



# Effectiveness of the Time Rushing Game Method in Enhancing Knowledge, Skills, and Self-Efficacy in Health-Oriented Disaster Response Simulations

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<p><b>Track Record Article</b></p> <p>Revised: 27 April 2026 Accepted: 12 June 2026 Published: 24 June 2926</p> <p><b>How to cite :</b> Hidayat, U. R., Arisandi, D., Hatmalyakin, D., Akbar, A., Alfikrie, F., Nurpratiwi, Amaludin, M., Anjarwadi, I. A., Nurannisa, &amp; Subandi, A. (2026). Effectiveness of the Time Rushing Game Method in Enhancing Knowledge, Skills, and Self-Efficacy in Health-Oriented Disaster Response Simulations. <i>Contagion: Scientific Periodical Journal of Public Health and Coastal Health</i>, 8(2), 195–206.</p>	<p style="text-align: center;"><b>Abstract</b></p> <p><i>Aims: This study aimed to evaluate the effectiveness of the time-rushing game method in enhancing knowledge, skills, and self-efficacy in health-oriented disaster response simulations. Methods: A quasi-experimental one-group pretest-posttest design study was conducted with 114 nursing students. The Time Rushing Game measured knowledge, skills, and self-efficacy in conducting disaster-response simulations. The Time Rushing Game intervention consisted of triage, evacuation, and initial assessment procedures, each with a 10-minute time limit. After receiving the intervention or playing the disaster simulation, knowledge, skills, and self-efficacy were measured again. Knowledge and self-efficacy were measured using a questionnaire. Skills are measured using an observation sheet. Results: There was a significant improvement in knowledge (<math>p=0.000</math>), skills (<math>p=0.000</math>), and self-efficacy (<math>p=0.000</math>) after the intervention using the Time Rushing Game learning method. The number of respondents who experienced an increase was 77 for knowledge and 106 for both skills and self-efficacy. Meanwhile, 37 respondents showed no change in knowledge, and 8 respondents each showed no change in skills and self-efficacy. Conclusion: The Time Rushing Game effectively enhanced students' knowledge, skills, and self-efficacy in health-oriented disaster response simulations. This learning method should be implemented not only in health-oriented disaster response simulations but also in other case-study-based simulations</i></p> <p><b>Keywords: Time Rushing Game, Knowledge, Skills, Self-Efficacy, Disaster Preparedness</b></p>
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## INTRODUCTION

Disasters remain one of the major global challenges, including in Indonesia. According to the Emergency Events Database in 2024, there were 393 natural disasters worldwide, affecting 167.2 million people, causing 16,753 deaths, and resulting in economic losses of US\$241.95 billion. (Delforge et al., 2025). Globally, both natural and non-natural disasters continue to increase in frequency and impact. Data from the United Nations Office for Disaster Risk Reduction show that average annual global disaster losses increased significantly from around US\$70–80 billion during 1970–2000 to US\$180–200 billion during 2001–2020. When indirect impacts and ecosystem damage are included, total disaster losses are estimated to exceed US\$2.3 trillion annually (United Nations Office for Disaster Risk Reduction, 2025).

Indonesia is considered one of the countries most vulnerable to disasters due to its geographical position on the Ring of Fire (Hendrawan et al., 2025). This condition makes Indonesia highly prone to earthquakes, tsunamis, volcanic eruptions, floods, landslides, forest

fires, and other hydrometeorological disasters (Spiridonov et al., 2025). Data from the National Disaster Management Agency (BNPB) in 2024 recorded 1,117 disaster events that affected 8.1 million people and caused 540 deaths (Ariyaningsih et al., 2025). These conditions demand strong preparedness from communities, institutions, and governments to reduce disaster risks and minimize impacts on social, economic, and health sectors (Nasution et al., 2025).

West Kalimantan Province is one of the Indonesian regions highly vulnerable to hydrometeorological disasters. In early 2025, flooding became the dominant disaster, with 29 flood incidents affecting around 459,815 people. Other frequently occurring disasters include forest and land fires, tornadoes, and landslides. Districts such as Sintang, Melawi, Ketapang, Kapuas Hulu, and Landak are categorized as high-risk areas due to repeated exposure to disasters. Pontianak City is also highly vulnerable due to its low-lying geography and location along the Kapuas and Landak rivers. These conditions highlight the urgent need for mitigation efforts and preparedness programs to strengthen community resilience. (Badan Nasional Penanggulangan Bencana, 2026).

In disaster management, training is an essential component of disaster risk reduction. Disaster training aims to improve knowledge, practical skills, and preparedness so that individuals and communities can respond effectively before, during, and after disasters. (Righi et al., 2021). Without proper education and training, first responders often panic, make inappropriate decisions, and fail to provide optimal assistance. (Mızrak & Aslan, 2024). Disaster training is also important for strengthening coordination among security personnel, healthcare workers, volunteers, and the public. (Gooding et al., 2022). Poor coordination may delay evacuation, increase casualties, and hinder post-disaster recovery. (Idrus et al., 2025). Therefore, systematic, standardized, and continuous disaster training is necessary to improve capacity and preparedness.

Previous studies have shown that communities receiving disaster training demonstrate faster response times, lower anxiety levels, and higher safety outcomes compared to those without training. (Guo et al., 2025). Thus, disaster training can be considered an important investment in building community resilience, reducing casualties, and accelerating recovery after disasters.

Various simulation methods are commonly used in disaster training (Mahdi et al., 2023). One of the most widely applied methods is the conventional drill simulation, which involves structured exercises conducted separately, such as triage drills, evacuation practices, or casualty management (Abualenain et al., 2024). Although effective for introducing basic procedures, this method often fails to reflect the complexity of real disaster situations because

activities are performed separately and without significant time pressure (Smith et al., 2023). Tabletop exercises are discussion-based simulations useful for strategic decision-making but limited in hands-on practice, while full-scale simulations are more realistic because they involve multiple stakeholders, equipment, and simulated victims (Emaliyawati et al., 2025). However, these simulations require high costs, extensive preparation, and complex resources.

The Time Rushing Game is a game-based disaster simulation method that integrates triage, evacuation, and initial assessment into one structured scenario with strict time limits. This method creates a dynamic learning experience that trains rapid decision-making, teamwork, practical skills, and self-efficacy under emergency-like conditions. (Mirza et al., 2024). The Time Rushing Game is based on experiential learning theory, emphasizing learning through direct experience and practice. Its use of time pressure simulates real emergencies and helps improve focus, response speed, decision-making, motivation, and procedural skills in disaster management. (Taheri et al., 2023).

Conventional simulation methods have several limitations. They are often conducted in separate stages, limiting participants' understanding of the overall disaster management process. (Rotzoll et al., 2025). These simulations also lack realistic time pressure and do not adequately train rapid decision-making in mass casualty situations. (Vage et al., 2024). In addition, the absence of dynamic and challenging elements may reduce participant engagement, motivation, and emotional involvement. (Pek et al., 2023).

The novelty of this study lies in integrating triage, evacuation, and initial assessment into a structured Time Rushing Game simulation using case-based scenarios. The triage process applies the Simple Triage and Rapid Treatment (START) method, emphasizing speed and accuracy in victim categorization using triage tags. (Tay et al., 2025). These tags determine which victims require immediate evacuation to field hospitals or referral hospitals. During evacuation, participants are assessed on the accuracy of injury management, the correct use of evacuation equipment, and teamwork coordination. The final stage involves initial assessment at the field hospital, including airway, breathing, circulation, disability, and exposure examinations. Participants must make rapid assessment and treatment decisions to determine whether victims require referral, further observation, or treatment at the field hospital. All stages must be completed within 30 minutes, creating significant time pressure similar to real emergency situations. (Chang et al., 2024).

A preliminary study found that disaster simulation learning in laboratories was considered monotonous and less engaging by nursing students, who preferred more realistic outdoor simulations. The findings also showed that students' knowledge, practical skills, and

self-efficacy in disaster management were still inadequate, particularly in triage, evacuation, decision-making, and emergency response. Therefore, innovative and realistic learning approaches such as the Time Rushing Game are needed to improve students' preparedness and confidence in disaster management.

## **METHODS**

This study used a quasi-experimental design with a one-group pretest-posttest. The study was conducted at STIKes YARSI Pontianak in November 2025. The population in this study consisted of 114 students from the 7th semester of the Bachelor of Nursing and the 5th semester of the associate degree of nursing who had taken the Emergency Nursing and Disaster Nursing courses. The research sample consisted of 114 people selected using total sampling. Pretest data collection was conducted on 10–12 November 2025 using knowledge and self-efficacy questionnaires, as well as skills assessment through laboratory simulations evaluated by three assessors. On 16 November 2025, participants received an explanation of the disaster simulation learning method using The Time Rushing Game approach and then undertook case-based simulations as a posttest.

This study did not use a control group due to several methodological and practical considerations. Firstly, from an ethical perspective, all participants needed to receive the same training intervention, as the method employed was designed to improve emergency response competencies. Failing to provide the intervention to some participants (the control group) could potentially lead to inequity in skill development. Secondly, this study focuses on evaluating the effectiveness of a training method under simulated conditions; therefore, it places greater emphasis on changes in ability before and after the intervention (pre-post design) rather than on comparisons between groups. Thirdly, the limited number of participants and resources was also taken into account, as dividing participants into groups could reduce the impact of the training and the effectiveness of the simulation, which requires optimal teamwork. Fourthly, the use of the integrated and dynamic 'time-rushing game' method is best tested within a single, unified group to ensure the simulation remains realistic and is not fragmented.

The simulation consisted of triage using the START method, victim evacuation based on triage results and injury severity, and initial assessment at a field hospital to determine referral needs. During the triage stage, the triage team must not spend more than 1 minute on any one patient. The maximum triage time is 10 minutes. After completing triage, participants carry out the extraction and transport stages, ensuring that patient transfer takes no longer than 10 minutes. The next step is the initial assessment stage, which participants must complete

within a maximum of 10 minutes. All these stages follow the Standard Operating Procedures for triage, extraction, transport, and initial assessment. After completing the skills assessment, participants filled out posttest questionnaires on knowledge and self-efficacy. The research instruments used were knowledge questionnaires, observation sheets, and self-efficacy questionnaires. The knowledge questionnaire consisted of 20 questions with a Guttman scale, where correct answers were given a value of 1 and incorrect answers a value of 0, with the lowest score being 0 and the highest 20. The knowledge questionnaire used by the researcher had been tested for validity and reliability on 20 respondents ( $r_{table} = 0.444$ ), which was declared valid ( $r_{count} = 0.738-0.875$ ) and reliable (Cronbach's Alpha = 0.979). The self-efficacy questionnaire consisted of 10 statements with a Likert scale of very unsure valued at 1, unsure valued at 2, less sure valued at 3, sure valued at 4, and very sure valued at 5. The highest score is 50, and the lowest is 10. The self-efficacy questionnaire has been tested for validity and reliability on 20 respondents ( $r_{table} = 0.444$ ) who declared valid ( $r_{count} = 0.630-0.855$ ) and reliable (Cronbach's Alpha = 0.941).

The observation sheet used in the study consisted of triage, evacuation, and initial assessment procedures. The triage assessment was scored as 1 for correct and 0 for incorrect, with 10 cases (lowest score 0 and highest score 10). The evacuation assessment consisted of 17 assessment components with a score of 0-2 (highest score 34 and lowest score 0). The observation sheets were tested for validity and reliability through assessment by three experts using the content validity index (CVI) approach. The observation sheets, consisting of triage, evacuation, and initial assessment observation sheets, were declared valid and reliable with a CVI of 0.867 for triage, 0.833 for evacuation, and 0.89 for initial assessment.

The data were analyzed using SPSS Version 2020. The univariate data consisted of respondent characteristics (age and gender), knowledge, skills, and self-efficacy before and after the intervention. The statistical test used was the non-parametric Wilcoxon test, as the data distribution was not normal. This study was approved by the Health Research Ethics Committee of STIKes YARSI Pontianak with the number: 095/KEPK/STIKes.YSI/X/2025.

## RESULT

A total of 114 respondents agreed to participate in this study. A total of 88 respondents were women (77.2%) with an average age of 21.35 years (Table 1). Before the intervention, the majority of respondents had low knowledge (68 people, 59.6%), poor skills (104 people, 91.2%), and low self-efficacy (104 people, 91.2%). After the intervention, the majority of respondents had moderate knowledge (67 people, 58.8%), adequate skills (109 people, 95.6%),

and moderate self-efficacy (109 people, 95.6%) (Table 2). Table 3 shows an improvement in all measured variables following the intervention. For the knowledge variable, the mean score increased from 10.74 in the pre-test to 14.16 in the post-test. For the skills variable, there was a significant increase from an average score of 23.25 in the pre-test to 32.75 in the post-test. The same trend was observed for the self-efficacy variable, where the average score rose from 23.25 in the pre-test to 32.75 in the post-test.

**Table 1: Respondent Characteristics Based on Age (n=114)**

Variable	Mean	SD
Age	21.35	0,959

**Table 2: Respondent Characteristics (Gender), Knowledge, Skills, and Self-Efficacy (n=114)**

No	Variable	Category	f	%
1	Gender	Men	26	22.8
		Women	88	77.2
2	Knowledge (Pretest)	High	0	0
		Moderate	46	40.4
		Low	68	59.6
3	Knowledge (Posttest)	High	42	36.8
		Moderate	67	58.8
		Low	5	4.4
4	Skills (Pretest)	Good	0	0
		Adequate	10	8.8
		Poor	104	91.2
5	Skills (Posttest)	Good	4	3.5
		Adequate	109	95.6
		Poor	1	0.9
6	Self-efficacy (Pretest)	High	0	0
		Moderate	10	8.8
		Low	104	91.2
7	Self-efficacy (Posttest)	High	4	3.5
		Moderate	109	95.6
		Low	1	0.9

**Table 3: Differences in Knowledge, Skills, and Self-Efficacy Scores Before and After the Intervention (n=114)**

No	Variable	Mean	SD
1	Knowledge (Pretest)	10.74	1.241
2	Knowledge (Posttest)	14.16	2.498
3	Skills (Pretest)	23.25	2.442
4	Skills (Posttest)	32.75	2.623
5	Self-efficacy (Pretest)	23.25	2.442
6	Self-efficacy (Posttest)	32.75	2.623

The results of the statistical test showed an increase in knowledge ( $p=0.000$ ), skills ( $p=0.000$ ), and self-efficacy ( $p=0.000$ ) after the intervention using the Time Rushing Game learning method (Table 4).

**Table 4. Improvement of Knowledge, Skills, and Self-Efficacy After Intervention of the Time Rushing Game Learning Method (n=114)**

Variable	Positive Ranks	Negative Ranks	Ties	P Value	Z
Knowledge	77	0	37	0.000*	-8.483
Skills	106	0	8	0.000*	-10.249
Self-efficacy	106	0	8	0.000*	-10.249

\*Wilcoxon test

Positive ranks indicate an increase in knowledge after the intervention was 77 people, an increase in skills was 106 people, and an increase in self-efficacy was 106 people. There were 37 people whose knowledge level remained unchanged, and 8 people whose skills and self-efficacy remained unchanged (Table 3).

## DISCUSSION

The results of this study indicated that there were differences in changes in knowledge, skills, and self-efficacy in conducting disaster management simulations after the intervention. There were several respondents whose knowledge, skills, and self-efficacy did not change (Ties) after the intervention. No respondents showed a decline in knowledge, skills, and self-efficacy after the intervention. The findings of this study indicate that the Time Rushing Game is effective in improving participants' knowledge, skills, and self-efficacy in disaster management.

The enhancement of knowledge among nursing students is attributed to the Time Rushing Game method, which presents realistic and contextual scenarios; consequently, students not only grasp concepts theoretically but are also able to apply them in situations that closely resemble real-world conditions. This process reinforces understanding of key stages in disaster management, such as triage, evacuation, and initial assessment, which are core competencies in emergency nursing practice.

These results are consistent with various international and national studies, which state that game-based learning and simulations provide a more in-depth, responsive, and practice-oriented learning experience compared to conventional methods. (Wang et al., 2024). Knowledge improvement occurs because The Time Rushing Game provides an interactive learning experience that allows participants to understand mitigation, response, and evacuation measures through realistic scenarios. The interactivity in the game reinforces the information encoding process and facilitates long-term knowledge retention. Meta-analysis studies show that game-based learning significantly improves cognitive learning outcomes in various educational contexts. (Mao et al., 2022). In addition, disaster simulations that require players

to make quick decisions based on visual and instructional information have proven effective in reinforcing procedural concepts, such as rescue priorities and risk assessment. (Bai et al., 2024). Research by Hastuti & Arisanty (2023) showed that game media such as Ludo Disaster Alert can improve students' understanding of floods and earthquakes when presented in a visual and interactive form. These results indicated that the use of game models in disaster education is highly relevant to the Indonesian context, especially given the high prevalence of natural disasters such as earthquakes, floods, and volcanic eruptions. In addition to cognitive aspects, Time Rushing Game also improved participants' skills. This game presents a simulated environment that closely resembles real conditions, allowing participants to practice rapid response measures such as hazard identification, emergency decision-making, and evacuation procedures under time pressure.

In terms of skills, this method provides students with the opportunity to engage in hands-on practice within a structured simulation environment. Students are trained to conduct rapid assessments, prioritise patients, and make clinical decisions within time constraints. This is highly relevant to the demands of the nursing profession, particularly in emergencies that require speed, accuracy, and effective team coordination. (Mirza et al., 2024). Furthermore, the increase in self-efficacy indicates that students have become more confident in handling emergencies. Through the experience of completing the simulation scenarios, students gain a sense of mastery that reinforces their self-confidence. This self-confidence is a crucial component of nursing practice, as it influences the ability to make decisions and take action independently. (Pamula et al., 2025).

Study from Choi & Song (2024) showed that the use of game-based simulations in Psychological First Aid (PFA) training significantly improved participants' ability to assess situations and respond appropriately in emergencies compared to traditional lecture methods. Repeated practice in games reinforced the motor-cognitive skills needed in disaster response, helping participants to internalize procedures without having to experience real risks. (Hidayat et al., 2024). Increased self-efficacy is also one of the important contributions of the Time Rushing Game. According to Bandura's theory, self-efficacy is formed primarily through experiences of success (mastery experiences). In the game, each participant's success in completing a mission within a certain time limit becomes a source of psychological reinforcement, thereby increasing their confidence in handling disasters in real-life situations. Study of Dumblekar & Dhar (2021) emphasized that game-based learning consistently increases participants' self-efficacy through feedback and reward mechanisms within the game. Choi & Choi (2024) showed that simulation-based PFA training increases participants'

confidence in responding to emergencies, proving that games can be an effective tool in strengthening psychological preparedness. The element of time pressure in the Time Rushing Game plays an important role in distinguishing this game model from conventional simulations. Time pressure simulates real-life conditions where decisions must be made quickly and accurately.

Bai et al (2024) explained that the elements of urgency in disaster simulations improved participants' ability to manage cognitive stress and maintain focus on safety priorities. Time pressure also trains participants to make decisions based on trained intuition, which is an important skill in the disaster response phase. However, there are several limitations. Many of the studies underlying these findings still use quasi-experimental designs and do not conduct long-term measurements, so the effects of knowledge and skill retention have not been fully measured. Wang et al (2024) highlight that the heterogeneity in serious game design makes generalizing results a challenge in itself. In addition, national research is still limited to small samples and basic education contexts, so more comprehensive studies need to be conducted on populations of students, health workers, volunteers, and the general public. Overall, the results of this study reinforce the evidence that Time Rushing Game is an effective and relevant pedagogical innovation for improving community capacity in disaster management. By combining elements of simulation, time pressure, interactivity, direct feedback, and repetitive practice, this game is able to strengthen the cognitive, skill, and psychological aspects necessary for emergency response. Further development and large-scale effectiveness testing are needed to ensure its long-term benefits and its ability to be widely used in disaster education, especially in Indonesia.

This study has several limitations. The absence of a control group makes it difficult to attribute improvements solely to the *Time Rushing Game*, as other factors, such as prior learning or testing effects, may influence the results. The single-group pretest–posttest design may also introduce bias, particularly the retest effect, which can affect internal validity. Additionally, the study did not assess long-term outcomes, so the sustainability of improvements remains unclear. Future studies should include a control group and long-term evaluation to strengthen the findings.

## CONCLUSION

This study demonstrates that the Time Rushing Game is effective in enhancing knowledge, skills, and self-efficacy through interactive, realistic, and practice-based learning. This method also trains participants in rapid decision-making and reinforces knowledge

retention through hands-on experience and feedback. This study offers an innovative time-pressured, game-based simulation that integrates triage, evacuation, and initial assessment within a single scenario. This approach is more holistic than conventional simulations and is capable of evaluating cognitive, practical, and psychological aspects through a pre-test–post-test design. This method is particularly relevant to Indonesia’s disaster-prone conditions and can be used to improve the preparedness of various groups, such as students, healthcare workers, volunteers, and the general public. Further research is needed, employing a more robust design and long-term evaluation. This method also has the potential to be scaled up and integrated into national disaster management training or curricula.

## REFERENCES

- Abualenain, J., Alhajaji, R., & Alsulimani, L. K. (2024). A systematic review of the efficacy of full-scale simulation exercises in enhancing hospital disaster preparedness. *The Journal of Medicine, Law & Public Health*, 4(3), 419–446. <https://doi.org/https://doi.org/10.52609/jmlph.v4i3.133>
- Ariyaningsih, Sukmara, R. B., Fauzi, A., Wijaya, N., Latief, K., Wu, R.-S., & Shaw, R. (2025). Disaster risk reduction in Indonesia: 20 years after the Aceh tsunami. In *Two decades from the Indian Ocean Tsunami: Key challenges and advancements* (pp. 241–270). Springer. [https://doi.org/https://doi.org/10.1007/978-981-96-2669-4\\_15](https://doi.org/https://doi.org/10.1007/978-981-96-2669-4_15)
- Badan Nasional Penanggulangan Bencana. (2026). *Data Bencana di Kalimantan Barat Tahun 2025*.
- Bai, S., Zeng, H., Zhong, Q., Shen, Y., Cao, L., & He, M. (2024). Application of Gamification Teaching in Disaster Education: Scoping Review. *JMIR Serious Games*, 12, e64939. <https://doi.org/https://doi.org/10.2196/64939>
- Chang, C.-Y., Jen, H.-J., & Yang, J. C. (2024). Integrating scenario game-based learning with the experiential learning strategy to facilitate nursing students’ learning performance and core competencies in labor support training. *Interactive Learning Environments*, 32(10), 7170–7185. <https://doi.org/https://doi.org/10.1080/10494820.2024.2308092>
- Choi, E.-J., & Choi, Y.-J. (2024). Development and effect of an interactive simulated education program for psychological first aid: A randomized controlled trial. *Journal of Nursing Management*, 2024(1), 8806047. <https://doi.org/https://doi.org/10.1155/2024/8806047>
- Choi, Y.-J., & Song, H. (2024). Effectiveness of a fire disaster PFA simulation game: a single-blinded trial. *Disaster Medicine and Public Health Preparedness*, 18, e64. <https://doi.org/https://doi.org/10.1017/dmp.2024.47>
- Delforge, D., Wathélet, V., Below, R., Sofia, C. L., Tonnelier, M., van Loenhout, J. A. F., & Speybroeck, N. (2025). EM-DAT: the emergency events database. *International Journal of Disaster Risk Reduction*, 105509. <https://doi.org/https://doi.org/10.21203/rs.3.rs-3807553/v1>
- Dumblekar, V., & Dhar, U. (2021). Perceived self-efficacy of students in a business simulation game. *Irish Journal of Management*, 40(1), 61–73. <https://doi.org/https://doi.org/10.2478/ijm-2021-0004>
- Emaliyawati, E., Ibrahim, K., Trisyani, Y., Nuraeni, A., Sugiharto, F., Miladi, Q. N., Abdillah, H., Christina, M., Setiawan, D. R., & Sutini, T. (2025). Enhancing disaster preparedness through tabletop disaster exercises: a scoping review of benefits for health workers and students. *Advances in Medical Education and Practice*, 1–11.

- <https://doi.org/https://doi.org/10.2147/AMEP.S504705>
- Gooding, K., Bertone, M. P., Loffreda, G., & Witter, S. (2022). How can we strengthen partnership and coordination for health system emergency preparedness and response? Findings from a synthesis of experience across countries facing shocks. *BMC Health Services Research*, 22(1), 1441. <https://doi.org/https://doi.org/10.1186/s12913-022-08859-6>
- Guo, L., Fang, M., Liu, L., Chong, H., Zeng, W., & Hu, X. (2025). The development of disaster preparedness education for public: a scoping review. *BMC Public Health*, 25(1), 1–14. <https://doi.org/https://doi.org/10.1186/s12889-025-21664-0>
- Hendrawan, V. S. A., Rahardjo, A. P., Mawandha, H. G., Aldrian, E., Muhari, A., & Komori, D. (2025). Past and future climate-related hazards in Indonesia. *EGUsphere*, 2025, 1–34. <https://doi.org/https://doi.org/10.5194/egusphere-2025-584>
- Hidayat, U. R., Alfikrie, F., Hatmalyakin, D., Arisandi, D., Akbar, A., Nurpratiwi, N., Amaludin, M., Iswara, R., Safitri, D., & Anjarwadi, I. A. (2024). Efektifitas Game Online “Camat (Cepat Tepat Selamat)” tentang Bantuan Hidup Dasar Oleh Penolong Awam dengan Konsep Selamat Terhadap Pengetahuan Masyarakat Kota Pontianak. *MAHESA: Malahayati Health Student Journal*, 4(9), 3648–3658. <https://doi.org/https://doi.org/10.33024/jkpm.v8i3.18020>
- Idrus, I. A., Kamal, K., & Syah, S. (2025). Challenges and Development of Disaster Mitigation Policies in North Luwu Regency: Strengthening Post-Disaster Resilience. *International Journal of Safety & Security Engineering*, 15(3). <https://doi.org/https://doi.org/10.18280/ijssse.150308>
- Mahdi, S. S., Jafri, H. A., Allana, R., Battineni, G., Khawaja, M., Sakina, S., Agha, D., Rehman, K., & Amenta, F. (2023). Systematic review on the current state of disaster preparation Simulation Exercises (SimEx). *BMC Emergency Medicine*, 23(1), 52. <https://doi.org/https://doi.org/10.1186/s12873-023-00824-8>
- Mao, W., Cui, Y., Chiu, M. M., & Lei, H. (2022). Effects of game-based learning on students’ critical thinking: A meta-analysis. *Journal of Educational Computing Research*, 59(8), 1682–1708.
- Mirza, M., Lukosch, S., & Lukosch, H. (2024). Exploring the effects of time pressure and distracting elements in an Augmented Reality game for emergency preparedness. *International Journal of Disaster Risk Reduction*, 114, 104900. <https://doi.org/https://doi.org/10.1016/j.ijdr.2024.104900>
- Mızrak, S., & Aslan, R. (2024). Experiences of First Responders in Enhancing Disaster Education Capacity. In *Disaster and Climate Risk Education: Insights from Knowledge to Action* (pp. 325–341). Springer. [https://doi.org/https://doi.org/10.1007/978-981-97-5987-3\\_18](https://doi.org/https://doi.org/10.1007/978-981-97-5987-3_18)
- Nasution, R. F., Lestari, E. B., & Usiono, U. (2025). Peran Pendidikan Kesiapsiagaan Bencana dalam Meningkatkan Kesadaran pada Remaja. *Jurnal Bintang Pendidikan Indonesia*, 3(1), 119–128. <https://doi.org/https://doi.org/10.55606/jubpi.v3i1.3491>
- Pamula, J. P., Adhi, M. H. P., Ramdani, M. L., & Angelia, N. (2025). The Effect Simba Puzzle on Student’s Self Efficacy Level in Flood Disaster Preparedness. *HealthCare Nursing Journal*, 7(1), 15–20. <https://doi.org/https://doi.org/10.35568/healthcare.v7i1.5629>
- Pek, J. H., Quah, L. J. J., Valente, M., Ragazzoni, L., & Della Corte, F. (2023). Use of simulation in full-scale exercises for response to disasters and mass-casualty incidents: a scoping review. *Prehospital and Disaster Medicine*, 38(6), 792–806. <https://doi.org/https://doi.org/10.1017/s1049023x2300660x>
- Righi, E., Lauriola, P., Ghinoi, A., Giovannetti, E., & Soldati, M. (2021). Disaster risk reduction and interdisciplinary education and training. *Progress in Disaster Science*, 10, 100165. <https://doi.org/https://doi.org/10.1016/j.pdisas.2021.100165>

- Rotzoll, D., Pott, C., Stöhr, R., Hartwig, T., & Gries, A. (2025). Triaging in Mass Casualty Incidents: A Simulation-Based Scenario Training for Emergency Care Senior Residents. *The Clinical Teacher*, 22(3), e70083. <https://doi.org/https://doi.org/10.1111/tct.70083>
- Smith, K., Fearnley, C. J., Dixon, D., Bird, D. K., & Kelman, I. (2023). *Environmental hazards: assessing risk and reducing disaster*. Routledge. <https://doi.org/https://doi.org/10.4324/9781351261647>
- Spiridonov, V., Ćurić, M., & Novkovski, N. (2025). Exploring natural hazards: From earthquakes, floods, and beyond. In *Atmospheric Perspectives: Unveiling Earth's Environmental Challenges* (pp. 271–306). Springer. [https://doi.org/https://doi.org/10.1007/978-3-031-86757-6\\_11](https://doi.org/https://doi.org/10.1007/978-3-031-86757-6_11)
- Taheri, E., Wang, C., & Zahmat Doost, E. (2023). Emergency decision-making under an uncertain time limit. *International Journal of Disaster Risk Reduction*, 95, 103832. <https://doi.org/https://doi.org/10.1016/j.ijdr.2023.103832>
- Tay, B., Turan, A., Altuncı, Y. A., Şahin, H., & Postacı, E. S. (2025). Comparison of Three Methods for START Triage Training in Paramedic Students: Traditional, Role-Play, and Web-Based Games. *Tip Eğitimi Dünyası*, 24(74), 98–107. <https://doi.org/Doi: 10.25282/ted.1695478>
- United Nations Office for Disaster Risk Reduction. (2025). *Global Assessment Report on Disaster Risk Reduction 2025: Resilience Pays: Financing and Investing for Our Future*. Stylus Publishing, LLC.
- Vage, A., Spence, A. D., McKeown, G., Gormley, G. J., & Hamilton, P. K. (2024). Simulate to stimulate? A systematic review of stress, learning, and performance in healthcare simulation. *The Ulster Medical Journal*, 93(3), 119.
- Wang, L., Zhao, Q., Dong, L., Zhao, H., Qin, L., Deng, T., Huang, H., Li, M., Wu, X., & Liu, J. (2024). The effectiveness of serious games on undergraduate nursing students' knowledge and skills: A systematic review and meta-analysis. *Nurse Education in Practice*, 80, 104102. <https://doi.org/https://doi.org/10.1016/j.nepr.2024.104102>