-50.917. Additionally, a p-value of 0.001;  $p < 0.25$  indicates that the relationship between chemical exposure hazards and workplace accident incidents meets multiple logistic regression testing requirements.

Table 1 shows that only 5 out of 15 independent variables, namely muscle and bone complaints, physical hazards, chemical hazards, psychosocial factors, and occupational health and safety surveillance implementation, meet the criteria for multiple logistic regression testing. Table 2 indicates that only 1 out of 5 variables tested in multiple logistic regression, the chemical hazard variable, impacts workplace accidents, with a significance value  $< 0.05$ , precisely 0.035, with an Exp (B) value of 64.188. This means that workers exposed to severe chemical hazards are 64.188 times more likely to experience workplace accidents than workers in environments with light or well-controlled chemical hazards.

Some chemicals found in salons include Sodium Laureth Sulfate (SLS), Cocamidopropyl Betaine, Polyquaternium-7, Cetyl Alcohol, Glyceryl Stearate, Cyclopentasiloxane, Hydrolyzed Silk, Potassium Persulfate, Ammonium Persulfate, Sodium Stearate, Hydrogen Peroxide, Dimethicone, Sodium Hydrosulfide, Mineral Oil, Thioglycolic Acid, Behentrimonium Chloride, Ethanolamine, Hydroxypropyl Starch Phosphate, Citric Acid, Polyquaternium-37, and others. These substances can cause skin irritation, eye irritation, respiratory tract irritation, digestive tract irritation, and skin sensitization (Trisna et al., 2024). Chemicals found in the batik industry include: soda ash, water glass, tapioca starch, alum, wax, Turkish Red Oil (TRO), and others. These substances can cause skin, eye, and respiratory tract irritation (Widowati et al., 2023). Chemicals found in paint workshops are quite diverse but are predominantly composed of epoxy, automotive paint, putty, thinner, and others. Meanwhile, in the furniture industry, the chemicals used are dominated by paint, varnish, and thinner. These chemicals can also cause skin and respiratory tract irritation (Sofia Zahra et al., 2024). The necessary controls include the need for safety awareness through improving understanding of good chemical management practices, the importance of housekeeping, regular health check-ups, improving ventilation systems, using Personal Protective Equipment (PPE), conducting routine inspections of machinery and tools, installing safety signs, labeling, and other measures (Jamila-

tul Izyati et al., 2023; Widowati et al., 2023; Nurul Amalia et al., 2024; Sofia Zahra et al., 2024; Trisna et al., 2024). Exposure to chemical odors such as furniture emissions, fragranced products, pesticides, or tobacco smoke has been reported to trigger central nervous system symptoms, such as fatigue, dizziness and headache (Azuma, Uchiyama, and Kunugita, 2019). The main cause of burn injuries resulting from workplace accidents is often chemicals. Lack of experience, inadequacy in implementing safety regulations, and insufficient training of employees in handling hazardous substances are contributing factors to these workplace accidents. Exposure to hazardous chemicals or toxic substances in the workplace can have negative health effects and may lead to workplace accidents due to loss of consciousness or errors in the use of these substances (Mian et al., 2011; Rommel et al., 2016).

Field conditions indicate that besides exposure to chemical hazards, exposure to physical hazards such as vibration, radiation, high temperatures, dust, inadequate lighting, and noise are still commonly found during field observations. Inadequate physical hazards can increase the risk of workplace accidents. Work environments that do not meet safety standards, are hazardous, or unsafe can cause various types of accidents (Rahmani et al., 2013). Several physical factors, such as vibration, noise, high temperatures, dust, and humidity, can affect the work capacity of individuals. A work environment with physical conditions exceeding Threshold Limit Values (TLVs) can lead to disturbances and even disabilities in the body, ultimately resulting in accidents due to errors resulting from limitations in work capacity (Thaper et al., 2023).

In addition to chemical and physical factors, issues related to psychosocial factors are also commonly found in the research focus, ranging from working hours, overtime, rest hours, employment status, social security for workers, wages, level of work stress, and the lack of implementation of occupational health and safety standards and norms are still prevalent in paint shops, batik workshops, furniture industries, and salons under study. The stress level in the informal sector of electronic waste recycling in Ghana is associated with injury occurrences. The income earned by companies does not equate to the benefits obtained by workers, such as the low safety and health protection level for workers. This aligns with research indicating that job satisfaction and job-related stress are related to workplace accident occurrences in micro woodwork enterprises in Ethiopia (Burns, Sayler and Neitzel, 2019;

Mulugeta, Tefera and Gezu, 2020). Furthermore, overtime work, which includes working beyond regular working hours or exceeding recommended time limits, can lead to an increased risk of workplace accidents. Overtime work can cause significant physical and mental fatigue in workers, and the lack of rest and recovery time necessary for workers can reduce alertness and increase the risk of accidents (Garde, 2021). Another simple method that can be applied to workers in the informal sector is by providing safety induction, providing PPE to deal with various dangerous exposures in the workplace and providing training to workers on how to use it, the urgency of why they have to wear PPE and carrying out adequate supervision during they work, because there is a relationship between respiratory symptoms (p-value = 0.024) and knowledge (p-value = 0.006) with compliance with the use of PPE for workers (p-value = 0.006), therefore it is important for business owners to provide and monitoring the use of PPE if residual risks are found that may still exist from the implementation of other hazard controls (Dwijaningtyas et al., 2023).

## CONCLUSION

The variable that has an influence on workplace accidents in several informal sectors, namely paint workshops, batik, furniture and salons, is chemical hazards, with a significance value  $<0.05$ , specifically 0.035 and Exp (B) 64.188, meaning that the chemical hazard variable affects workplace accident occurrences 64.188 times more significantly. This occurs because all four informal sectors studied use chemicals in their production processes. Thus, intensive supervision and guidance regarding the workplace environment, especially in the identification and control of chemical hazards in the workplace, as well as the implementation of related occupational health and safety standards and norms, are still highly needed in the informal sector to prevent and reduce workplace accidents, occupational diseases, and declining work productivity. This situation demands an enhancement of comprehensive and sustainable occupational health and safety management implementation across various informal sectors in Indonesia. The development and implementation of a comprehensive occupational health and safety management system should be based on a thorough identification of workplace hazards, including physical, biological, chemical, ergonomic, and psychosocial hazards, as well as factors influencing the degree of occupational safety and health in the informal sector. A safe and healthy environment will ul-

timately increase work productivity (Widowati, 2018).

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