Asian Journal of Healthy and Science
p-ISSN: 2980-4302
e-ISSN: 2980-4310
Vol. 5 No. 4 April, 2026

Incidence Rate of Work-Related Accidents in the Laboratory of the Manggala Yogyakarta Health Analysis Academy

Destu Satya Widyaningsih*, Maria Gratia Barage
Akademi Analis Kesehatan Manggala Yogyakarta, Indonesia
Email: destu.satya@gmail.com*

Abstract

This study is motivated by the high risk of workplace accidents in laboratory settings, particularly in educational institutions that utilize hazardous chemicals and equipment. The objective of this study is to determine the incidence rate of workplace accidents in the Laboratory of the Manggala Health Analyst Academy, Yogyakarta, over the past five years. This research employed a descriptive approach with a cross-sectional design using a questionnaire distributed to lecturers, laboratory assistants, active students, and alumni. A total of 134 respondents were selected using an opportunity sampling technique. The results indicate that the average workplace accident rate in the laboratory is 26.73%, which falls into the low category. Based on work stages, the highest incidence occurs in the pre-analytical stage (34.78%), followed by the analytical stage (25.15%), and the post-analytical stage (23.43%). Accidents in the pre-analytical stage are generally caused by non-ergonomic preparation of tools and materials. In the analytical stage, incidents are mainly due to exposure to chemicals and sharp instruments. Meanwhile, accidents in the post-analytical stage tend to be minor and related to manual activities such as cleaning and storing equipment. In conclusion, although the overall accident rate is relatively low, improvements in the implementation of occupational safety standards, consistent use of personal protective equipment, and ergonomic laboratory arrangement are necessary to further minimize workplace accident risks in educational laboratory environments.

Keywords: workplace accidents; educational laboratory; occupational safety; risk analysis; occupational health.

INTRODUCTION

The International Labour Organization (ILO) estimated in 2018 that more than 1.8 million work-related deaths occur annually in the Asia and Pacific region. This region accounts for two-thirds of the world's total occupational deaths, indicating high occupational safety risks in Asia. Every year, 2.78 million workers die from work-related accidents and diseases. Approximately 2.4 million (86.3%) are caused by work-related diseases, while more than 380,000 (13.7%) are caused by work-related accidents.

An accident occurred in the Chemistry Laboratory of the Faculty of Pharmacy, University of Indonesia, on March 16, 2015. Fourteen students were injured by fragments from an exploding distillation flask. The accident occurred while a laboratory experiment was being conducted (Abidin & Ramadhan, 2019).

Research by the US Chemical Safety Board recorded 261 laboratory incidents across the United States between January 2001 and July 2018. Of these, 130 occurred in schools and colleges. This data demonstrates the high frequency of laboratory accidents in educational settings. These incidents resulted in 185 injuries and 5 deaths. In 2015, an incident occurred at Woodson High School in Fairfax, Virginia. The incident involved a large fire and chemical explosion. The incident burned three students, a teacher, and injured three other students. Another incident occurred at Merrol Hyde Magnet School in Hendersonville, Tennessee, in

2018. This incident resulted in 17 students and one teacher being injured. The fire was caused by a chemical reaction (Ridasta, 2020).

Laboratories contain chemicals, reagents, glassware, and specialized instruments that can cause workplace accidents if used or stored incorrectly. Workplace accidents can also occur due to negligence and carelessness in carrying out their work, resulting in injuries and even harm to those around them.

High-risk work accidents can occur in laboratories. This is due to the various potentially hazardous tools and materials used in the work process. Healthcare workers, particularly laboratory workers, are at high risk. This can occur due to continuous interaction with hazardous chemicals (Asiyatul Janah et al., 2023).

Workplace accidents are essentially caused by two factors: human factors, equipment factors, and workplace environmental factors. According to (Rejeki, 2015), (Triwibowo, & Pusphandani, 2013), (Fenelia & Herbawani, 2022), human factors include age, education level, and personal protective equipment (PPE). Equipment factors also contribute to workplace accidents. Equipment that lacks safety features can lead to workplace accidents, including injuries caused by falling work equipment and hands or feet being hit by work equipment (Pravitra et al., 2017). The third factor is environmental factors, which include the physical, chemical, and biological environments.

According to the Ministry of Manpower (2022), there are four classifications of occupational accidents: type of accident, cause of accident, and nature of injury. The fourth classification is the location of the injury. The location of the injury is classified as mild, moderate, severe, and fatal.

A laboratory is a place for experiments, measurements, research, or scientific studies in fields such as chemistry, physics, biology, and other fields. A laboratory can be a closed room like a bedroom or an open space like a garden or other place (Emda, 2017). A laboratory is a location where a group of individuals conducts various research activities, observations, training, and scientific testing as an approach to connecting theory and practice across various disciplines. Physically, a laboratory can also refer to an enclosed space like a bedroom or an open space (Ramadhani, 2020).

An educational laboratory is part of an educational institution that aims to support academic activities. This laboratory can be a permanent or portable room, structured to conduct activities such as testing, calibration, and/or limited-scale production. The use of equipment and materials in this laboratory is based on specific scientific methods aimed at supporting educational, research, and community service activities (Permenpan, 2021).

The stages of laboratory examination according to Permenkes (2015): (1) The Pre-Analytical Stage consists of patient preparation, sample collection, preparation of equipment and materials, identification, specimen collection, specimen storage, and specimen transportation; (2) The Analytical Stage consists of specimen examination; (3) The Post-Analytical Stage consists of instrument calibration and reporting of results.

The novelty of this research lies in four key aspects. First, this study comprehensively examines accident rates across all three stages of laboratory work (pre-analytical, analytical, and post-analytical) within a single research framework, whereas previous studies have often focused on only one or two stages. Second, this research expands the respondent population beyond active students to include lecturers, laboratory assistants, and alumni from multiple

graduating cohorts, providing a more representative picture of laboratory accident incidence over a five-year period. Third, this study focuses specifically on the Manggala Yogyakarta Health Analyst Academy, an educational laboratory context that has been minimally studied in existing literature. Fourth, this research uses a larger sample size (134 respondents) compared to previous studies, enhancing the reliability and generalizability of findings. This novelty addresses the research gap identified from the works of Rahmawati (2024), Cahyaningrum et al. (2019), and Hadi et al. (2023).

According to a 2024 scientific paper by Citra Rahmawati entitled "Occupational Accidents in the Laboratory of the Manggala Yogyakarta Health Analyst Academy," the incidence of occupational accidents was 6.7%. This result is considered very low. However, this study did not measure the incidence of occupational accidents at the post-analytical stage. Therefore, this study covers all stages: pre-analytical, analytical, and post-analytical. This study also expanded the respondent population by adding lecturers, laboratory assistants, and active students from 2025, as well as alumni from 2020 and 2021.

The purpose of this study was to determine the incidence of workplace accidents in the laboratory of the Manggala Yogyakarta Health Analyst Academy over the past five years.

RESEARCH METHODS

This research was a descriptive qualitative design. The research design used a qualitative *cross-sectional approach* using a questionnaire. This study was limited in scope, being conducted only in the laboratory of the Manggala Health Analyst Academy, Yogyakarta. This study was conducted in July 2025. Data were obtained through questionnaires completed by respondents consisting of lecturers, laboratory assistants, active students of 2025, and alumni of 2020 and 2021.

The population in this study was 7 lecturers and 5 laboratory assistants. 53 alumni from the class of 2020, 41 from the class of 2021, 58 from the class of 2022, 22 from the class of 2023, and 23 from the class of 2024.

This study used *the opportunity sampling technique*. This technique involves respondents selected for their accessibility and willingness to participate during the study. The sampling period was one month, from March to April 2025. The sample size for this study was 134.

Data collection in this study used a questionnaire in the form of a *Google Form link.* The questionnaire link was distributed to lecturers, laboratory assistants, active students of 2025, and alumni of 2020 and 2021 at AAKM Yogyakarta. The categorization of accident rates was determined based on intervals. The interval score calculation was taken from the journal by Srijayanthi *et al.*, in 2012. The calculation method was carried out using the same method, but using different scores, question items, and number of respondents. Thus, the categories of work accidents based on their intervals were obtained in Table 1.

Table 1. Occupational Accident Rate in Educational Laboratories

Score	Interval	Accident Rate
1	0-1989	Very Low
2	1990-3979	Low
3	3980-5969	Currently
4	5970-7959	Tall

5	7960-9950	Very high

Source (Srijayanthi *et al.*, 2012)

The results of the categorization are then described in percentage form in table 2.

Table 2. Percentage of Occupational Accidents in the Laboratory

Criteria	%
Very high	80-100
Tall	60-79
Currently	40-59
Low	20-39
Very low	0-19

Source: Sugiyono (2017).

RESULTS AND DISCUSSION

Table 3. Respondents' Answer Results

Indicator	Sub Indicators	Item No.	SS	S	KK	P	TP
Pre-Analytics	Preparing the Tools and Materials	1	3	12	21	42	56
		2	0	3	11	35	85
Analytic	Hit by a sharp object	3	0	0	5	13	116
		4	0	3	9	38	84
	Poisoning	5	0	1	4	26	103
	Exposed to chemicals	6	0	3	4	39	88
		7	0	1	0	9	124
	Tool stuck	8	0	0	1	12	121
Post-Analytics	Clean Tools	9	0	1	1	14	118
	Tool Return	10	0	1	3	18	112

The results of processing questionnaire data using *Microsoft Excel,* it is known that **the average percentage of work accidents in the laboratory is 26.73%.** This is included in the **low category,** according to the classification of the value range in table 6. The remaining percentage of 73.27% indicates that most work activities in the AAK Manggala laboratory run safely. This illustrates that the implementation of work safety procedures is quite good, although it still needs to be improved in certain aspects. The results of the percentage of work accident rates can be seen in figure 2.

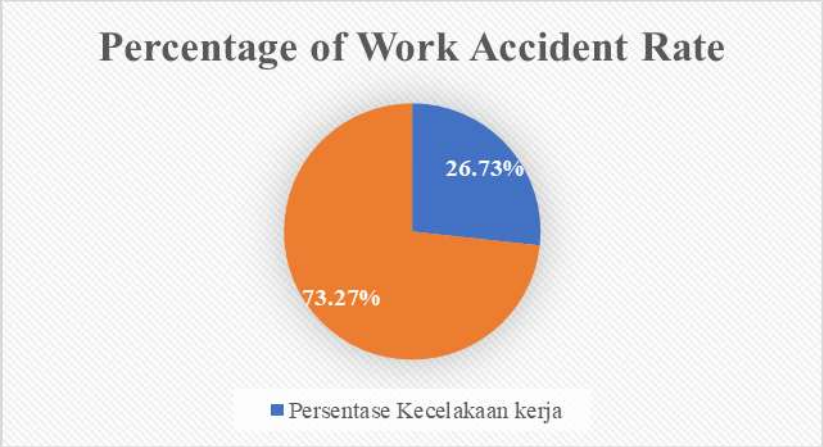

Figure 1 Percentage of work accident rate at AAKM Laboratory

The questionnaire data processing results were also analyzed to determine the percentage of work-related accidents at each stage of the laboratory examination. This analysis aimed to determine the incidence of accidents at each stage of the laboratory work process. The results of the data analysis can be seen in Figure 2

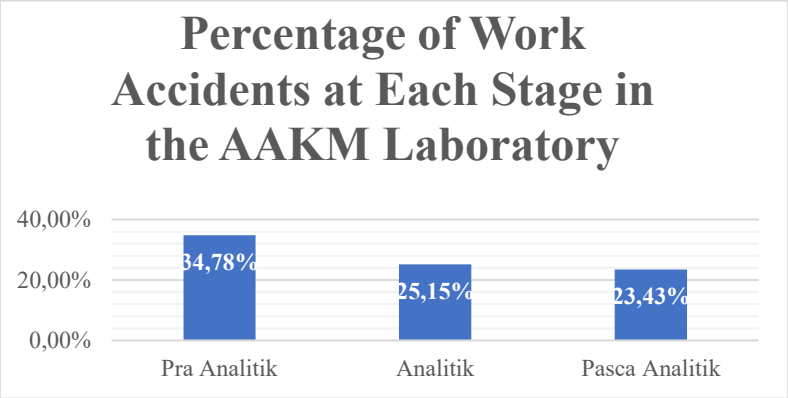

Figure 2 Analysis of score data per indicator

Data analysis of the percentage of work accidents in the laboratory consisting of three main indicators, namely pre-analytical at 34.78%, analytical at 25.15%, and post-analytical at 23.43%.

Research at the Manggala Yogyakarta Health Analyst Academy Laboratory found that workplace accidents occur in laboratories. In the **pre-analytical phase**, incidents most frequently occur during the preparation of equipment and materials, particularly due to physical contact with the laboratory's layout. Meanwhile, in the **analytical phase**, the most common incidents are caused by direct contact with solutions or chemical splashes.

post-analytical phase, injuries are likely minor. This can still occur in the final stages of laboratory operations, particularly due to manual activities such as washing equipment and lifting heavy equipment, or being in less ergonomic positions.

These results align with research by Sulistyaningsih & Nugroho (2022), which states that workplace accidents can be caused by equipment factors, which in practice are also influenced by human factors. Unergonomic laboratory layout and improper use of equipment

can trigger injuries. Therefore, implementing the 5R principle (Tidy, Neat, Clean, Maintain, Diligent) is crucial in creating a safe work environment.

This finding is also supported by research by Cahyaningrum (2019), which states that frequent laboratory accidents include exposure to chemicals, heat, and hazardous vapors. Therefore, understanding chemical risks is crucial. Redhana (2015) emphasizes the importance of understanding the types and effects of hazardous chemicals, such as corrosive, toxic, or flammable substances, as well as the importance of consistently using PPE (Personal Protective Equipment).

Similar research by Rahmantiyoko (2019) also reported workplace accidents due to unfavorable laboratory conditions, such as slippery floors and footwear that does not meet safety standards, as well as injuries from direct contact with hot objects or chemicals. Therefore, facility maintenance and the implementation of safety standards must be a primary concern in laboratory activities.

The analysis results show that workplace accidents still occur, albeit at a low level. Most workplace accidents occur in the pre-analytical stage, indicating that initial preparation prior to testing is crucial, including evaluation of laboratory layout and non-ergonomic equipment and equipment positioning. In the analytical stage, most accidents are related to direct contact with chemicals, sharp instruments, and other laboratory equipment. Despite the existence of SOPs and laboratory guidelines, this demonstrates a lack of discipline in occupational safety, including inconsistent use of personal protective equipment (PPE).

The post-analytical phase, which exhibits the lowest accident rate, still requires attention. Minor injuries while washing equipment or muscle strains while storing microscopes indicate that post-analytical activities have not fully addressed the ergonomics and layout of laboratory facilities.

CONCLUSION

Research on the incidence rate of work-related laboratory accidents among students at the Manggala Yogyakarta Health Analyst Academy found that the rate of accidents in the laboratory was low. The pre-analytical stage was 34.78%, the analytical stage was 25.15%, and the post-analytical stage was 23.43%.

REFERENCES

Abidin, A. U., & Ramadhan, I. (2019). Penerapan Job Safety Analysis, Pengetahuan Keselamatan dan Kesehatan Kerja terhadap Kejadian Kecelakaan Kerja di Laboratorium Perguruan Tinggi. Jurnal Berkala Kesehatan, 5(2), 76. https://doi.org/10.20527/jbk.v5i2.7827

Akademi Analis Kesehatan Manggala Yogyakarta. (2021). Panduan akademik Program Diploma III Teknologi Laboratorium Medis. Akademi Analis Kesehatan Manggala Yogyakarta.

Asiyatul Janah, N., Hariyono, W., Ani Marwati, T., Handayani, L., Kesehatan Masyarakat, M., Ahmad Dahlan, U., & Penelitian dan Pengembangan Kesehatan Magelang, B. (2023). Literature Review : Pengaruh Tingkat Pengetahuan Terhadap Angka Kecelakaan Kerja

Di Laboratorium (Vol. 11, Issue 1). http://ejournal.uika-bogor.ac.id/index.php/Hearty/issue/archive

Badan Standardisasi Nasional. (2021). Sistem harmonisasi global – Bagian 1: Klasifikasi bahaya bahan kimia (SNI 9030-1:2021). Jakarta: BSN

Cahyaningrum, D., Muktiana Sari, H. T., & Iswandari, D. (2019). Faktor-Faktor yang Berhubungan dengan Kejadian Kecelakaan Kerja di Laboratorium Pendidikan. Jurnal Pengelolaan Laboratorium Pendidikan, 1(2), 41–47. https://doi.org/10.14710/jplp.1.2.41-47

Emda, A. (2017). Laboratorium Sebagai Sarana Pembelajaran Kimia Dalam Meningkatkan Pengetahuan Dan Ketrampilan Kerja Ilmiah. Lantanida Journal, 5(1), 83. https://doi.org/10.22373/lj.v5i1.2061

Febriyanti, R., & Suwandi, W. (2021). Analisis hubungan antara pendidikan dengan perilaku tidak aman pada pekerja di PT Sunan Rubber Palembang. Jurnal Ilmu Kedokteran dan Kesehatan, 8(2), 181-185. https://ejurnalmalahayati.ac.id/index.php/kesehatan/article/view/4283/pdf

Fenelia, N., & Herbawani, C. K. (2022). Faktor Yang Berhubungan Dengan Kepatuhan Penggunaan Alat Pelindung Diri Pada Pekerja Konstruksi : Kajian Literatur. PREPOTIF : Jurnal Kesehatan Masyarakat, 6(1), 221–230. https://doi.org/10.31004/prepotif.v6i1.2974

Hadi, A. A., Ruliati, L. P., & A.R Salmun, J. (2023). Analisis Faktor-Faktor Yang Berhubungan dengan Kecelakaan Kerja pada Pekerja di Laboratorium Kesehatan Provinsi Nusa Tenggara Timur. Jurnal Bidang Ilmu Kesehatan, 13(4), 415–423. https://doi.org/10.52643/jbik.v13i4.2943

International Labour Organization (2018). Meningkatkan Keselamatan dan Kesehatan Pekerja Muda. ILO, Jakarta.

Kementerian Pendidikan dan Kebudayaan Republik Indonesia. (2014). Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 145 Tahun 2014 tentang Petunjuk Teknis Jabatan Fungsional Pranata Laboratorium Pendidikan dan Angka Kreditnya. https://peraturan.bpk.go.id

Kementerian Kesehatan Republik Indonesia. (2015). Peraturan Menteri Kesehatan Republik Indonesia Nomor 25 Tahun 2015 tentang Penyelenggaraan Pemeriksaan Laboratorium untuk Ibu Hamil, Bersalin, dan Nifas di Fasilitas Pelayanan Kesehatan dan Jaringan Pelayanannya. https://peraturan.bpk.go.id

Kementerian Ketenagakerjaan Republik Indonesia. (2022). Profil Keselamatan dan Kesehatan Kerja Nasional Indonesia Tahun 2022 (Cetakan pertama). Direktorat Jenderal Pembinaan Pengawasan Ketenagakerjaan dan K3. https://www.kemnaker.go.id/

Kementerian Pendayagunaan Aparatur Negara dan Reformasi Birokrasi Republik Indonesia. (2010). Peraturan Menteri Negara Pendayagunaan Aparatur Negara dan Reformasi Birokrasi Nomor 03 Tahun 2010 tentang Jabatan Fungsional Pranata Laboratorium Pendidikan dan Angka Kreditnya. Jakarta: Permenpan.

Permenkes. (2013). Www.Djpp.Kemenkumham.Go.Id. Lampiran Peraturan Menteri Kesehatan Nomor 43 Tahun 2013 Tentang Cara Penyelenggaraan Laboratorium Klinik Yang Baik, 1216, 5–196.

Pravitra, D., Bagyono, T., & Hendrarini, L. (2017). Analisis Faktor Risiko Kecelakaan Kerja pada Tenaga Kerja Produksi PT Indotama Omicron Kahar di Purworejo, Jawa Tengah. Sanitasi: Jurnal Kesehatan Lingkungan, 9(1), 31. https://doi.org/10.29238/sanitasi.v9i1.72

Rahmantiyoko, A., Sunarmi, S., Rahmah, K., Slamet, D., Kunci-Keselamatan, K., & Kerja, K. (2019). Keselamatan dan Keamanan Kerja Laboratorium. IPTEK Journal of Proceedings Series, 4, 36–38.

Rahmawati, C. (2024). Kejadian kecelakaan kerja di laboratorium pada mahasiswa Akademi Analis Kesehatan Manggala Yogyakarta. Karya Tulis Ilmiah, Program Studi DIII Teknologi Laboratorium Medik, Akademi Analis Kesehatan Manggala Yogyakarta

Redhana, I. W. (2013). Identifikasi Bahan Kimia Berbahaya yang Digunakan dalam Praktikum Kimia SMA. Prosiding Seminar Nasional MIPA, 9. https://ejournal.undiksha.ac.id/index.php/semnasmipa/article/view/2679/2263

Rejeki, S. (2015). No TitleSanitasi, Hygiene, dan Kesehatan & Keselamatan Kerja (K3). Rekayasa Sains, Bandung

Ridasta, B. A. (2020). Penilaian Sistem Manajemen Keselamatan dan Kesehatan Kerja di Laboratorium Kimia. HIGEIA Journal of Public Health Research and Development, 4(1), 64–75. http://journal.unnes.ac.id/sju/index.php/higeia

Sugiyono. (2017). Metode Penelitian Kuantitatif, Kualiatif, dan R&D. Alfabeta

Sulistyaningsih, E., & Nugroho, A. (2022). Analisis Penyebab Kecelakaan Kerja Dengan Menggunakan Metode Analytic Hierarchy Process (AHP) di PT BSPL. INSOLOGI: Jurnal Sains Dan Teknologi, 1(4), 376–384. https://doi.org/10.55123/insologi.v1i4.701

Suma'mur, PK. (2015). Keselamatan Kerja dan Pencegahan Kecelakaan. Jakarta: Haji Masagung

Srijayanthi, N. L. P., Sudipta, I. G. K., & Putera, I. A. (2012). Kecelakaan Tenaga Kerja Pada Proyek Konstruksi Di Kabupaten Tabanan. Fakultas Teknik Universitas Udayana, Denpasar, 1–6.

Utama, M. F. L., & Rachman, T. (2020). Tinjauan Kebisingan Alat Angkat Proses Bongkar Muat Kapal Barang Di Pelabuhan Paotere Makassar. Riset Sains Dan Teknologi Kelautan, 3(1), 125–131. https://doi.org/10.62012/sensistek.v3i1.13255