



An Analysis of Neurotoxic Symptoms Among Motorcycle and Automotive Workshop Workers

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Article Info

Submitted November 13, 2025

Revised December 14, 2025

Accepted January 05, 2026

Keywords:

Occupational disease;
Neurotoxicity;
Workshop workers;
German Q18;
Occupational health

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ABSTRACT

Exposure to compounds that damage the nervous system is one of the main causes of occupational diseases, particularly neurological disorders among workers. The work environment in motorcycle and automobile repair workshops poses a high risk of exposure to organic chemicals, fuels, and exhaust fumes from vehicle combustion processes, which can adversely affect the nervous system. This study aimed to identify neurotoxic symptoms experienced by workers in motorcycle and car repair workshops in the South Surabaya area by considering worker characteristics and existing risk factors. The study employed a descriptive method with an observational approach. Data were collected through interviews, observations, and administration of the German Q18 questionnaire to 30 workshop workers. The results showed that the majority of respondents were over 20 years of age and all respondents were male.

1. INTRODUCTION

Exposure to neurotoxic substances in automotive workshop environments particularly organic solvents such as toluene, benzene, and xylene originating from cleaning processes and welding activities poses serious risks to the nervous system health of workers through inhalation and dermal contact. Such exposure may lead to symptoms including headaches, memory impairment, decreased concentration, and prolonged fatigue, which often develop gradually without clear early clinical manifestations. This condition not only reduces productivity and increases the likelihood of occupational accidents, but also contributes to the high burden of occupational diseases (ODs) in Indonesia's informal sector. The prevalence of neurotoxic-related complaints in this sector ranges from 20–70%, influenced by factors such as poor ventilation, prolonged exposure duration, and low utilization of personal protective equipment (PPE), as reported by the ILO, WHO, and recent local studies. The urgency of this analysis is further underscored by the fact that millions of workers globally and nationally remain exposed to hazardous chemicals, with commonly reported symptoms among workshop workers including fatigue (80%), headaches (77.8%), and dizziness (66.7%), which may progress to permanent toxic encephalopathy if not detected and managed early.

The objective of this practicum activity, integrated with a literature review, is grounded in evidence indicating that neurotoxic substances can damage neurons through mechanisms such as oxidative stress, neurotransmitter imbalance, and lipophilic accumulation in the brain. Major risk factors include productive age, employment duration exceeding five years, smoking habits (which contribute to benzene exposure), and concurrent exposure to biomechanical stressors. The German Q18 questionnaire has been demonstrated to be effective for subclinical screening, where a score of ≥ 6 indicates moderate to severe neurotoxic symptoms. Situational analysis in automotive workshops in South Surabaya indicates that male workers aged 20–40 years with an average working duration of eight hours per day are particularly vulnerable, highlighting the importance of identifying specific risk factors and providing structured preventive recommendations.

This study aims to describe the prevalence of neurotoxic symptom complaints among motorcycle and car workshop workers in South Surabaya by considering demographic characteristics, smoking habits, and alcohol consumption. In addition, the study will evaluate the prevalence of complaints using the Q18 questionnaire and analyze the relationship between factors such as length of employment and smoking habits with neurotoxic symptoms. Problem-solving measures will be implemented through primary data collection at workshops in the Wonocolo–Wonokromo area in January 2026, involving observation, interviews, and administration of the Q18 questionnaire to 30 respondents. Data will be processed through editing, coding, data entry using SPSS, and univariate analysis to generate recommendations, including improved ventilation systems, mandatory PPE implementation, reduction of excessive working hours, and occupational health education to minimize cumulative exposure and reduce the burden of neurological occupational diseases in the informal sector.

2. METHOD

This study employed a descriptive observational design aimed at describing complaints of neurotoxic symptoms as an occupational impact among motorcycle and automobile workshop workers. The research was conducted in motorcycle and car workshops located in South Surabaya, specifically in the Wonocolo and Wonokromo districts, from January 3 to January 5, 2026. The study sample included all motorcycle and automobile workshop workers in the study area. A total sampling technique was applied,

resulting in 30 respondents who met the inclusion criteria and agreed to participate in the study.

Data collection was carried out through direct workplace observation, interviews with respondents, and completion of the German Q18 questionnaire, which served as the primary instrument for detecting neurotoxic symptom complaints. The questionnaire consists of 18 dichotomous questions with “Yes” and “No” response options. Each “Yes” response was assigned a score of 1, while each “No” response was assigned a score of 0. The total score ranged from 0 to 18 and was used to categorize the severity level of neurotoxic complaints experienced by the respondents. In addition, respondent characteristics including age, gender, length of employment, working hours, type of work, smoking habits, and alcohol consumption, were collected through interviews.

The collected data were analyzed through several stages, including editing, coding, scoring, data entry, and data cleaning, using SPSS software. Data analysis was conducted using univariate analysis to describe the frequency distribution of respondent characteristics and to illustrate the prevalence of neurotoxic symptom complaints among motorcycle and automobile workshop workers. The results were presented in the form of frequency distribution tables accompanied by descriptive explanations.

3. RESULTS

Based on the results obtained, this study employed univariate analysis for data analysis

General Characteristics of Responden

This section presents the general characteristics of the study respondents.

Table 3.1 Distribution of Respondents by Age

		AGE			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20	2	6,7	6,7	6,7
	>20	28	93,3	93,3	100,0
	Total	30	100,0	100,0	

Source: Primary Data, 2026

Based on the age distribution table, it was found that the majority of respondents were in the age group of >20 years, accounting for 28 individuals (93.3%). Meanwhile, respondents aged 20 years comprised only 2 individuals (6.7%) out of a total of 30 respondents. These findings indicate that most participants in this study were within the adult age group.

Characteristics Based on Gender

Table 3.2 Distribution of Respondents by Gender

		GENDER			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Man	30	100,0	100,0	100,0

Source: Primary Data, 2026

Based on the gender distribution table, all respondents in this study were male. This is indicated by a total of 30 respondents, representing 100% of the study population.

Characteristics Based on Length of Employment

3.3 Distribution of respondents by length of employment

		LENGTH OF EMPLOYEMENT		
		Frequency	Percent	Valid Percent
Valid	<5 Tahun	17	56,7	56,7
	>5 Tahun	12	40,0	40,0
	5 Tahun	1	3,3	3,3
Total		30	100,0	100,0

Source: Primary Data, 2026

Based on the length of employment table, the majority of respondents had a length of employment of less than 5 years, totaling 17 individuals (56.7%). Respondents with more than 5 years of employment numbered 12 individuals (40.0%), while only 1 respondent (3.3%) had exactly 5 years of employment. Cumulatively, 56.7% of respondents had a length of employment ≤ 5 years, and 96.7% of respondents had employment duration up to more than 5 years.

Characteristics Based on Working Hours

Table 3.4 Distribution of Respondents Based on Working Hours

		WORKING HOURS		
		Frequency	Percent	Valid Percent
Valid	<8 hours	22	73,3	73,3
	>8 hours	8	26,7	26,7
Total		30	100,0	100,0

Source: Primary Data, 2026

Based on the working hours table, it was found that the majority of respondents worked 8 hours per day, totaling 22 individuals (73.3%). Meanwhile, respondents working more than 8 hours per day numbered 8 individuals (26.7%). These findings indicate that most respondents had working *hours* in accordance with standard regulations. However, more than one-quarter of respondents worked beyond 8 hours per day.

Respondent Characteristics Based on Work Section

Table 4.5 Distribution of Respondents Based on Work Section

		WORK SECTION			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mekanik Motor	27	90,0	90,0	90,0
	Mekanik Mobil	3	10,0	26,7	100,0
Total		30	100,0	100,0	

Based on the table, out of a total of 30 respondents, the majority worked as motorcycle mechanics, totaling 27 individuals (90%). Meanwhile, automobile mechanics accounted for only 3 individuals (10%). The cumulative percentage shows that motorcycle mechanics dominated the respondents at 90%, and when combined with automobile mechanics, the total reached 100%.

Characteristics Based on Smoking Habits

The analysis of the relationship between nutritional status and work stress showed no statistically significant association ($p = 0.167$; $r = 0.162$). This finding indicates that nutritional status was not significantly associated with work stress among the workers.

Table 3.6 Distribution of Respondents Based on Smoking Habits

SMOKING HABIST					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ya	25	83,3	83,3	83,3
	Tidak	5	16,7	16,7	16,7
Total		30	100,0	100,0	100,0

Source: Primary Data, 2026

Based on the table, out of a total of 30 respondents, 25 individuals (83.3%) reported having a smoking habit, while 5 individuals (16.7%) indicated that they did not smoke. The cumulative percentage shows that the majority of respondents were smokers, accounting for 83.3%. These findings indicate that smoking was a relatively prevalent habit among the respondents.

Characteristics Based on Alcohol Consumption Habits

Table 3.7 Distribution of Respondents Based on Alcohol Consumption Habits

CONSUMPTION HABITS					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tidak	30	100,0	100,0	100,0

Based on the table, all 30 respondents (100%) reported that they did not consume alcoholic beverages. The cumulative percentage reached 100%, indicating that none of the respondents had a habit of alcohol consumption.

Frequency Distribution of Q18 Questionnaire Responses among Motorcycle and Automobile Workshop Workers

Table 3.8 Frequency Distribution of Q18 Questionnaire Responses among Motorcycle and Automobile Workshop Workers

No	Quisioner	Reported Symptoms		Total Respondent	
		Yes	no	n	%
		n	%	n	%
1	Rasa Mual	0	0	30	100
2	Apakah Saudara Mudah Lupa	15	50	15	50
3	Apakah Teman Saudara Pernah Mengatakan Saudara pelupa	12	40	18	60
4	Apakah Saudara Sering Membuat Catatan Untuk Mengingat	5	16,7	25	83,3

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5	Apakah Saudara Kesulitan Menemukan Makna Dari Membaca Koran / Buku	16	53,3	14	46,7
6	Apakah Saudara Kesulitan Berkonsentrasi	13	43,3	17	56,7
7	Apakah Saudara Sering Merasa Kesal Tanpa Alasan	7	23,3	23	76,7
8	Apakah Saudara Merasa Tertekan Tanpa Alasan	7	23,3	23	76,7
9	Apakah saudara merasa lelah yang berlebihan	16	53,3	14	46,7
10	Apakah jantung saudara sering berdebar	10	33,3	20	66,7
11	Apakah Saudara merasa berat di dada	6	20	24	80,0
12	Apakah Saudara Sering Berkeringat	18	60	12	40
13	Apakah Saudara Sering Merasa Sakit	13	43,3	17	56,7
14	Apakah Saudara Merasa Mati Rasa di Tangan dan Kaki	21	70	9	30
15	Apakah Saudara Merasakan Lelah di lelngan dan Kaki	19	63,3	11	36,7
16	Apakah Tangan Saudara Gemetar	17	56,7	13	43,3

Source: Primary Data, 2026

Based on the frequency distribution table of Q18 questionnaire responses among 30 motorcycle and automobile workshop workers, it was found that all respondents (100%) did not experience nausea. However, 50% of respondents reported being forgetful, and 40% stated that they had been told they were forgetful, while only 16.7% of respondents frequently made notes to assist memory. In addition, 53.3% of respondents experienced difficulty understanding the meaning of text in newspapers or books, and 43.3% reported difficulty concentrating.

From a psychological perspective, 23.3% of respondents often felt irritable without an apparent reason, and 23.3% reported feeling depressed without a clear cause, whereas 53.3% complained of excessive fatigue. Regarding physical complaints, all respondents (100%) reported frequent palpitations, 80% experienced chest tightness, 60% reported excessive sweating, and 43.3% frequently experienced pain. Furthermore, neuromuscular symptoms were also observed, with 70% of respondents experiencing numbness in the hands and feet, 63.3% reporting fatigue in the arms and legs, and 56.7% experiencing hand tremors.

Overview of Neurotoxic Symptoms among Motorcycle and Automobile Workshop Workers

Table 4.9 Distribution of Respondents Based on the Profile of Neurotoxic Symptoms among Motorcycle and Automobile Workshop Workers

TOTAL Q18					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	1	3,3	3,3	3,3
	4	2	6,7	6,7	10,0
	5	6	20	20	30,0

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6	5	16,7	16,7	46,7
7	8	26,7	26,7	73,3
8	4	13,3	13,3	86,7
9	2	6,7	6,7	93,3
10	2	6,7	6,7	100,0
Total		30	100,0	100,0

Based on the table above, among the 30 motorcycle and automobile workshop workers, the majority of respondents experienced neurotoxic symptoms. The Q18 scores obtained ranged from 3 to 10, with the most frequent score being 7, reported by 8 respondents (26.7%), which falls into the category of moderate neurotoxic complaints. These findings indicate that a substantial proportion of motorcycle and automobile workshop workers experienced disturbances in the nervous system.

Scores ranging from 5 to 8 indicate that workers experienced more than half of the total neurotoxic symptoms assessed by the Q18 questionnaire, including memory impairment, difficulty concentrating, headaches, sleep disturbances, and decreased work accuracy. This condition suggests that the neurotoxic complaints were no longer mild but had reached a level that could adversely affect comfort and work productivity. Furthermore, scores of 9 and 10 were observed in 4 respondents (13.4%), which were classified as severe neurotoxic complaints.

4. DISCUSSIONS

This study aimed to identify neurotoxic symptom complaints among motorcycle and automobile workshop workers based on individual characteristics and screening results using the German Q18 questionnaire. The findings indicate that the majority of respondents were over 20 years of age and all were male. This situation reflects the general characteristics of workshop workers, who are predominantly individuals of productive age with relatively high physical work demands. Although individuals in the productive age group are biologically active, they remain at risk of developing neurotoxic disorders when continuously exposed to hazardous chemicals, particularly organic solvents and heavy metals commonly encountered in automotive work.

Based on employment duration, most respondents had a working period of approximately five years, which represents a significant proportion. Length of employment is an important factor in the accumulation of neurotoxic exposure, as neurotoxic disorders often develop gradually due to prolonged exposure. Previous studies have reported that long-term exposure to organic solvents over several years can impair cognitive function, memory, and the peripheral nervous system, even when initial complaints are mild. Therefore, although some respondents had relatively shorter work experience, the presence of workers with more than five years of service indicates a meaningful potential for cumulative neurotoxic risk.

In terms of daily working hours, most respondents worked 8 hours per day; however, more than one-quarter worked longer than 8 hours. Working beyond normal hours may increase daily exposure time to hazardous substances in the workshop environment, particularly under conditions of inadequate ventilation and ineffective use of personal protective equipment. Prolonged daily exposure may accelerate the onset of neurotoxic symptoms due to increased cumulative exposure doses.

Job characteristics showed that the majority of respondents were motorcycle mechanics. Motorcycle mechanics are typically more frequently exposed to organic solvents, fuel vapors, lubricants, and cleaning agents compared to automobile mechanics, especially in small-scale workshops. The dominance of motorcycle mechanics in this study suggests that the findings primarily represent exposure conditions and health risks in this group, which is known to have a high potential for neurotoxic exposure in daily work activities. The results also revealed a high prevalence of smoking habits among respondents, with more than 80% being active smokers. Smoking represents an additional risk factor that may exacerbate neurotoxic effects, as cigarette smoke contains various hazardous substances such as benzene and carbon monoxide, which also possess neurotoxic properties. Combined exposure to workplace chemicals and toxic substances from smoking may act synergistically, increasing the vulnerability of the nervous system to neurobehavioral disorders.

Analysis of responses to the Q18 questionnaire revealed that many respondents experienced neurotoxic complaints. Cognitive symptoms such as forgetfulness, difficulty understanding written text, and impaired concentration were reported by nearly half of the respondents. These symptoms indicate mild to moderate cognitive dysfunction commonly associated with chronic exposure to organic solvents. In addition, psychological complaints such as irritability and unexplained feelings of distress were reported by some respondents, reflecting neurobehavioral disturbances related to neurotoxic exposure.

Physical and neuromuscular complaints were particularly prominent, including numbness in the hands and feet, fatigue in the arms and legs, and hand tremors. These symptoms are characteristic signs of peripheral nervous system disorders frequently reported among workers exposed to neurotoxic chemicals over prolonged periods. These findings are consistent with previous studies demonstrating that long-term exposure to organic solvents and heavy metals can lead to peripheral neuropathy, characterized by sensory and motor impairments.

Based on total Q18 scores, most respondents were classified as having moderate neurotoxic symptoms, with a frequently observed highest score of 7. This condition indicates that the neurotoxic complaints experienced by motorcycle and automobile workshop workers have progressed beyond mild levels and have begun to affect comfort, concentration, and work productivity. In addition, several respondents exhibited high scores (9–10), indicating severe neurotoxic symptoms that require further medical attention and health evaluation. Overall, the results of this study demonstrate that motorcycle and automobile workshop workers face a significant risk of developing neurotoxic symptoms. Several factors, including duration of employment, daily working hours, type of work, and smoking habits, are likely to contribute to the occurrence of these complaints.

5. CONCLUSION

Research on complaints of neurotoxic symptoms experienced by motorcycle and automobile workshop workers in South Surabaya concludes that workers in the automotive industry face a high risk of nervous system disorders due to exposure to neurotoxic substances in the workplace. The sources of exposure mainly originate from the use of organic solvents, fuel vapors, oils, cleaning agents, and other chemicals frequently used in vehicle maintenance and repair activities. This exposure can enter the body through the respiratory tract or through repeated direct skin contact over long periods of time.

Analysis of respondent characteristics shows that all workers involved were of productive age and male. This reflects the general characteristics of the automotive workshop sector, which is dominated by men and involves physically demanding work. The productive age group represents a period in which individuals still possess good physical capacity to work; however, they remain at risk of developing work-related health problems

if repeatedly exposed to hazardous substances without proper control measures.

In terms of length of employment, most respondents had work experience of less than five years, although some had been working for more than five years. This finding is important because neurotoxic disorders generally do not occur suddenly but develop gradually as a result of long-term cumulative exposure. Therefore, workers with longer employment duration are at higher risk of experiencing nervous system dysfunction, even though the initial symptoms are often mild and tend to be overlooked.

Regarding daily working duration, most respondents worked approximately eight hours per day, although some worked more than eight hours. Working hours exceeding the normal limit may increase both the duration and intensity of daily exposure to neurotoxic substances. This condition can accelerate the accumulation of hazardous substances in the body, particularly when it is not supported by adequate ventilation systems, proper occupational hygiene practices, and consistent use of personal protective equipment in accordance with established standards.

With respect to job type, the majority of respondents were motorcycle mechanics. Motorcycle mechanics generally have more intensive interactions with organic solvents, fuels, and cleaning fluids compared to automobile mechanics, especially in small- and medium-scale workshops. The dominance of motorcycle mechanics in this study indicates that the findings more strongly reflect exposure conditions and health risks in this group, which is considered to have a relatively high potential for neurotoxic exposure in daily work activities.

The analysis of smoking habits indicates that most respondents were active smokers, while none reported alcohol consumption. The high prevalence of smoking among workshop workers constitutes an additional risk factor that needs attention, as cigarette smoke contains various hazardous substances such as benzene and carbon monoxide, which are neurotoxic. Exposure to harmful substances from smoking may have additive effects or exacerbate the impact of chemical exposure in the workplace, potentially increasing workers' nervous system vulnerability to neurobehavioral and neurological disorders.

The results of measurements using the German Q18 questionnaire show that most participants experienced symptoms associated with neurotoxicity. The most commonly reported symptoms were cognitive problems, such as frequent forgetfulness, difficulty concentrating, and difficulty understanding written material, indicating mild to moderate impairment of cognitive function. These symptoms reflect changes in central nervous system function that are often caused by long-term exposure to organic solvents and other neurotoxic substances.

In addition, mental complaints such as irritability and unexplained anxiety were also identified, indicating the presence of neurobehavioral disturbances. Physical and neuromuscular complaints were also detected at relatively high rates, including numbness in the extremities, fatigue in the limbs, and hand tremors. These symptoms indicate peripheral nervous system disorders commonly observed among workers exposed to neurotoxic chemicals over prolonged periods.

Overall analysis of Q18 scores shows that the majority of respondents fell into the category of moderate neurotoxic symptoms, with the most frequent highest score being 7. This indicates that the neurotoxic complaints experienced by workshop workers are no longer at a mild level but have reached a degree that can interfere with comfort, concentration, and productivity. In addition, several respondents were classified as having severe neurotoxic symptoms, indicating a greater risk of more serious nervous system disorders that require further attention and comprehensive health management.

Thus, the overall objective of this study to describe neurotoxic complaints among motorcycle and automobile workshop workers based on individual characteristics and risk factors has been fully achieved. All specific objectives of the study were also accomplished, including analysis of worker characteristics based on age, sex, length of employment, daily

working duration, and job type; identification of smoking habits and alcohol consumption; description of neurotoxic complaints based on the results of the German Q18 questionnaire; and identification of risk factors associated with the occurrence of neurotoxic complaints, particularly length of employment, daily working hours, job type, and smoking habits.

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