World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

Occupational safety and health risk management in watershed rehabilitation supervision in Southeast Sulawesi

Syawal Kamiluddin Saptaputra [1], Zulkarnain [2,*], Arniawati [2], Baharuddin [3], Fuji Rahmat [4], Abkar [4], Muhajir Febrianto [4] and Dwiki Andrianus [4]

[1] *Faculty of Public Health, Halu Oleo University, Indonesia.*
[2] *Faculty of Forestry and Environmental Sciences, Halu Oleo University, Indonesia.*
[3] *Faculty of Forestry, Hasanuddin University, Indonesia.*
[4] *PT. Vale Indonesia Tbk.*

World Journal of Advanced Research and Reviews, 2025, 26(02), 205-214

Publication history: Received on 17 March 2025; revised on 26 April 2025; accepted on 29 April 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.26.2.1469

Abstract

Background: Watershed rehabilitation is essential for restoring degraded ecosystems, improving water quality, and increasing biodiversity. However, supervision of watershed rehabilitation activities has potential hazards for the health and safety of workers, so it needs attention. This study aims to conduct hazard identification, risk assessment and evaluation, and risk control efforts in watershed rehabilitation supervision activities in Southeast Sulawesi.

Method: This study uses an observational description approach. This type of research is quantitative descriptive. This activity was carried out from December 2024 to February 2025 in several villages in North Kolaka Regency and one in Bombana Regency, Southeast Sulawesi. OSH risk assessment uses a semi-quantitative approach.

Results: Based on the study's results, watershed rehabilitation supervision activities have various potential hazards with varying levels of risk. Poor road accessibility is the highest risk, requiring comprehensive control measures. Meanwhile, the risk of ineffective communication is considered low, but it still requires attention to maintain good relationships. Exposure to extreme weather and the threat of wild animals presents a moderate risk, emphasizing the importance of preventive measures such as providing protective equipment and education. This study highlights the need to effectively implement Occupational Safety and Health to protect workers during watershed rehabilitation supervision activities. Periodic evaluations are needed to ensure the effectiveness of implementation and make continuous improvements.

Keywords: Watershed rehabilitation; Hazard identification; Risk assessment; Control efforts

1. Introduction

Watershed rehabilitation projects are essential for restoring degraded ecosystems, improving water quality, and increasing biodiversity (Gann et al., 2019). However, these projects often involve hazardous activities that significantly risk worker safety and Health (Song et al., 2022). Therefore, adequate occupational safety and health (OSH) risk management is essential to protect workers and ensure the success of watershed rehabilitation efforts (Baghdadi, 2024).

Watershed rehabilitation includes various activities to restore the ecological function of degraded watersheds (Melvani et al., 2024). These activities include reforestation, soil conservation, river restoration, and invasive species control

* Corresponding author: Zulkarnain

(Gann et al., 2019). While these efforts benefit the environment, they often involve physical labor, exposure to adverse weather conditions, and heavy equipment, which can pose safety hazards (Erena & Worku, 2018).

Some hazards are commonly encountered in watershed rehabilitation projects, posing risks to the safety and health of workers. Physical hazards include slipping, tripping, and falling due to uneven terrain and dense vegetation (Montero-Odasso et al., 2022). Workers may also face risks from falling objects, such as tree branches or rocks, and injuries caused by heavy equipment, such as chainsaws and tractors, either from accidents or equipment malfunctions (Song et al., 2022).

Environmental hazards involve exposure to extreme temperatures, including heat and cold, and adverse weather conditions like rain, snow, and wind (Schulte et al., 2016). Workers can also find poisonous plants, insects, and animals, posing significant health risks (Gann et al., 2019). Additionally, working near water bodies increases the risk of drowning. Chemical hazards arise from pesticides, herbicides, and fertilizers, which, if not handled properly, can cause skin irritation, respiratory problems, or severe health impacts (Kaushal et al., 2021).

Ergonomic and biological hazards are also prevalent in watershed rehabilitation. Repetitive movements, awkward posture, and heavy weight lifting can lead to musculoskeletal disorders (MSDs) such as back pain, carpal tunnel syndrome, and tendonitis, especially in activities such as tree planting, terracotta making, and removal of invasive species (Cancelliere et al., 2016). In addition, workers can be exposed to waterborne and vector-borne diseases, especially in tropical and subtropical areas, and infections from contaminated soil or water. (Schulte et al., 2016).

This study aims to conduct hazard identification, risk assessment and evaluation, and risk control efforts in watershed rehabilitation supervision activities in Southeast Sulawesi.

2. Material and methods

This type of research is quantitative descriptive. This activity was carried out from December 2024 to February 2025 in several villages in North Kolaka Regency, Southeast Sulawesi, namely Watumotaha Village, Wadiabero Village, Parutellang Village, Nimbuneha Village, Bukit Baru Village, and Saludongka Village, and Lengkong Batu Village. In addition, observations were also carried out in Wulu Village, Bombana Regency.

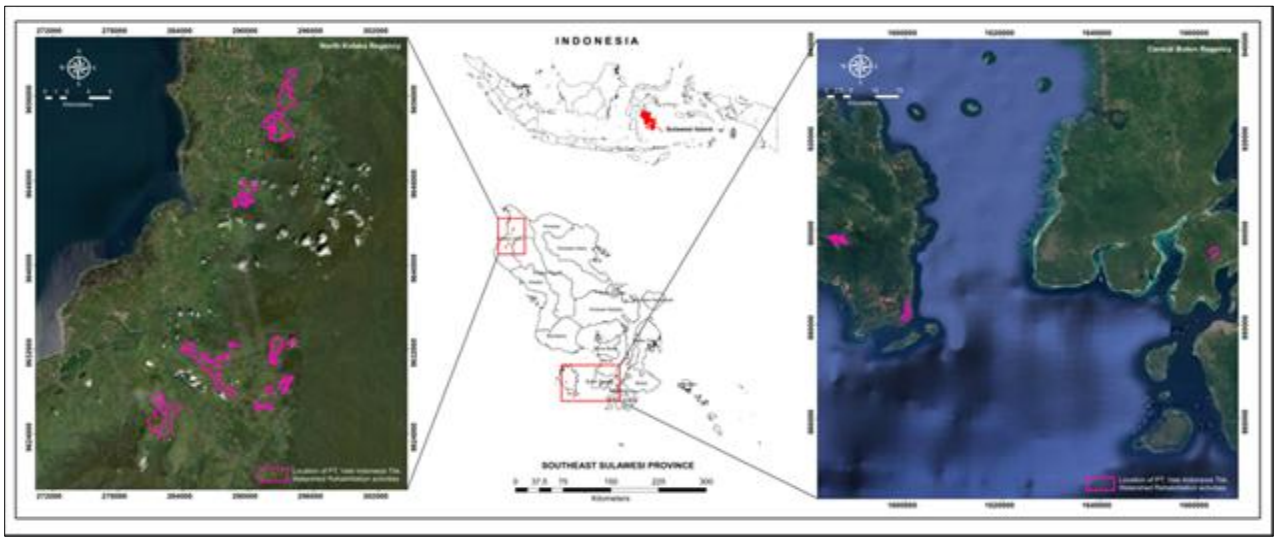

Figure 1 Research Location Map

2.1. Sampling Techniques

The risk assessment of OSH uses a semi-quantitative approach by adapting the AS/NZS ISO 31000:2009 standard. Semi-quantitative methods are methods that use a combination of qualitative and quantitative data to conduct analysis and assessment. In this method, qualitative data is used to understand the context and characteristics of the risk, while quantitative data is used to perform risk calculations and assessments. Hazard identification, risk assessment, and control were carried out using Observational Sheets and interviews in the block area of each village. OSH risk assessment includes several components, namely likelihood and severity. The categorization is as follows:

Likelihood: Very High (5): Frequent (more than once a week); High (4): Occurs occasionally (once a month); Moderate (3): Rare (once in a few months); Low (2): Very rare (once a year); and Very Low (1): Almost never happens.

Severity: Fatal (5): Death or major loss to the environment/finances; Critical (4): Permanent serious injury or major damage; Moderate (3): Moderate injury or moderate damage; Low (2): Minor injury or minor damage; and Very Low (1): No injury or damage. Risk Assessment Formula (Risk Level = Likelihood×Severity): 1 - 4 Low; 5–9 Medium; 10–15 Height; and 16–25 Extreme.

2.2. Data Collection

This study uses several data collection methods to obtain information on potential hazards, risk assessments, and risk control efforts in watershed rehabilitation supervision activities. The methods used were observation and interviews with the community, village officials, and the local government.

3. Results

3.1. Hazard Identification and Risk Assessment

- The accessibility of the road is steep and slippery, and it is damaged to the rehabilitation area of the River Flow Area. Risks of causing minor accidents that have the potential to cause minor to serious injuries

Table 1 Road Accessibility

Location	**Documentation**	**Risk Assessment**			
		Possibility (a)	**Severity (b)**	**Total (a x b)**	**Risk Level**
Watumotaha Village		Very High (5)	Medium (3)	15	High
Wadiabero Village		Very High (5)	Medium (3)	15	High
Lenkong Batu Village		High (4)	Critical (4)	16	Ekstrem

Parutellang Village		High (4)	Critical (4)	16	Ekstrem
Wulu Village		High (4)	Medium (3)	12	High
Nimbuneha Village		High (4)	Critical (4)	16	Ekstrem
Bukit Baru Village		High (4)	Critical (4)	16	Ekstrem

Source: Primary Data (December 2024 - February 2025)

The steep, slippery, and damaged road accessibility to watershed rehabilitation areas presents a significant risk of accidents. This poor road condition can cause falls, vehicle slips, and injuries due to impacts. The risk assessment results show a "High" to "Extreme" risk level in various villages, indicating a high likelihood of accidents and the severity of serious injuries. Therefore, strong control measures, such as road repairs, installation of warning signs, driver training, and personal protective equipment (PPE), are indispensable to reduce the risk of accidents and protect workers.

- Ineffective communication with the public or vendors has the potential for verbal conflict and obstacles in the execution of work.

Table 2 Communication with the public or vendor

Location	Documentation	Risk Assessment			
		Possibility (a)	Severity (b)	Total (a x b)	Risk Level
Watumotaha Village		Low (2)	Low (2)	4	Low
Wadiabero Village		Low (2)	Low (2)	4	Low
Lenkong Batu Village		Low (2)	Low (2)	4	Low
Parutellang Village		Low (2)	Low (2)	4	Low
Wulu Village		Low (2)	Low (2)	4	Low
Saludongka Village		Low (2)	Low (2)	4	Low

Source: Primary Data (December 2024 - February 2025)

Ineffective communication with the public or vendors can trigger verbal conflicts and hinder the execution of work due to misunderstandings. Based on the risk assessment results, this potential hazard has a "Low" risk level across the observed sites. This condition indicates that the likelihood of verbal conflict due to miscommunication is relatively low,

and the severity may also be low. Nonetheless, it is essential to maintain effective communication and build good relationships with the community and vendors to prevent potential future conflicts.

- Exposure to extreme weather that has the potential to cause fatigue, dehydration, and hypothermia

Table 3 Extreme weather exposure

Location	Documentation	Risk Assessment			
		Possibility (a)	Severity (b)	Total (a x b)	Risk Level
Watumotaha Village		3 (Medium)	3 (Medium)	9	Medium
Wadiabero Village		3 (Medium)	3 (Medium)	9	Medium
Lenkong Batu Village		3 (Medium)	3 (Medium)	9	Medium
Parutellang Village		3 (Medium)	3 (Medium)	9	Medium
Wulu Village		3 (Medium)	3 (Medium)	9	Medium

Sumber: Data Primer (Desember 2024 - Februari 2025)

Exposure to extreme weather is a potential hazard that can cause fatigue, dehydration, and hypothermia, especially for active workers in the field. Based on the risk assessment results, this potential hazard has a "Medium" risk level across the observed sites. This finding suggests that the likelihood of health impacts due to extreme weather is quite significant, and the severity that may arise is also moderate. Therefore, preventive measures such as adequate drinking water, regular rest, and protective clothing are essential to reduce the risk of health impacts due to extreme weather.

- Exposure or threat of wild animals that have the potential to cause minor to severe injury

Table 4 Exposure or threat of wild animals

Location	Documentation	Risk Assessment			
		Possibility (a)	Severity (b)	Total (a x b)	Risk Level
Watumotaha Village		2 (Very rare)	4 (Critical)	8	Medium
Parutellang Village		2 (Very rare)	4 (Critical)	8	Medium
Wulu Village		2 (Very rare)	4 (Critical)	8	Medium

Source: Primary Data (December 2024 - February 2025)

Exposure or threat of wild animals is a potential hazard that can cause minor to serious injuries to workers in the field. Based on the risk assessment results, this potential hazard has a "Medium" risk level in Watumotaha, Parutellang, and Wulu Villages. This finding indicates that although the likelihood of interactions with wild animals occurring is very rare, the severity of the injuries that may arise is quite critical. Therefore, workers must remain vigilant and take precautionary measures, such as using personal protective equipment (PPE) and avoiding direct interaction with wild animals, to reduce the risk of injury.

4. Discussion

4.1. The Role of Surveillance in Disaster Mitigation

Adequate supervision is essential to reduce these hazards and ensure worker safety. Supervisors play a key role in identifying hazards, assessing risks, implementing control measures, and monitoring workers' compliance with safety procedures (Song et al., 2022). They are also responsible for providing adequate training and equipment to workers, as well as promoting a culture of safety in the workplace.

A systematic risk management framework is essential to address the issue of OSH in watershed rehabilitation supervision work. This framework typically includes the following steps:

4.2. Hazard Identification, Risk Assessment, Control Measures, Monitoring and Evaluation

The first step in risk management is to identify potential hazards. This step can be done through various methods, including Occupational Hazard Analysis (JHA), which involves breaking down each task into individual steps and identifying the hazards associated with each step (Zisook et al., 2020). Workplace Inspections: Regular inspections can

help identify risks that may not be visible during the JHA process (Gann et al., 2019). Incident Report Review: Analyzing past incident reports can help identify trends and patterns of workplace injuries and illnesses (Song et al., 2022). Input from Workers: Workers are often the first to identify hazards, and their input should be actively solicited (Gann et al., 2019).

Once the hazard has been identified, the next step is to assess the associated risks. This step involves determining the likelihood of an incident and the severity of potential consequences (Tariq et al., 2020). Risk assessments can be qualitative or quantitative, depending on the hazard's nature and data availability. Qualitative Risk Assessment: This involves using descriptive terms such as "high", "medium", or "low" to describe the likelihood and severity of potential incidents. Quantitative Risk Assessment: This approach uses numerical values to estimate the probability and severity of potential incidents (Zisook et al., 2020). This approach is often used for hazards with exposure limits or well-established dose-response relationships.

The next step is to implement control measures to eliminate or reduce the risks associated with the hazards that have been identified. A hierarchy of control is a widely used framework for prioritizing control measures, with the most effective controls implemented first. The hierarchy of control includes the following: Elimination: This includes eliminating hazards. For example, drones can survey steep slopes instead of sending workers on foot. Substitution: This involves replacing hazardous materials or processes with less hazardous ones. For example, non-toxic herbicides can be used instead of toxic herbicides. Engineering Control: This requires workplace modification to reduce the risk of exposure. For instance, installing guardrails on elevated platforms or providing ventilation in enclosed spaces. Administrative Control: This involves implementing work practices or procedures to reduce the risk of exposure. For example, training on safe work practices, implementing a buddy system or scheduling frequent breaks. Personal Protective Equipment (PPE): This includes providing equipment for workers to protect them from danger. For example, protective hats, safety goggles, gloves, and respirators should be provided (Zisook et al., 2020).

In addition to hazard identification, risk assessment, and control efforts, another critical step is monitoring and evaluating control measures' effectiveness. This step includes Incident Investigation: Investigating all incidents to identify the root cause and prevent future occurrences (Song et al., 2022). Further conducting regular inspections to ensure that control measures are in place and being used correctly, soliciting feedback from workers on the effectiveness of control measures and new hazards that may have been identified, and regularly reviewing and revising risk management plans to ensure that they remain practical and up-to-date (Gann et al., 2019).

4.3. Special OSH Considerations in Watershed Rehabilitation Supervision

In addition to the risk management framework, several specific OSH considerations are highly relevant to watershed rehabilitation supervision work. These things include:

4.3.1. Training

Workers should receive adequate training on the hazards associated with their work and the control measures available to protect them (Song et al., 2022). Training should be provided in a language that the worker understands and should be tailored to the specific tasks they will be performing. Supervisors should also receive training on their responsibilities for OSH, including hazard identification, risk assessment, and incident investigation.

4.3.2. Emergency Preparedness

An emergency preparedness plan should be in place to address potential emergencies such as injuries, illnesses, natural disasters, and chemical spills (Gann et al., 2019). The plan should include first aid and medical care procedures, such as providing first aid and prompt medical care to injured or sick workers. Communication: Communicating with workers, emergency responders, and the public during emergencies (Liang et al., 2020). Evacuation: Evacuating workers from job sites in a natural disaster or other emergency (Hoegh-Guldberg et al., 2018). Spill Control: Containing and cleaning chemical spills (Kaushal et al., 2021).

4.3.3. Health Monitoring

Health monitoring may be necessary for workers exposed to specific hazards, such as chemicals or biological agents (Landrigan et al., 2020). Health monitoring can include Pre-Employment Health Screening To establish a baseline of workers' Health. Periodic Health Check-ups: To monitor workers' health and detect early signs of illness or injury (Liang et al., 2020). Exposure Monitoring: To measure workers' exposure to hazardous substances (Landrigan et al., 2020).

4.3.4. Promote Health Culture

Creating and maintaining a strong safety culture is essential to preventing workplace injuries and illnesses. Safety culture is a set of shared values, beliefs, and attitudes about safety reflected in an organization's policies, procedures, and practices. Key elements of a safety culture include Management Commitment: Management must demonstrate a strong commitment to safety by providing resources, setting clear expectations, and holding employees accountable for safety performance (Song et al., 2022). Worker Engagement: Workers should be actively involved in safety decision-making and encouraged to report hazards and near-misses (Gann et al., 2019). Open Communication: Management and workers should communicate openly about safety issues (Liang et al., 2020). Continuous Improvement: Organizations should strive to improve their safety performance by learning from past incidents and implementing new and innovative safety practices (Gann et al., 2019).

4.4. The Role of Technology in OSH Risk Management

Emerging technologies offer significant potential to revolutionize OHS risk management within watershed rehabilitation supervision. Among these advancements, drones stand out as a valuable tool. (Hoegh-Guldberg et al., 2018). These devices can be employed to continuously monitor key physiological parameters of personnel, such as heart rate, body temperature, and exposure levels to hazardous substances (Liang et al., 2020) .

5. Conclusion

Based on the study's results, watershed rehabilitation supervision activities have a variety of potential hazards with varying levels of risk. Poor road accessibility is the highest risk, requiring comprehensive control measures. Meanwhile, the risk of ineffective communication is considered low, but it still requires attention to maintain good relationships. Exposure to extreme weather and the threat of wild animals presents a moderate risk, emphasizing the importance of preventive measures such as providing protective equipment and education. This study highlights the need to effectively implement Occupational Safety and Health to protect workers during watershed rehabilitation supervision activities. We would like to express our gratitude to the administrative team and PIC for Watershed Rehabilitation at PT. Vale Indonesia in Southeast Sulawesi: M. Reza Setiawan, Alan Saputra, Adnan Anhum, Hasrudin Hayat, Simaali, La Ode Abdul Rajab, Wahyu Syahputra, Muhammad Fatwa Jumain, La Hamrun, Dedi Darmawan, and Muhammad Rizal, who were very helpful throughout the data collection and field documentation processes.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Republic of Indonesia Presidential Decree. RI Perpress Number 72 of 2012 concerning the National Health System. Indonesia; 2012 p. 1–7.

[2] Republic of Indonesia Law. Republic of Indonesia Law no. 36 of 2009 concerning Health. Indonesia; 2009.

[3] Ariani D, Nugraha T, Muhammad I. Analysis of determining factors of work satisfaction for the nurses in the inpatient installation of RSUD Langsa. J Public Health [Internet]. 2020;6(1):23–37. Available from: http://dx.doi.org/10.35329/jkesmas.v6i1

[4] Saputra RT, Ernawati, Rachmadi F. The Relationship between Nurse Workload and the Quality of Nursing Services in Inpatients at the Sultan Syarif Mohamad Alkadrie Regional General Hospital, Pontianak City, 2016. 2016. 1–11.

[5] Werdani YDW. The Effect of Nurse's Mental Workload on the Level of Patient Satisfaction in Private Hospital Inpatient Rooms in Surabaya (The Effect of Nurse's Mental Workload to the Level of Patient's Satisfaction in Private Hospitals around Surabaya). J Ners Lantera [Internet]. 2016;4(2):97–105. Available from: http://jurnal.wima.ac.id/index.php/NERS/article/view/873

[6] Erlina E, Arifin A, Salamah AU. The Influence of Workload on Nurse Performance in the Inpatient Installation of Labuang Baji Hospital, Makassar. J Masy Marit's Health. 2019;1(3):335–41.

[7] Krismawati NKA, Manuaba IS. Contribution of Work Environment and Work Motivation to Teacher Job Satisfaction. Indonesia J Instr. 2022;3(2):92–104.

[8] Ratnasari SL, Rahmasari Eka Putri, Ramon Zamora, Gandhi Sutjahjo, Widyo Winarso, Velya Tri Desi. The Influence of Leadership Style and Work Motivation. J Ilm Business Econ. 2020;5(November):1–12.

[9] Widakdo S, Ramli AT, Ardiasih LS. The Influence of Leadership, Motivation, and Providing Incentives on Employee Performance at the Bima Regency Education, Culture, Youth and Sports (Dikbudpora) Office. Sci J Reflect Econ Accounting, Manag Bus. 2022;5(3):544–52.

[10] Suryani R, Saktianingsih D, Maesaroh S. Social support, workload and providing incentives on nurses' performance at Hj Regional Hospital. Anna Lasmanah Banjarnegara. Mediconist. 2021;12(2):54–66.

[11] Ulum MB. The Influence of Incentives, Intrinsic Motivation and Non-Physical Work Environment on Nurse Performance (Study of Non-PNS Nurses at Prembun Regional Hospital). J Ilm Student of Management, Business and Accounting. 2021;2(1):1–9.

[12] Afthina RE, Hidayat MS, Masyarakat FK, Dahlan; B Faculty A, Community K, Ahamad U, et al. The Effect of Training and Incentives on Nurse Performance at Pambalan Batung Amunta Regional Hospital, South Kalimantan. Int J Healthc Res [Internet]. 2020;3(1):15–22. Available from: https://doi.org/10.12928/ijhr.v3i1.xxx

[13] Pundati TM, Tamtomo D, Sulaeman ES. Motivation, Competence, Workload, and Their Association with Nurse Performance in Dr. Arif Zaenudin Hospital, Surakarta. J Heal Policy Manag. 2018;3(2):63–70.

[14] Rezeki DS, Pasaribu SE, Bahri S. The mediating role of work stress on the influence of workload and work environment on nurse performance in the Covid-19 patient care room at Dr. Pirngadi Medan. Jesya. 2022;6(1):328–45.

[15] Septiani R, Ahri RA, Surahman Batara A. The Influence of Workload and Motivation on the Performance of ER and ICU Nurses at Dr. RSUD. La Palaloi Maros. J Muslim Community Heal 2023 [Internet]. 2023;4(4):44–50. Available from: https://doi.org/10.52103/jmch.v4i4.1322JournalHomepage:https://pasca-umi.ac.id/index.php/jmch

[16] Yustikasari SAT, Santoso B. The Influence of Workload, Work Stress, and Work Environment on the Performance of Inpatient Nurses at Level III Brawijaya Hospital, Surabaya. Al-Kharaj J Sharia Business Finance Econ. 2023;6(1):928–39.

[17] Wijaya R, Halin H, Wulandari T. The Influence of Supervision and Motivation on Employee Performance at PT Promexx Stationery, Palembang City. J EMT US. 2023;7(4):1375–85.

[18] Ahmad Averus, Andi Pitono. The Effect of Supervision on Employee Performance in Improving Health Services in Palu City, Central Sulawesi Province. Sociohumanities. 2018;20(1):15–21.

[19] Supriadi S. Factors Associated with Nurse Performance at PDHI Islamic Hospital Yogyakarta. Heal Sci Pharm J. 2017;1(1):30.

[20] Suherman J, MT H, Nusantara hilal sadad. Aanalysis of workload, work environment and work stress in improving the performance of nurses at Ciampea Community Health Center, DI Bogor. 2023;2(3):279–86.