

The Work Accidents in Educational Laboratories: An Analysis of Behavioral and Environmental Factors in the Safety Triad Perspective

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ABSTRACT

This study aimed to analyze factors associated with occupational accidents based on the *Safety Triad* model in the Medical Laboratory Technology Laboratory at Poltekkes Kemenkes Manado. A quantitative analytic observational study with a cross-sectional design was conducted among 111 second-year students using total sampling. Independent variables included behavioral factors (compliance with personal protective equipment/PPE use) and environmental factors (availability of occupational safety facilities), while the dependent variable was the occurrence of occupational accidents within the past six months. The results showed that 33.3% of respondents experienced occupational accidents, with chemical inhalation exposure as the most common type. Bivariate analysis revealed that behavioral factors ($p=0.036$; $PR=1.4$) and environmental factors ($p=0.018$; $PR=1.4$) were significantly associated with occupational accidents. These findings indicate that occupational accidents in educational laboratories result from interactions between behavior and the work environment. Therefore, a system-based safety approach is required, including strengthening PPE compliance, standardizing safety facilities, and promoting a safety culture to reduce occupational accident risks.

INTRODUCTION

Workplace accidents are still a significant global issue and have a wide impact on the health, safety, and productivity of the workforce, including in the health education sector. The implementation of Occupational Health and Safety (K3) is a strategic approach in creating a safe, healthy, and productive work and learning environment. K3 not only functions as a preventive effort against occupational accidents and work-related diseases, but also contributes to increasing individual motivation, compliance, and performance (Sumampouw & Roebijoso, 2017; Sumampouw, 2024). Globally, the International Labour Organization reports that every year there are more than 2.78 million deaths due to occupational accidents and diseases (ILO, 2020). In the Asia Pacific region, the number of work-related deaths reached around 1.2 million cases in the period 2000–2016 (ILO Asia Pacific, 2023). Meanwhile, in Indonesia, BPJS Ketenagakerjaan recorded 370,747 work accident claims in 2023 (Ministry of Manpower, Satudata, 2023). This data shows that workplace accidents are still a serious problem that requires evidence-based interventions and systematic approaches.

One of the environments with a high potential risk of work accidents is the laboratory. This environment has a variety of sources of hazards, including exposure to chemicals, biological agents, sharp tools, and electrical and heat equipment. Research in Lebanon shows that 45% of laboratory workers have had a work accident, with most caused by exposure to chemicals (73.7%) and inhalation (45.4%) (Nasrallah I.M., 2022). Another study reported that 25–38% of laboratory workers were injured, while only about 40% consistently used personal protective equipment (PPE) (Menard, 2020). Furthermore, the improper use of PPE increases the risk of work accidents by up to 3,388 times (Sinolungan et al., 2021). The findings confirm that behavioral factors, especially compliance with the use of PPE, are important determinants in the prevention of work accidents in the laboratory (Liswanti & Nugraha, 2020).

In the context of education, laboratories function as the main means of practice-based learning involving students, lecturers, and laboratory staff. Even though it is not production-oriented, activities in educational laboratories still have significant potential dangers if not managed systematically (Sari I, 2020). This risk is increasing because students are generally still in the stage of forming competencies, experience, and work safety culture.

In Indonesia, the implementation of health education laboratories should refer to various national standards related to occupational safety, including infrastructure standards, laboratory K3 guidelines, and regulations on the management of hazardous and toxic materials (B3). The implementation of the standard includes the provision of safety facilities such as PPE, eyewash, and safety showers, the preparation of standard operating procedures (SOPs), the implementation of safety management systems, and the implementation of K3 training on a regular basis. However, various studies show that the implementation of the standard is still not optimal. Problems that are often found include inconsistencies in the use of PPE, low understanding of safety procedures, and laboratory environmental conditions that do not fully meet

safety standards (Andriyani & Nurhidayah, 2021). Similar findings in Malaysia also show that the combination of low knowledge, unsafe behavior, and limited facilities significantly increases the risk of work accidents (Rahman et al., 2018).

Various previous studies have identified factors related to the occurrence of work accidents, including knowledge, attitudes, behaviors, compliance with the use of PPE, and availability of facilities (Huda et al., 2021; Kusuma et al., 2024; Runtuwarouw, 2020; Hardiyan et al., 2021). However, most studies still partially analyze these factors, so they have not been able to explain the comprehensive relationship between the determinants of work accidents. In this case, the Safety Triad model proposed by Geller (2001) offers a more integrative approach by grouping the factors that cause accidents into three main components, namely individual factors (person), behavioral factors (behavior), and environmental factors (environment). This model confirms that work accidents are the result of dynamic interactions between the three components.

In the context of educational laboratories, the application of the Safety Triad model is very relevant because it involves individuals with varying levels of experience, safety behaviors that have not yet been fully formed, and environmental conditions that do not necessarily meet optimal standards. However, research that specifically examines the relationship between behavioral and environmental factors in a Safety Triad framework in health education laboratories is still limited, especially in Indonesia.

Based on the results of an initial survey conducted in 2024 at the Laboratory of the Department of Medical Laboratory Technology of the Manado Ministry of Health, it was found that there were work accidents. However, the factors that caused the accident have not been clearly identified, whether it is more predominantly influenced by behavioral factors or environmental factors. This condition shows that there is an information gap that needs to be further studied through structured and theoretical model-based research.

Therefore, this study aims to analyze factors related to the incidence of work accidents based on the Safety Triad model in the Department of Medical Laboratory Technology, Polytechnic of the Ministry of Health, Manado. The results of this research are expected to make a scientific contribution to the development of K3 studies in educational laboratories and become the basis for the formulation of more effective policies and interventions in the prevention of work accidents.

RESEARCH METHODS

This study uses an analytical observational quantitative design with a cross-sectional approach, which aims to analyze the relationship between behavioral and environmental factors and the incidence of work accidents in laboratory students. This design was chosen because it is able to describe the relationships between variables simultaneously in one measurement time.

The research was carried out at the Laboratory of the Department of Medical Laboratory Technology, Polytechnic of the Ministry of Health, Manado in the period from December 2025 to February 2026. The research population is all level II students who have participated in practicum activities in six

laboratories during July-December 2025 as many as 111 people. The sampling technique uses total sampling, so that all populations that meet the inclusion criteria are made respondents. The inclusion criteria include active students at level II and present at the time of the research, while exclusion includes students who are absent at the time of data collection or refuse to participate.

The research variables consisted of bound variables, namely the occurrence of work accidents in the last six months (categorized: never/never), as well as independent variables, namely behavioral factors (compliance with the use of personal protective equipment/PPE) and environmental factors (availability of K3 infrastructure). Variable measurements were carried out using a structured questionnaire. Behavioral variables were measured through 10 question items related to compliance with PPE use with ordinal scale and median cut-off (≥ 47 = good; < 47 = poor). Environmental variables were measured through 10 items related to the safety of laboratory facilities with a median cut-off (≥ 45 = good; < 45 = poor).

The research instruments included informed consent sheets, questionnaires on respondent characteristics and work accident occurrences, questionnaires on PPE usage behavior, and environmental safety questionnaires. All instruments have gone through a validity test using the Pearson Product Moment correlation with an r value of > 0.361 , as well as a reliability test using Cronbach's Alpha with a value of 0.682–0.938 which shows sufficient to very high reliability. Data was collected through the self-administered questionnaire method after the respondents agreed to informed consent.

Data analysis is carried out in stages. Univariate analysis was used to describe the frequency distribution of respondent characteristics and research variables. Bivariate analysis used the Chi-Square test to test the relationship between independent and dependent variables, with a significance level of $p < 0.05$. The magnitude of the risk is measured using the Prevalence Ratio (PR). Furthermore, multivariate analysis was carried out using multiple logistics regression to identify the most dominant variables affecting the incidence of work accidents.

The entire data analysis process is carried out using statistical software, with processing stages including editing, coding, entry, and cleaning data before the analysis is carried out

RESEARCH RESULTS

1. Characteristics of Research Respondents

The characteristics of the respondents in this study are presented as descriptive information that includes several aspects of the age and gender of the respondents seen in Table 2.

Table 2. Distribution of Respondents by Age and Gender

Age	N ($\Sigma=111$)	% ($(\Sigma=100)$)
18 Years	25	22.5
19 Years	60	54.1
20 Years	19	17.1
21 Years	2	1.8
22 Years	2	1.8

23 Years	2	1.8
25 Years	1	0.9
Gender	n	%
Male - Male	17	15.3
Women	94	84.7

Table 2. shows the distribution of respondents by age group and gender. The majority of respondents were at the age of 19, namely 60 people (54.1%), and the majority were female as many as 94 people (84.7%).

2. Univariate Analysis

The results of the univariate analysis describe the distribution of respondents based on the following categories:

Table 3. Distribution of respondents based on research variables

Research variables		n	%	Valid %
Behavioral Factors	Less good	49	44,1	44,1
	Good	62	55,9	55,9
	Total	111	100,0	100,0
Environmental Factors	Less good	50	45,0	45,0
	Good	61	55,0	55,0
	Total	111	100,0	100,0
Work Accidents	Never	74	66,7	66,7
	Ever	37	33,3	33,3
	Total	111	100,0	100,0

Table 3 shows that the dominant respondents were well-informed (53.2%), well-behaved (59.5%), compliant with the use of PPE (55.9%) and the availability of good K3 facilities (55.0%) and had never experienced work accidents (66.7%). Furthermore, the distribution of respondents was explained based on the type of work accident that had been experienced. This can be seen in Table 4.

Table 4. Distribution of Respondents by Type of Work Accident

Types of Work Accidents	n (37)	%
Exposed to chemical spills	5	13,5
Inhalation of chemicals	19	51,4
Shortness of breath due to inhaling chemicals	3	8,1
Splashing chemicals on the skin/eyes	6	16,2
Irritation of the skin/eyes due to chemicals	4	10,8
Fire burns	1	2,7
Electrocution	9	24,3
Slipped	11	29,7
Injuries due to sharp tools/needle punctures	7	18,9

The table above shows that the most common types of work accidents experienced by respondents were chemical inhalation (51.4%), followed by slipping (29.7%) and electrocution (24.3%). In addition, there were injuries due

to sharp or needle (18.9%) as well as chemical splashes on the skin or eyes (16.2%). Other types of accidents have a smaller proportion, and no cases of burns due to chemicals have been found.

3. Bivariate Analysis

The results of the bivariate analysis can be seen in the following table.

Table 5. Results of bivariate analysis

		Work Accidents		Total	<i>p-value</i>	PR (95% CI)
		Never	Ever			
Behavioral Factors	Less good	27	22	49	0,036*	1,4
	Good	47	15	62		(1,174-1,880)
	Total	74	37	111		
Environmental Factors	Less good	27	23	50	0,018*	1,4
	Good	47	14	61		(1,155-1,791)
	Total	74	37	111		

The results of this analysis show that the variables of compliance with the use of PPE (0.036) and the availability of K3 facilities (0.018) are significantly related to work accidents where the compliance of PPE users and the availability of poor K3 facilities are 1.4x more likely to have experienced accidents.

DISCUSSION

1. The relationship between behavioral factors and Accidents in the Laboratory

The results showed that behavioral factors (compliance with the use of PPE) had a significant relationship with the incidence of work accidents ($p=0.036$; $PR=1.4$), where respondents with low compliance have a greater risk of accidents. This shows that the behavior of using PPE is an important factor in preventing work accidents.

In the framework of the Safety Triad, compliance with the use of PPE is included in the *behavior factor*, which is real actions that are directly related to the risk of accidents. These findings are consistent with the research of Runtuwarouw (2020) and Amanah and Utama (2024) which show a significant relationship between PPE compliance and work accidents.

Behavior is an individual's response or reaction to a stimulus received both from the outside and from within the individual. (Pakpahan M, 2021). According to Wawan and Dewi (2017), the form of behavior/response can be passive (without action) or active (taking action), the two behaviors/responses can be explained as follows:

- Passive behavior/response. This behavior is often referred to as covert behavior. In this closed behavior, the response to stimuli is still limited to attention, perception, knowledge and attitude towards objects. This response or behavior can be clearly observed by others, because no action has been taken against the object.
- Active behavior/response. This behavior is often referred to as overt behavior. Open behavior is an individual response in the form of real actions that can be clearly seen by others.

Factors that can affect behavior, namely internal factors and external factors of the individual. Internal factors are individual characteristics and other things that are innate, for example; level of intelligence, emotional level, gender, etc. Meanwhile, external factors are physical, social, cultural, economic, political, etc. (Notoatmodjo, 2014; Sarwono, 2004).

Safety behavior is an action or deed carried out by a person in an effort to comply, support, and participate in all activities related to safety in the workplace to avoid, minimize the possibility or prevent the occurrence of accidents at work. Definitions and definitions of safety behavior from several book sources:

- a. Safety behavior is an individual's action in complying with occupational safety procedures and participating in safety activities to prevent work accidents (Kim & Park, 2021).
- b. Safety behavior is a worker behavior that aims to maintain the safety of oneself and others through the implementation of safe work measures (Curcuruto et al., 2020).
- c. Neal and Griffin (2020) explained that safety behavior consists of two main dimensions, namely compliance with safety procedures and participation in safety activities.
- d. Safety behavior is a form of safe work behavior carried out by individuals to reduce the risk of injuries and accidents in the work environment (Wu et al., 2021).

According to Andi, Alifen, and Chandra (2005), some examples of forms of occupational safety behavior in the work environment include the following:

- a. Always use work safety equipment (PPE).
- b. Put materials and work equipment in place.
- c. Work follows work safety procedures.
- d. Follow work according to the orders of the superior.
- e. Remind other employees of the dangers in occupational safety

Interpretively, these results confirm that behavior is a proximal determinant of work accidents. This means that even if the individual has a good enough knowledge and attitude, without appropriate behavior, the risk of accidents remains high.

However, PPE compliance is not only affected by individuals, but also by systemic factors such as PPE availability, convenience, tool quality, and supervision. Field findings show that there is inconsistent use of PPE, such as the use of non-optimal masks or the quality of PPE.

The novelty of this research lies in the affirmation that safety behavior is the result of interaction between individual and environmental factors. Therefore, interventions are not enough to simply improve compliance, but must ensure systems that support those behaviors.

The practical implication is the need for institutional policies that ensure the standardization of PPE, strict supervision, and the enforcement of discipline in the use of PPE in practicum activities.

2. The Relationship between Environmental Factors and Accidents in the Laboratory

The results showed that the availability of K3 facilities had a significant relationship with the incidence of work accidents ($p=0.018$; $PR=1.4$). Respondents who are in an environment with inadequate K3 facilities have a higher risk of accidents.

From the perspective of Safety Triad, the availability of facilities is part of the *environmental factors* that play a role in creating safe working conditions. These findings are in line with the research of Hardiyan et al. (2021) and Andi RAR et al. (2022).

More in-depth, these results show that the work environment has a role as an enabler and barrier to safety. Facilities such as PPE, fire extinguishers, P3K, ventilation, and laboratory security systems function as a layer of protection against risks.

However, the existence of facilities alone is not enough without optimal utilization. Therefore, the relationship between the facility and the accident is indirect, but through user behavior.

The availability of facilities is a very important environmental factor in supporting work safety. The facilities in question include the availability of PPE, safety equipment, and other supporting facilities in the workplace.

The International Labour Organization (2019) states that the availability of adequate occupational safety facilities can help reduce the risk of work accidents, as well as quick handling when incidents occur in the workplace. A work environment equipped with good safety facilities can improve safety as well as minimize the impact of work accidents.

The novelty of this research lies in the affirmation of the importance of standardization of health education laboratories in Indonesia, where K3 facilities must not only be available, but also meet quality, accessibility, and functionality standards. Implication, educational institutions need to ensure that laboratories meet national K3 standards, including the provision of complete safety facilities, periodic maintenance, and integration with safety management systems.

3. Implications

Work accidents in health education laboratories are still a serious issue that requires immediate policy attention. The results of research at the Department of Medical Laboratory Technology of the Manado Ministry of Health showed that 33.3% of students had experienced work accidents, with the most dominant type of incident being in the form of exposure to chemicals through inhalation. These findings show that risks in the laboratory are not only potential, but have been real in the learning process. Although most students have good knowledge and attitudes regarding occupational safety, these two factors have been shown to be not significantly related to the occurrence of accidents. This confirms that the safety approach that has been focusing on improving knowledge and attitudes has not been effective enough in reducing the risk of accidents in educational laboratories.

These findings indicate that occupational safety in the laboratory is determined more by system and environmental conditions than by individual factors. In other words, students who have good knowledge and attitudes are

still at risk of accidents if they are not supported by adequate facilities and a strong supervision system. This condition reinforces the urgency of shifting the approach from individual-based safety to system-based safety management, where safety is built through integration between infrastructure, regulation, supervision, and safety culture.

Based on these findings, a strategic policy is needed that focuses on strengthening the overall health education laboratory safety system. The top priority is to ensure the standardization of laboratory facilities according to the principles of K3, including the provision of adequate and uniform PPE, safety facilities (fire extinguishers, P3K, ventilation, and security systems), and periodic safety audits. In addition, it is necessary to implement a mandatory compliance policy for the use of PPE (no PPE, no lab access) supported by active supervision by lecturers and laboratory staff. This effort must be strengthened by building a safety culture through the integration of safety in the curriculum and learning practices. Thus, investment in laboratory safety systems will not only reduce the incidence of work accidents, but also improve the quality of education and produce health workers who have strong occupational safety competencies from the education stage.

CONCLUSION

The findings of this study confirm that work accidents in educational laboratories are not just a potential risk, but real events (33.3%) which are significantly influenced by low compliance with the use of PPE and limited K3 facilities ($p < 0.05$; $PR = 1,4$). This reinforces that the main determinant of safety is no longer knowledge or attitude, but actual behavior and quality of the environmental system, so that accidents are more accurately understood as *system failures* within the framework of the Safety Triad. Implicitly, a paradigm shift from *individual-based safety* to an integrated *system-based safety management* is needed, through the global standardization of international best practice-based health education laboratories (ILO/WHO), the implementation of mandatory PPE policies (*no PPE, no lab access*), periodic safety audits, as well as the integration of safety culture in the curriculum. This approach is not only relevant in the local context, but also a global agenda in strengthening the safety of health workers from the education phase as part of the health system resilience.

REFERENCES

- Andi, Alifen, S dan Chandra, A. 2005. Model Persamaan Struktural Pengaruh Budaya Keselamatan Kerja pada Prilaku Pekerja Proyek Konstruksi. *Jurnal Teknik Sipil Universitas Petra Surabaya*.
- Andi, R.A.R, Rahman, Ikhrum Hardi S. 2022. Faktor yang Berhubungan dengan Penggunaan APD pada Perawat di Instalasi Rawat Inap RSUD Tenriawaru. *Window of Public Health Journal*.
- Andriyani, N., & Nurhidayah, S. 2021. Kepatuhan Penggunaan APD pada Mahasiswa Praktik di Laboratorium. *Jurnal Kesehatan Masyarakat*, 16(2), 45-52
- Curcuruto, M., et al. (2020). Safety behavior and organizational factors. *Accident Analysis & Prevention*. <https://doi.org/10.1016/j.aap.2020.105698>
- Geller, E.S. 2001. *The Psychology Of Safety Handbook*. Lewis Publishers.
- Hardiyan, R., Sukmono, Y., dan Tambunan, W. 2021. Hubungan Pengetahuan, Pelatihan, Penggunaan APD dan Fasilitas Kesehatan dan Keselamatan Kerja Terhadap Kecelakaan Kerja pada Proses Pengelasan di PT. Barokah Galangan Perkasa. *Journal of Industrial and Manufacture Enggineering (JIME)*, 5(1). DOI : 10.31289/jime.v5i1.4304
- Huda, N., Fitri, A.M., Buntara, A., & Utari, D. 2021. Faktor-faktor yang Berhubungan dengan Kecelakaan Kerja pada Pekerja Proyek Pembangunan Gedung di PT. X Tahun 2020. *Jurnal Kesehatan Masyarakat* vol. 9, Nomor 5
- International Labour Organization (ILO) Asia Pacific. 2023. Safety and Health at Work in Asia and The Pacific. [Safety and health at work in Asia and the Pacific | International Labour Organization](#). (10/10/2025).
- International Labour Organization (ILO). 2020. Quick Guide on Sources and Uses of Statistics on Occupational Safety and Health
- International Labour Organization. 2019. Safety and health at the heart of the future of work: Building on 100 years of experience. Geneva: ILO. Link: https://www.ilo.org/global/publications/books/WCMS_686645/lang--en/index.htm. (20/03/2026)
- Kementerian Tenaga Kerja. 2023. Data Prioritas Ketenagakerjaan SDI 2023. Kecelakaan Kerja Tahun 2023. [Satudata Kemnaker | Portal Data Ketenagakerjaan RI](#). (10/10/2025).

- Kim, Y., & Park, J. (2021). Safety compliance and participation behavior. *Safety Science*. <https://doi.org/10.1016/j.ssci.2021.105348>
- Kusuma, S. A., Mujiyono & Prasetyo, A. 2024. Hubungan Perilaku Kerja dengan Kecelakaan Kerja di CV. Nutri Health Kota Madiun Tahun 2023. *Jurnal Profesi Kesehatan Masyarakat (JPKM)*.
- Liswanti, Y., Nugraha, T. 2020. The Relationship Between Knowledge And Behavior On Study Products Of Health Analyst Diploma Student in Handling Chemicals. Paper Presented At The 2nd Bakti Tunas Husada-Health Science International Conference (BTH-HSIC 2019).
- Menard, A.D, Tran JF. 2020. A Review and Critique of Academic Lab Safety Research. *Nat Chem* 2020;12(1):17-25
- Nasrallah I.M, El Kak Ak, Ismail LA, Nasr RR, Bawab WT. 2022. Prevalence of Accident Occurrence Among Scientific Laboratory Workers of the Public University in Lebanon and the Impact of Safety Measures. *Saf Health Work* 2022; 13(2):155-62
- Neal, A., & Griffin, M. A. (2020). Safety behavior dimensions. *Journal of Applied Psychology*. <https://doi.org/10.1037/apl0000464>
- Notoatmodjo, S. 2014. Ilmu Perilaku Kesehatan. Jakarta. Rineka Cipta
- Nur Suci Amanah & Winda Trijayanthi Utama. 2024. Hubungan Pengetahuan, Sikap, dan Perilaku Penggunaan Alat Pelindung Diri pada Perawat Instalasi Rawat Inap dengan Kejadian Kecelakaan Kerja di RSUD Dr. H. Abdul Moeloek Provinsi Lampung. *Medula* vol. 14, Nomor 3.
- Pakpahan, M., dkk. 2021. *Promosi Kesehatan dan Perilaku Kesehatan*. Medan: Yayasan Kita Menulis
- Rahman, M.A., Noor, S.M., & Jamaludin, S. 2018. Factors Contributing To Laboratory Accidents Among Undergraduate Students In Malaysia. *Journal Of Occupational Safety And Health*, 15(2), 55-62
- Runtuwarouw, N.Y., Kawatu, P.A.T., Maddusa, S.S. 2020. Hubungan Kepatuhan Penggunaan Alat Pelindung Diri dengan Kejadian Kecelakaan Kerja. *Journal of Public Health and Community Medicine*, vol.1, nomor 2.
- Sari, I., Wulandari,E., &Wibowo,A. 2020. Analisis Risiko Kecelakaan Kerja di Laboratorium Pendidikan. *Jurnal Kesehatan Lingkungan*, 12(1), 10-17.

- Sarwono, S. 2004. *Sosiologi Kesehatan*. Yogyakarta: Gadjah Mada University Press.
- Sinolungan, J.S.V., Wenas, A.R., Doda, D. V. D.,. 2021. *Kecelakaan Kerja pada Pemulung di Tempat Pembuangan Akhir Sumompo Kota Manado*
- Sumampouw, O. J. 2024. *Kesehatan dan Keselamatan Kerja (K3) Kemaratimian*. CV. Sketsa Media. ISBN: 978-623-09-0849-1
- Sumampouw, O. J., & Roebijoso, J. 2017. *Pembangunan Wilayah Berwawasan Kesehatan*. Deepublish
- Wawan, A., & Dewi, M. 2017. *Teori dan Pengukuran Pengetahuan, Sikap dan Perilaku Manusia*. Yogyakarta: Nuha Medika.
- Wu, X., et al. (2021). Workplace safety behavior. *International Journal of Environmental Research and Public Health*.
<https://doi.org/10.3390/ijerph18094789>