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Analytical Study: The Effectiveness of Emergency Response Training in Enhancing Community Competence Along Tuban's North Coast Route

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ABSTRACT

Background : Traffic accidents along the North Coast Route (Pantura) in Tuban, East Java, remain a major public health concern, often leading to severe injuries and fatalities due to delays in early emergency response at the scene. Limited community capacity in providing first aid highlights the urgent need for effective training interventions. This study aimed to evaluate the effectiveness of simulation-based emergency response training in improving knowledge, attitudes, and practical skills among adolescents living in high-risk areas. **Methods :** A quantitative quasi-experimental study with a one-group pretest–posttest design was conducted among 155 adolescents aged 15–18 years selected using cluster random sampling across five high-risk areas. The intervention consisted of four training sessions delivered within one week, combining lectures, demonstrations, and scenario-based simulations covering CPR, bleeding control, and victim evacuation. Data were collected using validated questionnaires and observation checklists before and after the intervention. Statistical analysis was performed using paired-sample t-test with a significance level of $p < 0.05$. **Results:** Knowledge scores increased from 56.3 to 82.7, attitude scores from 60.1 to 84.2, and practical skills scores from 48.5 to 79.9, all showing statistically significant improvements ($p < 0.001$). **Conclusions:** Simulation-based emergency training significantly improves community capacity in emergency response, particularly in practical skills. This approach is recommended as a scalable strategy to strengthen early emergency management in accident-prone areas and reduce preventable morbidity and mortality.

Keyword: Community Competence; Emergency response training; First aid; Traffic accidents; Simulation-Based Training.

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INTRODUCTION:

The North Coast Route (Pantura) is one of the main transportation corridors in Indonesia, including in the Tuban region, characterized by high traffic density dominated by heavy vehicles, public transportation, and private cars (Husaini & Junoasmono, 2017; Rosyida, 2015). High traffic density combined with a lack of road safety awareness often leads to traffic accidents. These accidents not only result in material losses but also cause minor injuries, severe injuries, permanent disabilities, and even death. Many victims die or suffer severe injuries due to delays in providing first aid before medical personnel arrive. The community's limited ability to

manage emergency situations is a major factor that worsens victims' conditions, particularly in areas far from healthcare facilities (Asdiwinata et al., 2019; Faqih & Ferianto, 2021; Mubalus, 2023).

According to data from the Indonesian National Police in 2024, traffic accidents in Indonesia reached more than one million cases annually, with fatalities exceeding 27,000 deaths. This means that every hour, approximately 3–4 people die as a result of traffic accidents. These data indicate that traffic accidents remain a serious threat to public safety. Compared to previous years, the number of fatalities due to traffic accidents in Indonesia has remained consistently high: 25,671 deaths in 2019, 23,529 in 2020, and 25,266 in 2021 (Badan Pusat Statistik, 2024).

The lack of public knowledge and skills in providing first aid has a significant impact on the survival of accident victims (Faqih & Ferianto, 2021; Karyo et al., 2023). A preliminary survey conducted using a structured questionnaire among community members at several points along the Pantura Route in Tuban (n = 30) revealed that 78% of respondents did not know basic first aid procedures, such as cardiopulmonary resuscitation (CPR), bleeding control techniques, and safe evacuation procedures. In addition, 65% of them expressed willingness to receive emergency response training if given the opportunity. This highlights an urgent need to improve community preparedness in dealing with roadside emergencies.

Several studies in various countries have shown that rapid and appropriate early intervention can substantially increase the survival rate of traffic accident victims. In Indonesia, community-based emergency response training has been shown to reduce mortality rates from traffic accidents (Ayu et al., 2025; Fauzi et al., 2024). However, to date, few training programs have been systematically implemented and rigorously evaluated in high-risk areas such as the Pantura Route in Tuban. Moreover, limited studies have specifically examined the effectiveness of simulation-based training approaches targeting adolescents as potential first responders in these settings. This gap underscores the need for empirical evidence on context-specific and practice-based emergency training interventions.

Furthermore, the Pantura Route in Tuban is a strategic corridor with high economic activity, involving thousands of daily road users, including truck, bus, and private car drivers. The high level of mobility further increases the risk of accidents. Local communities—including street vendors, motorcycle taxi drivers, and nearby residents—are often the first witnesses to traffic accidents. Without adequate skills, they can only serve as passive bystanders or may provide inappropriate aid that could potentially worsen victims' conditions (Rohmani et al., 2022). Therefore, practice-based emergency response training is crucial to equip the community with appropriate skills to handle emergency situations effectively.

The lack of community understanding of emergency response contributes to the high mortality rate. Practice-based training can improve first aid skills by up to 50%, highlighting the need for systematic interventions to enhance community preparedness (Mukarromah et al., 2022; Rohmani et al., 2022).

As first witnesses to accidents, communities along the Pantura Route have great potential to become effective first responders (Luxmono et al., 2023). This study is expected to provide recommendations for the development of more systematic and sustainable emergency response training programs.

This study aims to analyze the effectiveness of emergency response training in improving community capabilities along the Pantura Route in Tuban to reduce traffic accident fatalities. The high accident rates in this area are often exacerbated by delays in providing first aid before medical personnel arrive.

METHODS:

This study employed a quantitative approach using a quasi-experimental design with a one-group pretest–posttest design to evaluate the effectiveness of emergency response training in improving community capabilities along the North Coast Route (Pantura) in Tuban, East Java. The study was conducted over a period of three

months, from June to August 2025, at several strategic locations identified as high-risk traffic accident areas along the Pantura route.

The study population consisted of adolescents aged 15–18 years residing in areas surrounding the North Coast Route in Tuban. The sample size of 155 respondents was determined based on the minimum sample requirement for quasi-experimental studies with paired measurements, considering a confidence level of 95%, statistical power of 80%, and an anticipated moderate effect size. To enhance representativeness, a cluster random sampling technique was employed. The study area was divided into five clusters based on geographical subregions with high accident incidence rates. From each cluster, participants were selected proportionally using a simple random sampling method (lottery technique). Inclusion criteria included adolescents aged 15–18 years, willingness to participate, and ability to follow the full training sessions. Exclusion criteria were prior formal emergency training experience and absence during either pretest or posttest.

The instruments used in this study consisted of three components: (1) a knowledge questionnaire on emergency response, (2) an attitude assessment scale, and (3) a skills observation checklist. The knowledge questionnaire was adapted from the Emergency Response Skill Checklist (ERSC) and consisted of 25 multiple-choice items, with each correct answer scored as 1 and incorrect answers scored as 0, resulting in a total score range of 0–25, which was then converted into a scale of 0–100. The attitude scale included 15 statements measured using a Likert scale (1–5), with total scores ranging from 15 to 75 and subsequently transformed into a 0–100 scale for comparability. Practical skills were assessed using a structured observation checklist covering CPR, bleeding control, and victim evacuation procedures, with a total of 20 items rated on a scale of 0–2 (incorrect, partially correct, correct), yielding a total score range of 0–40, which was also converted into a 0–100 scale. The instruments were adapted from previous validated studies and underwent content validity testing by three emergency care experts, with a Content Validity Index (CVI) of 0.89. The reliability test results showed a Cronbach's alpha coefficient of 0.82 for knowledge, 0.85 for attitude, and 0.88 for skills, indicating good internal consistency.

The research procedure was conducted in three main stages: pretest, intervention (training), and posttest. The training intervention was delivered using a scenario-based simulation method to replicate real-life accident situations. The training was conducted in four sessions, as presented in Table 1.

Table 1. Training Sessions on Emergency Response

Session	Material Description	Duration	Instructor
1	Basic concepts of emergency response	60 min	Emergency nursing lecturer
2	Cardiopulmonary Resuscitation (CPR)	90 min	Certified BLS instructor
3	Bleeding control and wound management	90 min	Certified BLS instructor
4	Victim evacuation and scenario simulation	120 min	Certified BLS instructor

Each session combined lectures, demonstrations, and hands-on practice. The training was delivered by a team of three experts, including one emergency nursing lecturer, and one certified Basic Life Support (BLS) instructor. All participants attended the complete series of sessions within a one-week period.

Data collection was performed in two stages: pretest (before training) and posttest (after completion of all training sessions). Data collection methods included self-administered questionnaires for knowledge and attitudes, as well as direct observation for practical skills using standardized checklists.

Data analysis was conducted using SPSS version 24. Descriptive statistics were used to summarize respondent characteristics and variable distributions. Prior to inferential analysis, data normality was tested using the Shapiro–Wilk test. Since the data were normally distributed ($p > 0.05$), the paired-sample t-test

was applied to compare pretest and posttest scores within the same group. No independent t-test was used in this study, as there was no comparison between different groups. Statistical significance was set at $p < 0.05$. The results were presented in tables and narrative form to support interpretation.

Ethical approval for this study was obtained from the Ethics Committee of the Institut Ilmu Kesehatan Nahdlatul Ulama Tuban (No.125/0084223523/LEPK.IIKNU/VII/2025). All participants provided informed consent prior to data collection.

RESULTS:

Table 2. Distribution of respondent characteristics (N = 155)

Characteristics	Category	n	%
Age (years)	15	18	11,6
	16	40	25,8
	17	42	27,1
	18	55	35,5
Gender	Male	56	36,1
	Female	99	63,9
Educational level	Junior High School	43	27,7
	Senior High School	112	72,3
Previous emergency training experience	Yes	28	18,1
	No	127	81,9

The majority of respondents were late adolescents aged 17–18 years, indicating that the sample was predominantly within a more cognitively mature developmental stage, which may facilitate better comprehension of training materials. The dominance of female participants and senior high school students suggests a relatively homogeneous educational background, potentially contributing to consistent baseline knowledge levels. Notably, most respondents had no prior emergency training experience, indicating that the observed improvements can be more confidently attributed to the intervention rather than prior exposure.

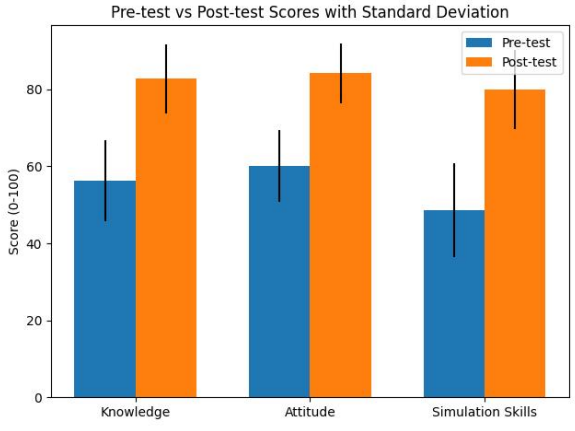

Figure 1. Comparison of Pre-test and Post-test Scores in Knowledge, Attitude, and Simulation Skills

The results showed a substantial improvement across all domains following the training. The knowledge score increased from 56.3 in the pretest to 82.7 in the posttest, indicating enhanced cognitive competence in recognizing emergency situations and appropriate first aid procedures. Similarly, the attitude score rose from 60.1 to 84.2, reflecting a positive shift in participants' readiness, confidence, and willingness to respond to emergencies. The most pronounced improvement was observed in simulation skills, which increased from 48.5 to 79.9, demonstrating the effectiveness of scenario-based simulation in developing practical competencies such as CPR, bleeding control, and victim evacuation. Overall, the greater magnitude of improvement in practical skills highlights the critical role of hands-on training inbridging the gap between theoretical knowledge and real-world application.

Table 3. Comparison of pre-test and post-test scores (N = 155)

	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	Δ Mean	t-value	p-value
Knowledge (0-100)	56,3 ± 10,5	82,7 ± 8,9	+26,4	28,76	<0,001 *
Attitude (0-100)	60,1 ± 9,4	84,2 ± 7,8	+24,1	27,15	<0,001 *
Simulation skills (0-100)	48,5 ± 12,2	79,9 ± 10,3	+31,4	30,42	<0,001 *

*Notes: Paired-sample t-test was used; *p < 0.05 indicates statistical significance.*

The results in Table 3 indicate a

statistically significant improvement across all measured domains following the intervention. Knowledge scores increased substantially from 56.3 ± 10.5 to 82.7 ± 8.9 (Δ = +26.4; $p < 0.001$), while attitude scores improved from 60.1 ± 9.4 to 84.2 ± 7.8 (Δ = +24.1; $p < 0.001$). The largest gain was observed in simulation skills, which increased from 48.5 ± 12.2 to 79.9 ± 10.3 (Δ = +31.4; $p < 0.001$).

These findings suggest that the simulation-based emergency response training was highly effective, particularly in enhancing practical competencies through experiential learning. Although improvements were observed in knowledge and attitudes, the greater magnitude of change in skills highlights the critical role of hands-on training in bridging the gap between theoretical understanding and real-world application. The consistently high t-values further confirm that the observed differences were not only statistically significant but also practically meaningful.

DISCUSSION:

The simulation-based emergency response training conducted along the Pantura Route in Tuban was proven to have a significant impact on improving community capabilities, particularly among the adolescent age group. These findings suggest that practice-based training effectively bridges the gap between theoretical knowledge and real-world readiness, especially in areas with limited access to healthcare services (Faqih, Karyo, & Purnamasari, 2026; Faqih & Ferianto, 2021; Luxmono et al., 2023). The observed improvements are likely driven by the integration of cognitive, affective, and psychomotor learning domains within the training design (Faqih et al., 2024; Neyişci, 2024).

The majority of the study respondents were adolescents aged 15–18 years who had never previously attended emergency response training. This condition reflects the lack of initial preparedness among the community living along the Pantura Route. This finding is consistent with previous studies reporting low baseline knowledge of first aid among community members (Asdiwinata et al., 2019; Oktaviani et al., 2020). Such unpreparedness increases the risk of delayed or inappropriate responses to emergencies, reinforcing the relevance of targeted training interventions (Oktaviani et al., 2020; Rohmani et al., 2022).

The training emphasized direct simulation methods of emergency scenarios such as respiratory arrest, massive bleeding, and victim evacuation. This approach aligns with experiential learning theory, which posits that active engagement and repetitive practice enhance skill acquisition more effectively than passive learning (Faqih et al., 2024; Neyişci, 2024). The substantial improvement in practical skills observed in this study may be attributed to immediate feedback, hands-on repetition, and scenario realism, which facilitate skill retention and confidence building.

The improvement observed in this study is consistent with findings by Mukarromah et al., who reported that simulation-based training reduced procedural errors and improved response time (Mukarromah et al., 2022). However, the magnitude of improvement in this study appears higher, which may be influenced by the intensive one-week training structure and the homogeneity of participants. This suggests that training duration and participant characteristics may play a critical role in determining intervention effectiveness.

In addition to knowledge and skills, this study also found an improvement in positive attitudes toward first aid. This is important because attitude functions as a key determinant of behavioral intention in emergency situations. This finding supports previous research indicating that

attitude changes following training are associated with increased readiness to act as first responders (Faqih, Karyo, Sari, et al., 2026; Luxmono et al., 2023). The shift in attitudes may be explained by increased self-efficacy and perceived responsibility after exposure to realistic emergency scenarios.

The post-training improvement in positive attitudes indicates that participants not only gained cognitive understanding but also developed stronger motivation and social awareness. According to behavioral theory, attitude acts as a mediator between knowledge and action; therefore, improvements in this domain are essential to ensure that knowledge is translated into practice (Faqih et al., 2024; Mukarromah et al., 2022).

Interestingly, although respondents with previous training experience had slightly higher post-test skill scores, the difference was not statistically significant. This suggests that the standardized training approach was effective in minimizing baseline disparities. It also indicates that simulation-based training can serve as an equalizing intervention, particularly for participants with no prior exposure (Dewi, 2025; Oktaviani et al., 2020).

These results align with the theory of community preparedness, which emphasizes that training effectiveness depends not only on prior experience but also on delivery quality, practice intensity, and participant engagement (Dewi, 2025; Oktaviani et al., 2020). The combination of simulation, discussion, and feedback likely contributed to deeper learning and internalization of first responder roles (Ayu et al., 2025; Mukarromah et al., 2022).

From a demographic perspective, differences in abilities based on gender were not significant, indicating that both males and females have equal capacity to acquire first aid skills. This finding supports inclusive training approaches and suggests that gender is not a limiting factor in emergency preparedness (Ayu et al., 2025; Faqih & Ferianto, 2021; Karyo et al., 2023).

The study's findings also suggest a positive relationship between knowledge acquisition and skill performance. This relationship indicates that theoretical understanding provides a necessary foundation for effective skill execution during simulations (Faqih et al., 2024; Karyo et al., 2023). However, the stronger improvement in skills compared to knowledge highlights the added value of experiential learning in translating knowledge into action.

From a public health perspective, enhancing the capabilities of adolescents in the Tuban Pantura Route area has significant implications for reducing preventable mortality and disability. Delays in first aid are a major contributor to traffic-related deaths, particularly in middle-income countries (Faqih et al., 2024; WHO, 2023). The findings of this study indicate that community-based training can serve as an effective strategy to mitigate these risks (Asdiwinata et al., 2019; Rohmani et al., 2022).

Beyond direct benefits to participants, the training may also generate a multiplier effect through peer-to-peer knowledge transfer. Adolescents who receive training are likely to disseminate information within their social networks, thereby expanding the impact of the intervention and fostering a culture of preparedness (Ayu et al., 2025; Rosyida, 2015).

The findings of this study are consistent with the concept of community-based health development, which positions local residents as first responders prior to the arrival of professional medical services. Integrating such training into regional policies could contribute to reducing traffic-related mortality rates in high-risk areas (Asdiwinata et al., 2019; Rohmani et al., 2022; Rosyida, 2015).

Overall, this study provides strong evidence that simulation-based emergency

response training effectively enhances the cognitive, affective, and psychomotor competencies of adolescents in high-risk areas such as the Tuban Pantura Route. The substantial improvements observed across knowledge, attitudes, and especially practical skills highlight the critical role of experiential learning in preparing community members as first responders. From a public health perspective, this approach offers a scalable and contextually relevant strategy to reduce preventable morbidity and mortality associated with delayed emergency response. With appropriate policy integration and sustained implementation, such programs have significant potential to strengthen community resilience and emergency preparedness systems.

Although the study showed positive results, it has limitations, including the limited coverage area confined to the Tuban Pantura Route and the use of a one-group pre-posttest design without a control group. These limitations may introduce threats to internal validity, such as maturation effects, testing effects, and potential external influences during the intervention period, meaning that the observed improvements cannot be attributed solely to the training intervention. In addition, the absence of a control group limits the ability to establish causal relationships with greater certainty. The relatively short duration of follow-up also restricts the assessment of long-term retention of knowledge, attitudes, and skills.

Furthermore, the use of self-reported questionnaires for knowledge and attitudes may introduce response bias, while observational assessment of skills may be subject to observer bias despite the use of standardized checklists. The homogeneity of the sample, which consisted only of adolescents aged 15–18 years, may also limit the generalizability of the findings to other age groups or community populations. These limitations should be considered when interpreting the results, and future studies are recommended to incorporate control groups, larger and more diverse populations, and longer follow-up periods to strengthen the robustness and external validity of the findings.

CONCLUSIONS:

Simulation-based emergency response training was proven effective in improving participants' ability to provide first aid to road traffic accident victims, as reflected by significant increases in knowledge, attitudes, and practical skills following the intervention. These findings confirm that training approaches integrating interactive lectures, demonstrations, and scenario-based simulations are highly effective in facilitating both cognitive and psychomotor learning. The greatest improvement observed in practical skills underscores the critical role of hands-on, experiential learning in enhancing rapid and accurate emergency responses.

From a practical and policy perspective, this study highlights the importance of integrating simulation-based first aid training into community health programs, particularly in high-risk areas such as the Tuban North Coast Route. Policymakers and health authorities are encouraged to incorporate such training into school-based programs, community preparedness initiatives, and local disaster risk reduction strategies to strengthen early response capacity and reduce preventable mortality and disability due to traffic accidents.

Future research is recommended to employ more robust study designs, such as randomized controlled trials or quasi-experimental approaches with control groups, to strengthen causal inference. Additionally, studies with longer follow-up periods are needed to assess the sustainability of training outcomes, as well as broader and more diverse populations to

enhance generalizability. Exploring the integration of digital simulation or blended learning approaches may also provide further insight into scalable and cost-effective training models.

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