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Community-Based Health Education to Improve Mountaineers' Knowledge and Attitudes Toward Mountain-Related Health Emergencies

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ABSTRACT

Background: *Mountain climbers are at risk of altitude-related medical problems such as hypothermia, acute mountain sickness (AMS), and traumatic injuries. Adequate knowledge and attitudes are essential to improve preparedness among outdoor enthusiast communities. This community service activity aimed to improve mountaineers' knowledge and attitudes regarding the prevention, early recognition, and basic management of mountain-related health emergencies through a structured health education program in Malang City.*

Methods: *This community service activity was conducted on August 30, 2025, in Malang City in collaboration with the Tiket Pendakian community. A total of 45 participants took part in health education sessions, interactive discussions, and field simulations on mountain-related health risks and emergency preparedness. Evaluation was carried out through pre- and post-activity assessments of participants' knowledge and attitudes, as well as feedback on the implementation and benefits of the program.*

Results: *The mean knowledge score significantly increased from 81.9 to 91.6 (+9.6 points; p=0.001; Cohen's d=0.52), indicating a moderate effect size. The mean attitude score was 34.2 (SD ±3.0) out of a maximum of 40, reflecting a generally positive attitude towards prevention and first aid in outdoor settings.*

Conclusion: *The integrated educational program effectively improved participants' knowledge of altitude-related hazards and reinforced positive attitudes towards preparedness. Similar interventions could be replicated in other outdoor enthusiast communities to strengthen resilience and self-reliance among climbers.*

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INTRODUCTION

Mountaineering activities are becoming increasingly popular in Indonesia; however, they bring specific medical risks associated with high-altitude environments—hypoxia, cold exposure, UV radiation, and dehydration—which may result in acute mountain sickness (AMS), high-altitude cerebral edema (HACE), high-altitude

pulmonary edema (HAPE), hypothermia, and heat-related illness (HRI) during the dry season (1–4). Management of severe cases remains focused on "descent" with supplemental oxygen and, if necessary, portable hyperbaric chambers, but recent clinical guidelines emphasize prevention through acclimatization, controlled ascent rate, hydration, and prophylactic medications when indicated (1–5). Conversely, outdoor activities in cold and extreme weather increase the risk of hypothermia and the "trauma triad" (hypothermia, acidosis, and coagulopathy) (6–8). Therefore, rapid and organized prehospital management—including prevention of afterdrop, gradual rewarming, and appropriate referral—is crucial.

More frequent and intense heat waves have altered the risk profile in the field. According to international sports consensus and reports from urban emergency responses, early recognition, prompt diagnosis, and rapid on-site cooling are the key determinants of outcome in exertional heat stroke (9–13). At the same time, evidence from wilderness and community first responder education demonstrates improved knowledge, preparedness, and skill retention, while sustaining essential competencies (14–17).

Malang and its surrounding areas host active mountaineering communities with limited access to healthcare services along mountain trails. Practical knowledge gaps remain regarding issues such as when to stop climbing, principles of spinal immobilization, and proper communication and evacuation procedures—frequently observed among climbers in diverse environments (16–19). Furthermore, mountain emergency data highlights the need for integrating education, simulation, and communication planning into community programs, given that hypothermia and environmental injuries contribute significantly to morbidity and mortality (18,20).

Although clinical guidelines and wilderness medicine recommendations are widely available, the application of this knowledge at the mountaineering community level remains limited, especially among non-medical groups. Community-based health education programs are a strategic approach to bridge this gap by raising risk awareness, strengthening first aid capacity, and building collective preparedness and emergency response in environments with limited access to health services. Through a combination of structured education, interactive discussions, and field simulations, these activities are expected to encourage safer decision-making during climbs and reduce preventable morbidity and mortality in mountainous areas (18,20).

In this context, this program aims to enhance the understanding of climbing community members regarding altitude-related hazards, first aid for trauma, and survival techniques through integrated education, interactive discussions, and field simulations. A pre–post evaluation was conducted to assess the impact on both cognitive knowledge and attitudes (1–5,9–13,16–18,20).

METHODS

This community service activity was conducted on August 30, 2025, in collaboration with the Tiket Pendakian community located in Malang City, Indonesia. The partner community consists of active mountain climbers and outdoor enthusiasts. A total of 45 participants were involved in the activity, including students, employees, and members of outdoor communities. The community service activity was carried out in several stages. Prior to the activity, coordination with community partners was conducted, educational materials were prepared, and evaluation instruments were developed.

Preparation Stage

Prior to the implementation of the activity, the community service team coordinated with the mountaineering community partners to agree on the objectives, targets, and timing of the program. During the preparation stage, the team compiled and prepared health education materials tailored to the characteristics of the participants and the conditions of the climbing site. In addition, evaluation instruments in the form of knowledge and attitude questionnaires were developed to measure changes before and after the intervention. All preparations were carried out systematically to ensure that the community service activities could run effectively, in a structured manner, and in accordance with the needs of the partners.

Implementation Stage

The implementation method consisted of health education and counseling, training and socialization, as well as workshops and practical field simulations. The educational materials focused on mountain-related health risks, including altitude-related hazards, hypothermia, AMS, trauma first aid, and basic survival techniques for mountaineers. The activities were delivered by lecturers and facilitators using interactive approaches to encourage active participation and knowledge exchange. Participants also completed an initial assessment to evaluate baseline knowledge and attitudes related to mountain health and safety. During the main activity, health education sessions, interactive discussions, and practical simulations were conducted in an integrated manner to enhance participants' understanding and skills in managing mountain-related emergencies.

Monitoring and Evaluation Stage

Monitoring and evaluation were conducted both during and after the activity. Monitoring during the activity was performed through direct observation of participant engagement and interaction throughout discussions and simulations. Post-activity evaluation was carried out using questionnaires to assess changes in participants' knowledge and attitudes, as well as their satisfaction with the implementation of activities, facilitators, methods, and the overall benefits of the program.

Knowledge evaluation consisted of 15 true or false or "don't know" questions covering altitude hazards, trauma first aid, and survival techniques, while attitudes were assessed using Likert-scale statements related to mountain safety and preparedness. All participant data were anonymized, and with the approval of the community partner, this activity was conducted as part of the community service program of the Faculty of Medicine, Brawijaya University.

Table 1. Operationalization of Research Instruments

Domain Measured	Type of Statement/Item	Scale & Scoring	Purpose of Measurement	Output Analysis
Knowledge of altitude hazards, trauma first aid, and survival techniques	15 questions with True/False/Don't Know answers	True = 1, False/Don't Know = 0; total score converted to 0–100	To measure improvement in participants' knowledge before and after the intervention	Mean pre–post scores, paired t-test, Wilcoxon, Cohen's d

Domain Measured	Type of Statement/Item	Scale & Scoring	Purpose of Measurement	Output Analysis
Attitudes toward altitude hazards, trauma first aid, and survival	5 Likert-scale statements	Likert scale 1–3 (1 = Disagree, 2 = Somewhat Disagree, 3 = Agree)	To assess changes in participants' attitudes pre– and post-intervention	Total mean score (5–15), paired t-test, Wilcoxon
Participants' evaluation of the program	8 statements regarding materials, methods, facilitators, and benefits	Likert scale 1–4 (1 = Strongly Disagree, 4 = Strongly Agree)	To measure participant satisfaction and perception of the program implementation	Mean per item, total mean score (8–32), descriptive distribution

RESULTS

The community service activity was attended by 45 members of the Tiket Pendakian community in Malang City, who participated fully in all stages of the program. During the preparation stage, participant characteristics were identified to ensure the suitability of educational materials. The majority of participants were male (62.2%), with ages ranging from 17 to 45 years. Most participants had a high school educational background and represented diverse occupations, including students, employees, and active mountain climbers (Table 1).

Table 2. Characteristics of Community Service Participants (n = 45)

Characteristic	Category	n	%
Gender	Male	28	62.2
	Female	17	37.8
Age (years)	17–45	45	100
Educational level	Senior high school or equivalent	45	100
Occupation	Students, employees, active mountaineers	45	100
Participation	Completed all program stages	45	100

During the implementation stage, participants actively engaged in health education sessions, interactive discussions, and field simulations related to altitude-related health risks, trauma first aid, and basic survival techniques. Knowledge evaluation conducted before and after the activity showed an improvement in participants' understanding of mountain-related health issues. The mean knowledge score increased from 81.9 before the activity to 91.6 after the activity, indicating a meaningful improvement following the educational intervention.

Evaluation of participants' attitudes toward mountain safety and preparedness revealed a slight increase in mean scores after the activity, from 14.64 to 14.84. Although this change was not statistically significant, participants maintained a positive attitude toward the importance of health preparedness during mountain activities, reflecting a consistently favorable perception throughout the program.



Figure 1. (a) Health education session, (b) Simulation

Program evaluation was carried out after the completion of all activities to assess participant satisfaction and perceived benefits. The results demonstrated high levels of satisfaction, with a mean total score of 26.3 out of a maximum score of 32. Participants particularly valued the practical field simulations, which received the highest evaluation score, indicating strong appreciation for hands-on learning methods. The lowest evaluation score, which remained within a favorable range, was related to the duration of training, suggesting that participants perceived the activity time as adequate but potentially improving.

Table 2. Changes in Knowledge, Attitude, and Program Evaluation Scores Before and After the Community-Based Education Program (n = 45)

Domain	Pre-test Mean	Post-test Mean	Mean Difference (Δ)	p-value	Cohen's d
Knowledge	81.9	91.6	+9.6	0.001	0.52
Attitude	14.6	14.8	+0.2	0.476	0.11
Evaluation*	–	–	26.3 ± 2.9	–	–

Overall, the results of this community service activity demonstrate that the program was well implemented from preparation to evaluation stages. The intervention successfully improved participants' knowledge of mountain-related health risks, maintained positive attitudes toward safety and preparedness, and was positively received by participants, particularly due to the inclusion of practical simulation activities.

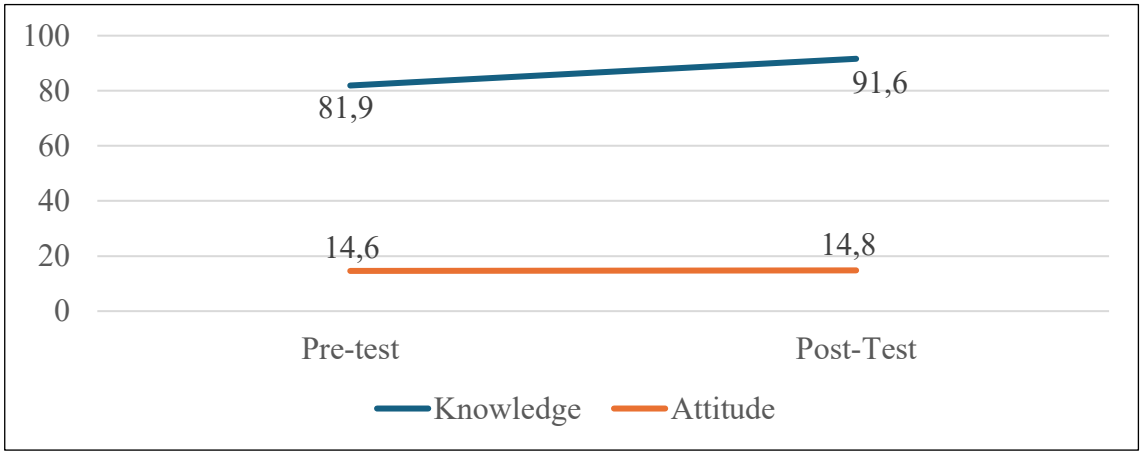


Figure 1. Comparison of Knowledge and Attitude Scores Before and After the Community-Based Education Program

DISCUSSION

The results of this activity demonstrate that members of the Tiket Pendakian community gained significant knowledge after receiving an integrated educational intervention. With a moderate effect size, the mean knowledge score increased from 81.9 to 91.6. Previous studies have shown that short community-based interventions can effectively enhance basic health knowledge in extreme environments (1–4). This finding is consistent with those results.

In contrast, changes in attitudes did not show statistical significance, although there was a small increase of +0.20 points. This may be explained by the fact that attitudes are generally more stable than knowledge. For values to be internalized, changes in attitudes require more intensive, repeated, and sustained interventions (5–7). Therefore, actual attitudes and behaviors may be better shaped through follow-up activities such as training of trainers (ToT), repeated field practice, and incorporation of materials into the community's routine activities.

Participants provided very positive evaluations of the program, with mean scores exceeding 3 on every aspect measured on a 1–4 Likert scale. The simulation item received the highest score, suggesting that hands-on practice was valued more highly than lectures alone. This finding supports previous research indicating that field simulation is an effective learning approach in emergency education (8–10).

In addition to measurable knowledge improvement, this educational activity has important implications for increasing the preparedness of the mountaineering community in dealing with health emergencies in mountainous environments. Better knowledge of the warning signs of altitude sickness, hypothermia, and injuries enables participants to make safer decisions, such as stopping the climb, evacuating early, or providing appropriate first aid (5–7).

This impact has the potential to reduce the risk of delays in handling emergencies, which often occur on climbing routes with limited access to health services. From a community capacity building perspective, this activity also contributes to enhancing the role of climbers as first responders in their respective environments. Hikers who have basic emergency knowledge and skills can be a source of information and initial assistance for other group members before professional help arrives. This is in line with the principle of community service that emphasizes community empowerment to be able to manage risks independently and sustainably, especially in high-risk activities such as mountain climbing (1–4).

Another equally important implication is the formation of a community-based health education model that can be replicated in other climbing areas. The integration of educational materials, interactive discussions, and field simulations has been proven to increase participant engagement and can be an effective approach in similar programs. With the support of cross-sector collaboration, such as SAR organizations, PSC 119 services, and hiking trail managers, this program has the potential to develop into a sustainable preventive education system. In the long term, this approach is expected to contribute to improving hiking safety and reducing the number of preventable emergencies in mountainous environments (5–7).

Furthermore, this activity helped establish a strong relationship between the implementing team and the community. Such collaboration may facilitate the development of sustainable programs, including regular simulation sessions, partnerships with SAR organizations or PSC 119, and the use of self-learning educational modules.

Despite these positive outcomes, several limitations should be acknowledged. The absence of a comparison group limits the ability to attribute all observed improvements solely to the intervention, as external factors may have influenced the results. Furthermore, the use of self-reported Likert-scale instruments to assess attitudes may not fully reflect actual behavior during real mountain activities. The short duration of the program and the lack of long-term follow-up also restrict conclusions regarding the sustainability of knowledge retention and behavioral change. Future community service activities are therefore recommended to include longitudinal evaluations, observational assessments during field activities, and broader participant involvement to enhance the impact and sustainability of mountain health education programs.

CONCLUSIONS AND SUGGESTIONS

This community service activity shows that community-based health education that combines material delivery, discussion, and field simulations can improve climbers' understanding of health risks and emergency response in mountainous environments. This activity also encourages preparedness, risk awareness, and active participation of participants in emergency prevention and initial response efforts. To bring about more sustainable changes in attitudes and behavior, similar activities need to be carried out repeatedly through tiered training, routine simulations, and the integration of educational materials into mountaineering community activities. Expanding the scope of activities to other mountaineering communities, using more comprehensive evaluation tools, and strengthening collaboration with SAR organizations, PSC 119, and local health agencies are recommended to build a sustainable community preparedness system and improve mountaineering safety in mountainous areas.

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CONFLICT OF INTERESTS

The author declares that there is no conflict of interest regarding the results of this community service activity.

DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

AI tools were used solely for grammar and language editing. The authors take full responsibility for the content and integrity of the manuscript.

REFERENCE

1. Luks AM, Beidleman BA, Freer L, Grissom CK, Keyes LE, McIntosh SE, et al. Wilderness Medical Society Clinical Practice Guidelines for the Prevention, Diagnosis, and Treatment of Acute Altitude Illness: 2024 Update. Wilderness

Environ Med. 2024 Mar 1;35(1_suppl):2S-19S. https://doi.org/10.1016/j.wem.2023.05.013 PMID: 37833187

2. Luks AM, Auerbach PS, Freer; Luanne, Grissom CK, Keyes LE, Scott; et al. Wilderness Medical Society Clinical Practice Guidelines for the Prevention and Treatment of Acute Altitude Illness: 2019 Update.

3. Centers for Disease Control and Prevention. High-altitude travel and altitude illness. In: Yellow Book [Internet]. Atlanta (GA): CDC; 2024 [cited 2025 Dec 21]. Available from: https://www.cdc.gov/yellow-book/hcp/environmental-hazards-risks/high-altitude-travel-and-altitude-illness.html

4. Luks AM, Beidleman BA, Freer L, Grissom CK, Keyes LE, et al. Wilderness Medical Society clinical practice guidelines for the prevention, diagnosis, and treatment of acute altitude illness: 2024 update. Wilderness Environ Med. 2024;35(1 Suppl):2S–19S. https://doi.org/10.1016/j.wem.2023.05.013

5. Simancas-Racines D, Arevalo-Rodriguez I, Osorio D, Franco JVA, Xu Y, Hidalgo R. Interventions for treating acute high-altitude illness. Vol. 2018, Cochrane Database of Systematic Reviews. John Wiley and Sons Ltd; 2018. https://doi.org/10.1002/14651858.CD009567.pub2 PMID: 29959871

6. Paal P, Pasquier M, Darocha T, Lechner R, Kosinski S, Wallner B, et al. Accidental Hypothermia: 2021 Update. Vol. 19, International Journal of Environmental Research and Public Health. MDPI; 2022. https://doi.org/10.3390/ijerph19010501 PMID: 35010760

7. Haverkamp FJC, Giesbrecht GG, Tan ECTH. The prehospital management of hypothermia — An up-to-date overview. Vol. 49, Injury. Elsevier Ltd; 2018. p. 149–64. https://doi.org/10.1016/j.injury.2017.11.001 PMID: 29162267

8. Avellanas Chavala ML, Ayala Gallardo M, Soteras Martínez Í, Subirats Bayego E. Management of accidental hypothermia: A narrative review. Medicina Intensiva (English Edition). 2019 Dec;43(9):556–68. https://doi.org/10.1016/j.medine.2018.11.006

9. Hosokawa Y, Racinais S, Akama T, Zideman D, Budgett R, Casa DJ, et al. Prehospital management of exertional heat stroke at sports competitions: International Olympic Committee Adverse Weather Impact Expert Working Group for the Olympic Games Tokyo 2020. British Journal of Sports Medicine. 2021 Dec 1;55(24):1405–10. https://doi.org/10.1136/bjsports-2020-103854

10. Hosokawa Y, Adami PE, Stephenson BT, Blauwet C, Bermon S, Webborn N, et al. Prehospital management of exertional heat stroke at sports competitions for Paralympic athletes. Br J Sports Med. 2022 Jun 1;56(11):599–604. https://doi.org/10.1136/bjsports-2021-104786 PMID: 34620604

11. Heat and health [Internet]. [cited 2025 Dec 21]. https://www.who.int/news-room/fact-sheets/detail/climate-change-heat-and-health (accessed 2025 Dec 21)

12. European Environment Agency. The impacts of heat on health: surveillance and preparedness in Europe [Internet]. 2024. Available from: https://www.eea.europa.eu/en/analysis/publications/the-impacts-of-heat-on-health

13. Stowell J, Pugsley P, McElhinny M, Comp G, Akhter M, Enenbach M, et al. 181 Pre-Hospital Management of Heatstroke During a Heatwave in Phoenix, Arizona. Ann Emerg Med. 2024 Oct;84(4):S84. https://doi.org/10.1016/j.annemergmed.2024.08.186

14. Yue MDT, Spivey DW, Gingold DB, Sward DG. The effect of wilderness and medical training on injury and altitude preparedness among backcountry hikers in Rocky Mountain National Park. World Journal of Emergency Medicine. 2018;9(3):172. https://doi.org/10.5847/wjem.j.1920-8642.2018.03.002

15. Rhue AL, VanDerveer B. Wilderness first responder: Are skills soon forgotten? Wilderness Environ Med. 2018;29(1):132–137. https://doi.org/10.1016/j.wem.2017.11.005

16. Muthomi N, Wachira LJ, Ooko WS. Knowledge in pre-hospital emergency and risk management among outdoor adventure practitioners in East Africa afro-alpine mountains. African Journal of Emergency Medicine. 2021 Mar 1;11(1):87–92. https://doi.org/10.1016/j.afjem.2020.08.006

17. Fatoni F, Letchmi Panduragan S, Sansuwito T, Stia Pusporini L. Community First Aid Training for Disaster Preparedness: A Review of Education Content. KnE Life Sciences. 2022 Feb 7; https://doi.org/10.18502/kls.v7i2.10356

18. Braybrook PJ, Tohira H, Brink D, Finn J, Buzzacott PL. Epidemiology and Severity of Medical Events for Mountain Bikers and Hikers Transported by Ambulance in Western Australia, 2015 to 2020. Wilderness Environ Med. 2024 Sep 1;35(3):257–65. https://doi.org/10.1177/10806032241245966 PMID: 38634125

19. Centers for Disease Control and Prevention. Adventure travel. In: Yellow Book [Internet]. Atlanta (GA): CDC; 2024 [cited 2025 Dec 21]. Available from: https://www.cdc.gov/yellow-book/hcp/travel-for-work-other/adventure-travel.html

20. Takauji S, Hifumi T, Saijo Y, Yokobori S, Kanda J, Kondo Y, et al. Accidental hypothermia: characteristics, outcomes, and prognostic factors—A nationwide observational study in Japan (Hypothermia study 2018 and 2019). Acute Medicine & Surgery. 2021 Jan;8(1). https://doi.org/10.1002/ams2.694