Tahun 2025 [JURNAL KREATIVITAS PENGABDIAN KEPADA MASYARAKAT (PKM), P-ISSN: 2615-0921 E-ISSN: 2622-6030 VOLUME 8 NOMOR 10 TAHUN 2025] HAL 4884-4895

OPTIMIZATION OF EMERGENCY RESPONSE TO EARTHQUAKE DISASTERS FOR HIGH SCHOOL STUDENTS RELATED TO EVACUATION AND TRANSPORTATION OF DISASTER VICTIMS

Indra Gilang Pamungkas[1], Eva Riantika Ratna Palupi[2*], Suprayogi[3], Risyda Ma'rifatul Khoirot[4], Tsania Ayu Zaharany[5], Helza Risdianti[6], Aurellia Firstania[7], Irwan Agustian[8], Kristianto Dwi Nugroho[9], Yusuf Hanafiah[10]

[1-10]Department of Health, Politeknik Negeri Subang, Subang, Indonesia

Correspondence: eva.riantikarp@gmail.com

Disubmit: 28 Agustus 2025 Diterima: 04 September 2025 Diterbitkan: 01 Oktober 2025
Doi: https://doi.org/10.33024/jkpm.v8i10.22353

ABSTRACT

Earthquakes are natural disasters that frequently occur and cause serious impacts, including physical destruction and injuries among victims. Data indicate that the incidence of earthquakes, particularly in Indonesia, continues to rise each year, thereby requiring rapid and appropriate management through effective evacuation and victim transportation. However, public knowledge, especially among students, remains low, highlighting the need for educational programs to improve their ability to conduct evacuation and transportation during earthquake disasters. This community service activity was carried out to enhance students' skills in performing evacuation and transportation of earthquake victims. This community service was carried out using the CERDAS method (Lecture, Demonstration, and Simulation), involving 4 groups consisting of 16 participants. The evaluation was conducted using a skills checklist during simulation. The results showed the percentage of achievement relative to the maximum score in each group, with 84.09% in group 1, 86.36% in group 2, 90.90% in group 3, and 86.36% in group 4. The SMART method can be used to improve aid and transportation for earthquake victims. This needs to be done routinely to improve students' evacuation and transportation skills.

Keywords: Disaster Emergency Response, Earthquake, Evacuation and Transportation

1. BACKGROUND

An earthquake is a natural disaster in which energy causes movement in the Earth's plates(Shalahuddin et al., 2022). This is supported by the United Nations Indonesia (2025) which states that an earthquake is a term used to describe a sudden shift in a fault and the resulting ground vibrations and seismic energy emitted by the shift, volcanic or magmatic activity, or other sudden changes in pressure in the Earth.

The number of earthquake events has been identified previously. Shalahuddin et al (2022) stated that earthquakes rank third after tsunamis and landslides among the disasters that frequently occur in the world. NOAA National Centers for Environmental Information (2025) reported that there have been 212 earthquakes measuring over 4.0 on the Richter scale

worldwide. This number fluctuated between 2020 and 2024. In 2020, there were 29 earthquakes. This number increased to 42 in 2021 and 2022, and 46 in 2023. In 2024, the number of earthquakes decreased to 34.

The number of earthquakes in Indonesia is quite high, making it the second country most affected by earthquakes(Buchholz, 2025). This is a problem because Indonesia is in an active seismic area. Badan Pusat Statistik (2024) stated that Indonesia experienced 98 earthquakes from 2020 to 2023. This number continues to increase every year, namely 17 times in 2020, 24 times in 2021, 26 times in 2022, and 31 times in 2023. This disaster cannot be avoided, so management is necessary to reduce the resulting impact.

Earthquakes have extremely devastating impacts. This is supported by Kurnio et al (2021) who stated that natural disasters such as earthquakes cause significant damage to affected communities and leave lasting impressions on people's memories. One of the problems often experienced by earthquake victims is injury.

Earthquake disaster victims can experience injuries while fleeing. Previous studies have investigated injury profiles and revealed that earthquakes can cause a variety of injury patterns, including intracranial hemorrhage, fractures, dislocations, and crushed bones(Li et al., 2021; Mavrouli et al., 2023). Trauma to victims requires appropriate management to improve patient safety.

Injured victims need to be moved to a safer location to receive assistance. This is known as the victim evacuation and transportation process. Efficient evacuation and transportation are crucial to saving lives and mitigating the impact of an earthquake on victims(Nadimi et al., 2025). Transportation systems are highly vulnerable to various disruptions that can negatively impact the movement of victims during a disaster. Transportation systems become crucial when people need to be evacuated from hazardous locations. They are also crucial for facilitating pre- and post-crisis access during rescue missions and disaster response efforts(Gu et al., 2020; Islam et al., 2023). The problem found was the low level of public knowledge regarding the post-earthquake victim evacuation process.

Research conducted by Soltani et al (2024) found that the community's knowledge score regarding the evacuation process was only 8.8 out of 20. This is less than half the maximum score. Other findings also revealed that students in schools have low levels of knowledge about earthquakes. This is due to a lack of practical training for students. More attention is needed to provide educational materials for students. Therefore, this community service program aims to improve students' skills in carrying out the evacuation and transportation process for earthquake victims.

2. PROBLEMS FORMULATION

Subang is located in an area at high risk of earthquakes, primarily due to its proximity to the Lembang Fault—an active fault approximately 29 km long with the potential to generate earthquakes with a magnitude of 6.5–7.0. According to the Meteorology, Climatology, and Geophysics Agency (BMKG), an earthquake scenario from this fault has the potential to cause significant shaking in the Greater Bandung area, including Subang. Furthermore, the BMKG also recorded increased seismic activity from July to August 2025 in the western segment of the Lembang Fault, such as small

earthquakes with magnitudes between 1.8 and 2.3, which are feared to be early indicators (foreshocks) of a larger earthquake.

Furthermore, the emergence of the new 147 km-long Baribis Cipunagara Fault along the Cipunagara River—discovered by BRIN and a research team in May 2024—adds to the complexity of the earthquake threat in the Subang area. The presence of other local faults, such as the Sagalaherang and Ciater Faults, further heightens concerns about the potential for earthquake disasters in this region.

Despite the high geological risk, initial interviews indicated that students at the community service location still lacked knowledge and skills in earthquake emergency response, particularly regarding evacuation procedures for injured victims and the use of transportation equipment such as stretchers or long spinal boards. The school has never conducted comprehensive emergency response simulation training, and adequate facilities and disaster preparedness teams are not yet available. This can increase the risk of panic and mishandling of victims during an earthquake. Based on the identified problems, the research question for this community service is as follows:

a. How have students' skills related to evacuating and transporting earthquake victims changed after being educated using the CERDAS method?

3. LITERATURE REVIEW

Evacuation and transportation begin at the scene of the incident. This is crucial first aid and requires prompt and accurate delivery. For victims with respiratory and circulatory problems, fractures, and burns, delays in providing prompt and appropriate assistance can significantly degrade their condition and can result in death. Evacuation and transportation are carried out for several reasons, such as(American College of Surgeons, 2018):

a. Fire or a situation that could potentially ignite a fire. In this situation, consider the potential threat to the patient and rescuers.
b. Explosion or a situation that could potentially ignite an explosion.
c. Inability of rescuers to protect the patient from the hazardous environment.
d. Evacuation and transportation techniques are the process of moving a victim when they are in a dangerous situation, either from the environment or the victim themselves. There are several evacuation and transportation techniques for victims, including emergency transfer techniques(American College of Surgeons, 2018; Kementerian Kesehatan RI, 2022):

a. Clothing pull
b. Blanket pull
c. Arm or shoulder pull

Non-emergency transfer techniques include:

a. Direct lift
b. Extremity lift
c. Lift with a Long Spine Board (LSB)
d. Direct Ground Lift

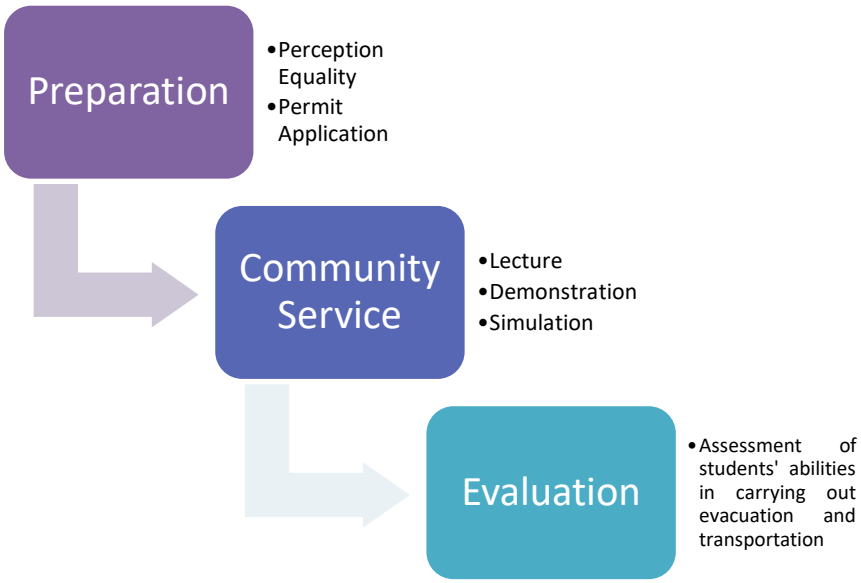
In the context of earthquakes, the ability to evacuate and transport victims is a crucial skill for students to master. The basic principles of victim

management, using the ABCDE approach (airway, breathing, circulation, disability, exposure), serve as the initial reference before victims are referred to a health facility(Newgard et al., 2022). In addition, skills in using a stretcher or long spinal board also need to be introduced so that evacuation of victims with injuries can be carried out safely and does not worsen the victim's condition(Feller et al., 2022). However, the lack of understanding and practical training in schools often makes evacuation efforts ineffective. Therefore, optimizing earthquake emergency response for high school students needs to be done through appropriate learning methods, one of which is the SMART method (Lecture, Demonstration, and Simulation). This method provides a complete combination, where lectures serve to provide theoretical understanding of earthquake risks and evacuation procedures, demonstrations emphasize concrete examples of evacuation techniques and the use of victim transportation, and simulations actively involve students in field exercises, thus developing practical skills ready to be applied when a disaster occurs(Görücü et al., 2024; Nugraha & Amir, 2023; Ogunlowo & Ajibade, 2024). With the SMART method, students not only gain knowledge but also direct experience in dealing with emergency conditions, which ultimately can increase the school's responsiveness and resilience to earthquake disasters.

4. METHOD

The community service activity was conducted using the CERDAS (Lecture, Demonstration, and Simulation) method. This activity was conducted with the Intra-School Student Organization (OSIS) administrators at SMAN 02 Kota Subang, consisting of four groups with a total of 16 students. The students had not previously received any training or preparation related to the evacuation and transportation of earthquake victims, so they were not yet equipped with the process.

The community service activity began with a consensus-building process and a permit application from SMAN 02 Kota Subang. After obtaining permission, the community service activity was conducted using the CERDAS method on July 31, 2025. A 15-minute lecture was delivered by a resource person on the evacuation and transportation process, covering definitions, key points to consider during the evacuation and transportation process, and the Standard Operating Procedures (SOPs). The demonstration was conducted through role-play, with one lecturer acting as the teacher and ten other participants (four lecturers and six students) as the students. The demonstration lasted 15 minutes. The community service process continued with a simulation involving four groups of high school students, each consisting of four students. The evaluation process was conducted using a checklist method during the simulation. The assessment of group abilities was divided into four sections: unable to perform, able to perform but with direct assistance, able to perform with direction, and able to perform with direct assistance. The assessors consisted of two individuals with competencies in Emergency and Disaster Nursing.



Scheme 1. Community Service Process

5. RESULT AND DISCUSSION

Description of Community Service Implementation

The community service activity was conducted through three processes: lecture, demonstration, and simulation. The lecture was delivered by a lecturer specializing in emergency and disaster nursing for 15 minutes. The material presented consisted of an understanding of the evacuation and transportation process, things that need to be considered during the evacuation and transportation process, and the standard operating procedures (SOP) for the evacuation and transportation process. Students were introduced to danger signs that need to be considered in victims, such as neck or spinal injuries, so that the evacuation and transportation process needs to be carried out by immobilizing the neck and not causing much movement.

Figure 1. Delivery of Material (Lecture) by Resource Person

After the lecture, the activity continued with a demonstration for the students. The demonstration was conducted using role-playing techniques by 11 students. One student played the role of the teacher delivering the material in class, while the other 10 students played the role of the students.

Figure 2. Implementation of Demonstration

A siren sounded to signal an earthquake. We used mannequins to represent students or victims trapped under the rubble, and four people acted as rescuers. Evacuation and transportation were carried out using several steps, as shown in Table 1.

Table 1. Standard Operating Procedures for Evacuation and Transportation

No	Procedure	Description
1	Identify the victim's condition	Determine whether the victim is conscious or unconscious, and assess for potential injuries (especially to the spine, head, and neck).
2	Stabilize the scene	Ensure the environment is clear of debris or other hazards before evacuating.
3	Call for help	A minimum of 3–4 personnel are required to transport a victim using a long spine board.
4	Prepare equipment	A long spine board, neck collar (if available), safety harness, and a stretcher, if needed, are required.
5	Apply neck collar	If a spinal injury is suspected, securely apply a neck brace.
6	Coordinate team	One person should hold the head (command), two should be on the sides, and one should be on the legs. All movements should be carried out according to instructions.
7	Log roll	Lift the victim according to the team leader's instructions.
8	Place victim on LSB	Carefully place the victim in a supine position on the board.

No	Procedure	Description
9	Attach safety strap	Strap the victim's body (chest, hips, and legs) to the long spine board to prevent movement during transport.
10	Lift LSB in coordination	A minimum of 4 people should lift the long spine board horizontally to maintain stability.
11	Transfer to Safe Assembly Point	Move the victim to a safe assembly area.

The next stage was a simulation conducted by the students. Four groups took turns performing the simulation, starting with the teacher delivering the material and ending with the rescuer carrying the victim to the ambulance.

Figure 3. Simulation Process

Evaluation of Victim Evacuation and Transportation Capabilities

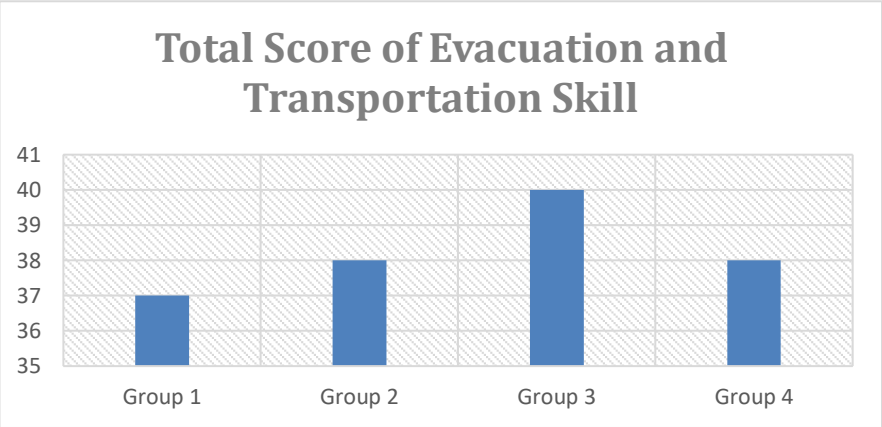
This section will explain the characteristics and abilities of students in carrying out evacuation and transportation.

Table 2. Student Characteristics (n = 16)

Characteristics	Total	Percent
Age		
15	3	18,75
16	10	62,50
17	3	18,75
Gender		
Male	2	12,50
Female	14	87,50

Source: (Primary Data, 2025)

The majority of students were 16 years old, with a total of 10 people (62.50%), of which only 3 people (18.75%) were 15 and 17 years old respectively.



Graph 1. Total Evacuation and Transportation Score

The results obtained by each group after the simulation varied, with the highest score being achieved by group 3 with 40 or 90.90% of the maximum score (44), followed by groups 2 and 4 with 38 or 86.36%, and group 1 with 37 or 84.09%. The lecture, demonstration, and simulation teaching methods had a positive influence. Simulation-based learning was effective in improving the clinical decision-making skills of nursing students. The lecture method increased students' knowledge, demonstrations improved skills, and simulations improved students' clinical decision-making abilities(Görücü et al., 2024; Nugraha & Amir, 2023; Ogunlowo & Ajibade, 2024). This is supported by Devi et al (2019) which states that the ideal way to improve memory storage, retrieval, cognition, and learning is to apply blended teaching techniques.

Table 3. Abilities Achieved by Each Group

No	Description	Achieved Abilities			
		Group 1	Group 2	Group 3	Group 4
1	Determine whether the victim is conscious and assess for potential injuries (especially to the spine, head, and neck).	Able to do with direction	Able to do but with direct assistance	Able to do under direction	Able to do but with direct assistance
2	Ensure the area is clear of debris or other hazards	Able to do but with direct assistance	Able to do independently	Able to do independently	Able to do with direction

No	Description	Achieved Abilities			
		Group 1	Group 2	Group 3	Group 4
	before evacuating.				
3	A minimum of 3–4 officers are required for the transfer of a victim with LSB.	Able to do independently	Able to do independently	Able to do independently	Able to do independently
4	Long Spine Board, neck collar (if available), safety straps, and a stretcher if needed.	Able to do with direction	Able to do but with direct assistance	Able to do it independently	Able to do it independently
5	If a spinal injury is suspected, properly apply the neck support.	Able to do but with direct assistance	Able to do with direction	Able to do it under direction	Able to do it under direction
6	One person holds the head (command), two on the sides, and one on the legs. Everyone moves on command.	Able to do with direction	Able to do independently	Able to do it under direction	Able to do it independently
7	Position the patient according to the team leader's instructions.	Able to do independently	Able to do independently	Able to do it independently	Able to do it independently
8	Carefully place the victim in a supine	Able to do independently	Able to do independently	Able to do it independently	Able to do it under direction

No	Description	Achieved Abilities			
		Group 1	Group 2	Group 3	Group 4
	position on the long spine board.				
9	Strap the victim's body (chest, hips, and legs) to the long spine board to prevent movement during transport.	Able to do it independently	Able to do it independently	Able to do under direction	Able to do under direction
10	At least four people must lift the long spine board horizontally to maintain stability.	Able to do it independently	Able to do it independently	Able to do independently	Able to do independently
11	Move the victim to a safe assembly area.	Able to do it independently	Able to do it under direction	Able to do independently	Able to do independently

Source: (Primary Data, 2025)

The evaluation results showed that two groups were able to perform the procedures for assessing patient consciousness and assessing potential injuries, provided they were guided by procedures. The other group was able to perform the procedures with direct assistance. Assessing or assessing patient consciousness requires considerable expertise and extensive training. This is supported by Brun et al (2025) which states that assessing a patient's level of consciousness is crucial in care because it supports decision-making and predicts outcomes, as well as determining the patient's treatment and prognosis. In ensuring a safe environment free from debris or other hazards, one group was able to perform the procedure with direct assistance, two groups were able to perform it independently, and one group was able to perform it with guidance.

In patient management, three groups were able to perform the procedure with guidance in correctly applying a neck brace. One group was able to perform the procedure with direct assistance. All groups were able to position the patient independently according to the team leader's instructions (logroll) to prevent spinal movement. This was done to avoid

aggravating the patient's condition. Continuous training and evaluation must be conducted to improve students' skills in evacuation and transport.

6. CONCLUSION

Community service using the CERDAS method successfully improved students' skills in evacuating and transporting earthquake victims. Group 1 achieved a success rate of 84.09% of the maximum score, groups 2 and 4 achieved 86.36%, and group 3 achieved 90.90%. The results of this community service demonstrate the importance of improving students' earthquake evacuation and transportation skills. Further research using randomized controlled trials or developing educational methods is warranted.

7. REFERENCES

American College of Surgeons. (2018). *ATLS: Advanced Trauma Life Support* (10th ed.).

Badan Pusat Statistik. (2024, February 22). *Jumlah Kejadian Bencana Alam Menurut Provinsi*. Https://Www.Bps.Go.Id/Id/Statistics-Table/3/TUZaMGVteFVjSEJ4T1RCMllyRjRTazVvVDJocVFUMDkjMw==/Jumlah-Kejadian-Bencana-Alam-Menurut-Provinsi.Html?Year=2023.

Brun, F. K., Fagertun, V. H., Larsen, M. H., & Solberg, M. T. (2025). Comparison of Glasgow Coma Scale and Full Outline of UnResponsiveness score to assess the level of consciousness in patients admitted to intensive care units and emergency departments: A quantitative systematic review. In *Australian Critical Care* (Vol. 38, Issue 1). Elsevier Ireland Ltd. https://doi.org/10.1016/j.aucc.2024.03.012

Buchholz, K. (2025, March 31). *The Countries Hit by the Most Earthquakes*. Https://Www.Statista.Com/Chart/29243/Countries-with-Most-Earthquakes/.

Devi, B., Khandelwal, B., & Das, M. (2019). Comparison of the effectiveness of video-assisted teaching program and traditional demonstration on nursing students learning skills of performing obstetrical palpation. *Iranian Journal of Nursing and Midwifery Research*, *24*(2), 118–123. https://doi.org/10.4103/ijnmr.IJNMR_35_18

Feller, R., Furin, M., Alloush, A., & Reynolds, C. (2022). *EMS Immobilization Techniques*. StatPearls [Internet].

Görücü, S., Türk, G., & Karaçam, Z. (2024). The effect of simulation-based learning on nursing students' clinical decision-making skills: Systematic review and meta-analysis. In *Nurse Education Today* (Vol. 140). Churchill Livingstone. https://doi.org/10.1016/j.nedt.2024.106270

Gu, Y., Fu, X., Liu, Z., Xu, X., & Chen, A. (2020). Performance of transportation network under perturbations: Reliability, vulnerability, and resilience. *Transportation Research Part E: Logistics and Transportation Review*, *133*. https://doi.org/10.1016/j.tre.2019.11.003

Islam, R., Jones, S., & Hudnall, M. (2023). Transportation system functions during hurricane Response: A systematic review of modes and methods. In *Transportation Research Interdisciplinary Perspectives* (Vol. 18). Elsevier Ltd. https://doi.org/10.1016/j.trip.2023.100786

Kementerian Kesehatan RI. (2022). *Modul Pelatihan Basic Trauma Cardiac Life Support (BTCLS)*. Kementerian Kesehatan RI.

Kurnio, H., Fekete, A., Naz, F., Norf, C., & Jüpner, R. (2021). Resilience learning and indigenous knowledge of earthquake risk in Indonesia. *International Journal of Disaster Risk Reduction*, *62*. https://doi.org/10.1016/j.ijdrr.2021.102423

Li, C. Y., Lin, C. H., Chang, C. W., Chuang, C. H., Chung, Y. H., Hu, M. H., & Lin, C. L. (2021). Musculoskeletal injuries and management of victims from collapsed buildings in the 2016 Taiwan earthquake: Experiences in a tertiary medical center. *Injury*, *52*(11), 3334–3339. https://doi.org/10.1016/j.injury.2021.08.030

NOAA National Centers for Environmental Information. (2025, August 12). *National Geophysical Data Center / World Data Service (NGDC/WDS): NCEI/WDS Global Significant Earthquake Database*. Https://Www-Ngdc-Noaa-Gov.Translate.Goog/Hazel/View/Hazards/Earthquake/Search?_x_tr_sl=en&_x_tr_tl=id&_x_tr_hl=id&_x_tr_pto=tc.

Nugraha, D., & Amir, M. (2023). *Pengaruh Metode Simulasi Demonstrasi Terhadap Hasil Belajar Mahasiswa*. *10*(1), 1–8.

Ogunlowo, S. O., & Ajibade, B. L. (2024). Investigating the differential efficacy of lecture and demonstration teaching methods in teaching medical-surgical nursing among nursing students. *BMC Nursing*, *23*(1). https://doi.org/10.1186/s12912-024-02541-4

Shalahuddin, I., Maulana, I., Pebrianti, S., & Eriyani, T. (2022). Efektifitas pendidikan kebencanaan terkait kesiapsiagaan penduduk di daerah rawan gempa: Studi literatur. *Holistik Jurnal Kesehatan*, *16*(2), 128–141. https://doi.org/10.33024/hjk.v16i2.2079

Soltani, A., Nikseresht, M., Rajabpour, M., & Khoundabi, B. (2024). The Knowledge of Safe Emergency Evacuation During an Earthquake Among the Residents of Tehran, Iran. *Health in Emergencies and Disasters Quarterly*, *10*(1), 21–28. https://doi.org/10.32598/hdq.10.1.135.3

United Nations Indonesia. (2025, August 12). *Earthquake - Definition and Facts*. Https://Indonesia.Un.Org/En/262071-Earthquake-Definition-and-Facts.