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QUANTITATIVE STUDIES

Effects of nurse-led home-visit cardiac emergency education on family knowledge and anxiety in Indonesian highland communities: A quasi-experimental study

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Abstract
Family members are often the first to recognize signs of cardiac deterioration and respond to emergencies occurring at home. However, inadequate knowledge of cardiac emergencies and anxiety about taking appropriate action may hinder timely recognition and delay emergency responses. In response to this need, the present study examined the effects of a nurse-led home-visit education program on family members' knowledge and anxiety related to cardiac emergencies. A two-group pretest–post-test quasi-experimental study was conducted in the Nagari Singgalang Public Health Center, Indonesia. To accommodate the geographical characteristics of the study area, eight hamlets were non-randomly allocated as geographical clusters to either the intervention or control group. The groups were maintained separately to minimise the potential for intervention contamination. Of the 106 participants initially enrolled, 93 completed the study, comprising 47 participants in the intervention group and 46 in the control group. Participants in the intervention group received four weekly home-visit education sessions, each lasting 45–60 minutes. The educational program incorporated videos, a learning module, leaflets, scenario-based discussions, and verbal teach-back to reinforce understanding. Meanwhile, participants in the control group received usual care without the additional educational intervention. To evaluate the intervention outcomes, family knowledge and anxiety were assessed at baseline, before the first week of intervention, and at follow-up, 3–7 days after the fourth week. Knowledge was measured using a researcher-developed Cardiac Emergency Knowledge Questionnaire and anxiety was assessed using the Zung Self-Rating Anxiety Scale. Knowledge improvement was greater in the intervention group (difference in mean change=7.88, 95% CI 6.82–8.95; $p<0.001$), as was anxiety reduction (difference in mean change=−18.11, 95% CI −19.75 to −16.48; $p<0.001$). Psychomotor cardiac-emergency and CPR (Cardiopulmonary Resuscitation) skills were not assessed. Nurse-led home-visit education improved family knowledge and reduced anxiety over the short term compared with usual care.

Keywords: Anxiety, cardiopulmonary resuscitation, family nursing, health education, house calls

Introduction

Cardiac emergencies are conditions that require rapid recognition and an appropriate initial response to reduce the risk of complications and death (Krishnan et al., 2025). For instance, acute myocardial infarction and sudden cardiac arrest are distinct cardiac emergencies that may occur in community settings (Reinier et al., 2023). Acute myocardial infarction is characterized by acute myocardial injury accompanied by clinical evidence of myocardial ischemia, commonly resulting from impaired coronary blood flow (Zhu et al., 2025). In contrast, sudden cardiac arrest is clinically manifested by the abrupt loss of effective cardiac function and circulation (Parizad et al., 2026). Because irreversible injury and death may occur rapidly following cardiac arrest, early recognition, immediate activation of emergency medical services, and initiation of an appropriate response are essential components of prehospital care (Kleinman et al., 2025). Cardiovascular diseases remain the leading cause of death worldwide (Di Cesare et al., 2024). The World Health Organization (WHO) estimated that approximately 19.8 million people died from cardiovascular diseases in 2022,

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accounting for approximately 32% of all global deaths (WHO, 2025). Approximately 85% of these deaths were caused by heart attacks and strokes, and more than three-quarters occurred in low- and middle-income countries (WHO, 2025). Out-of-hospital cardiac arrest also continues to have a poor prognosis (Amacher et al., 2022). Although substantial developments have been made in emergency cardiovascular care, survival remains low when cardiac arrest occurs at home and an appropriate response is not initiated promptly (Tsao et al., 2023). Many out-of-hospital cardiac arrests occur in private residences, where family members are commonly the first people to witness sudden loss of consciousness or abnormal breathing. However, the home setting presents several challenges, including delayed recognition of cardiac arrest, emotional distress, uncertainty about the appropriate action, and hesitation to initiate an emergency response. These conditions demonstrate the importance of preparing family members to recognize cardiac emergencies, seek professional assistance promptly, and provide an appropriate initial response while waiting for healthcare personnel to arrive (Missel et al., 2025).

In Indonesia, cardiovascular disease also represents a considerable public health burden (Muharram et al., 2024). The 2023 Indonesian Health Survey reported that the prevalence of physician-diagnosed heart disease among individuals of all ages was 0.85% nationally (Kemenkes, 2024). In West Sumatra, the prevalence was 0.87%, representing an estimated weighted population of 18,138 individuals with heart disease (Kemenkes, 2024). Preliminary records from the Nagari Singgalang Public Health Center showed that 132 patients with cardiac conditions attended the health centre between April and September 2025, with heart failure representing the predominant cardiac condition recorded during this period. In addition, preliminary community exploration indicated that some residents reported family or community members who died following what they described as a heart attack. Since these reports depended on self-reported community accounts instead of verified clinical diagnoses, researchers classified them as contextual information rather than solid epidemiological data. Taken together, these findings indicate that families in the community may encounter both chronic cardiac conditions and sudden cardiac deterioration, highlighting the importance of recognizing warning signs, making timely decisions, and seeking emergency assistance. Nagari Singgalang is a highland community located in X Koto District, Tanah Datar Regency, West Sumatra. The community is situated in a mountainous and agricultural environment, with residential areas distributed across several administrative hamlets locally known as *jorong* (Badan Pusat Statistik Kabupaten Tanah Datar, 2025). Geographical context directly impacts health education delivery, as structured educational activities may not be equally accessible or convenient for all families. To bridge this gap, a home-visit approach enables nurses to reach families directly within their living environments and promote educational information. Therefore, the geographical characteristics of Nagari Singgalang provide an important contextual justification for delivering cardiac emergency education through home visits. Geographical challenges may be important in providing cardiac emergencies action. Evidence from mountainous settings in other countries suggests that distance and emergency-response time can influence outcomes following out-of-hospital cardiac arrest. For instance, In the Polish Tatra Mountains, a study reported that shorter emergency-team arrival and earlier initiation of advanced life support were associated with better outcomes after sudden cardiac arrest (Mikiewicz et al., 2023). Evidence from Asia has shown similar geographical disparities. In Korea, cardiac arrest survival rates are lower in rural and mountainous regions than in cities due to delayed ambulance response, fewer emergency facilities, and lower bystander Cardiopulmonary Resuscitation (CPR) rates (Lee et al., 2024). Despite differences in geography and healthcare systems, these findings demonstrate that quick recognition, bystander intervention, and timely emergency response remain essential in challenging terrains like Nagari Singgalang.

Bridging this gap successfully requires empowering the closest individuals to the patient; therefore, family members need sufficient knowledge to distinguish between a heart attack and cardiac arrest, recognize warning signs such as sudden chest pain, shortness of breath, loss of consciousness, and absence of normal breathing, and understand when emergency assistance should be sought. However, previous research has shown that family members of individuals with cardiovascular disease may have limited knowledge of CPR and inadequate understanding of the actions required during a cardiac emergency (Teng et al., 2020). Insufficient knowledge may contribute to misinterpretation of symptoms, delayed decision-making, and inappropriate initial responses. In addition, the possibility of a cardiac emergency can cause psychological distress among family members. Witnessing the sudden deterioration or collapse of a relative may trigger fear, panic, helplessness, uncertainty, and anxiety about making an incorrect decision. Family members of cardiac arrest patients may experience anxiety, uncertainty, and fear of losing their relatives (Rojas et al., 2023). Anxiety is also relevant before an emergency occurs because family members who perceive themselves as unprepared may experience worry about the possibility of a cardiac event and uncertainty about what they should do during the situation. High levels of anxiety may reduce attentional control and cognitive processing efficiency, potentially making it more difficult for individuals to concentrate on and process essential information during threatening

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situations (Eysenck et al., 2023). Families experiencing cardiac arrest report uncertainty, psychological distress, and unmet information needs, highlighting the importance of clear communication, information, and emotional support (Douma et al., 2023). Therefore, cardiac education must provide factual knowledge, address misconceptions, address family concerns, and build psychological readiness for emergencies.

Nurses have an important role in preparing families for health-related emergencies in community settings. Nurse-led home visits facilitate direct communication, assessment, reinforcement of essential information, and identification of misconceptions. Education delivered in the home also allows family members to ask questions and express their fears in a familiar environment. Previous studies have demonstrated that nurse-led home-based interventions can improve patients' and families' understanding and management of chronic health conditions (Savini et al., 2021). However, evidence regarding nurse-led home visits specifically addressing family preparedness for cardiac emergencies remains limited. Previous studies have demonstrated the value of educating family members of patients with cardiovascular conditions about cardiac emergencies. A study found that patient-centred CPR education improved cardiovascular and CPR knowledge, self-efficacy, skills, and performance among family caregivers of patients with cardiovascular disease (Kim et al., 2016). More recently, a nurse-led quasi-experimental intervention involving relatives of patients with cardiac conditions improved basic life support knowledge, practical skills, and self-perceived competence (Alcoceba et al., 2026). These findings are further supported by a review showing that targeted Basic Life Support (BLS) training for family members and caregivers of individuals at high risk of out-of-hospital cardiac arrest improved simulated CPR skills, confidence, and willingness to provide CPR (Doherty et al., 2025).

Building directly upon this evidence-based need for household preparedness, specialized programs have emerged to operationalize these training strategies. The HeartSafe Home intervention was also developed to increase household awareness and preparedness for out-of-hospital cardiac arrest. This intervention recognizes family members and friends as important targets for cardiac emergency education because many cardiac arrests occur in private residences. The program was developed through stakeholder engagement and a learning-community approach to prepare household members to recognize cardiac arrest, activate emergency services, initiate CPR, and use an automated external defibrillator when available. However, further evaluation of its effectiveness was recommended (Missel et al., 2025). A preliminary assessment conducted among 10 family members in the working area of the Nagari Singgalang Public Health Center identified substantial educational and psychological needs. Seven family members considered a heart attack and cardiac arrest to be the same condition and were unable to identify the appropriate initial response to sudden chest pain, unconsciousness, or absence of normal breathing. Only one family member knew that chest compressions might be required during cardiac arrest, although this participant had never received formal training. None had previously received structured cardiac emergency education. All participants expressed fear of suddenly losing a relative, uncertainty about responding to a cardiac emergency, and concern about delays in obtaining professional healthcare. Several also reported recurrent worry, restlessness, palpitations, and panic when a relative experienced chest discomfort. However, this preliminary assessment focused on family knowledge and self-reported responses and did not include direct observation or objective assessment of psychomotor CPR skills. Therefore, the practical emergency-response competence of these family members could not be determined. Routine healthcare services and general health information were available through the Nagari Singgalang Public Health Center; however, none of the 10 family members included in the preliminary assessment reported having received education addressing cardiac emergency recognition, initial family response, or CPR. This finding does not indicate that cardiac-related health education had never been provided within the broader health-center catchment area, but it identifies an important educational gap among the families assessed. Strengthening collaboration between community health nurses, primary healthcare services, families, and local community resources may therefore be important for improving timely recognition and activation of professional assistance when cardiac emergencies occur.

Despite the demonstrated benefits of cardiac emergency education, several important gaps remain. Previous interventions have predominantly focused on CPR or BLS training delivered through hospital-based, classroom-based, video-based, or simulation-based approaches rather than through individualized and repeated home visits. Most studies examined knowledge, practical skills, attitudes, self-efficacy, confidence, or willingness to perform CPR, whereas family anxiety has received comparatively limited attention. Evidence regarding nurse-led cardiac emergency education for families living in geographically dispersed highland communities in Indonesia also remains scarce. Many previous interventions have assessed practical CPR skills, self-efficacy, confidence, or willingness to perform CPR. In contrast, evidence regarding interventions that address family knowledge and anxiety through nurse-led home visits remains limited, particularly in highland communities in Indonesia. Importantly, the present intervention was designed to address cognitive and psychological outcomes and did not include hands-on CPR practice or objective psychomotor skill

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assessment. This study addressed these gaps by evaluating a structured nurse-led cardiac emergency education program delivered directly to families through home visits. The program focused on improving cardiac emergency knowledge and reducing anxiety through repeated education, audiovisual and written materials, scenario discussion, and verbal teach-back rather than on developing or testing psychomotor CPR competence. Therefore, this study aimed to evaluate the effects of a nurse-led home-visit cardiac emergency education program on family knowledge and anxiety in Nagari Singgalang, an Indonesian highland community. It was hypothesized that families receiving the program would demonstrate greater improvements in cardiac emergency knowledge and greater reductions in anxiety than families in the control group. Practical CPR skills were outside the scope of the present study.

Method

This study used a community-based, cluster-allocated quasi-experimental design with a nonequivalent control-group pretest–posttest approach to evaluate the effects of a nurse-led home-visit cardiac emergency education programme on family knowledge and anxiety (Capili & Anastasi, 2024). The study was conducted in the working area of the Nagari Singgalang Public Health Center, X Koto District, Tanah Datar Regency, West Sumatra, Indonesia. The intervention was delivered over four consecutive weeks from 6 April to 2 May 2026. Baseline assessments were conducted before the first intervention session in week 1, whereas post-intervention assessments were conducted 3–7 days after completion of the fourth weekly session. The study was designed and reported in accordance with the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) recommendations (Des Jarlais et al., 2004). Participants were eligible if they were adults (aged ≥18 years) residing within the service area of the Nagari Singgalang Public Health Center, were family members of a patient with a cardiovascular condition, were literate, and provided informed consent. Conversely, individuals were excluded if they presented with cognitive or communication impairments that could hinder their participation in the educational sessions or the completion of questionnaires.

All eight *jorong* in Nagari Singgalang were included as geographical clusters. Participants were allocated non-randomly to the intervention or control group at a 1:1 ratio. Four *jorong* located relatively farther from the Nagari Singgalang Public Health Center were assigned to the intervention group, whereas four *jorong* located closer to the health center were assigned to the control group. This allocation was used to prioritize home-visit education for family members with greater geographical distance from the health center and to minimize potential contamination between the intervention and control groups. Participants within each *jorong* were recruited purposively according to the eligibility criteria. A total of 106 participants were enrolled, with 53 participants in each group. Education was delivered individually at participants' homes rather than through combined group sessions. Participants from intervention and control clusters did not attend joint educational sessions, and intervention materials were not provided to control-group participants until all post-intervention assessments had been completed. These procedures were used to minimize, although they could not completely eliminate, the possibility of contamination between groups. Because allocation was based on geographical proximity rather than randomization, baseline demographic characteristics and pre-intervention outcome scores were compared to evaluate group comparability. Outcome assessors were not blinded to group allocation. The same standardized instruments and data-collection procedures were applied to both groups to minimize assessment bias. The sample size was estimated a priori using G*Power version 3.1.9.4 for a two-tailed independent-samples t-test. Assuming a moderate-to-large effect size of Cohen's d=0.60 based on previous research (Kim et al., 2016), a significance level of 0.05, statistical power of 0.80, and an allocation ratio of 1:1, the minimum required analytical sample was 90 participants, comprising 45 participants in each group. To allow for anticipated loss to follow-up, the calculated sample was increased by approximately 15%. Increasing the initial sample to account for anticipated dropout is a recognized approach for maintaining the required final analytical sample (Overall et al., 1998). Using an anticipated retention rate of 85%, the adjusted sample was approximately 106 participants (90/0.85=105.9), resulting in a recruitment target of 53 participants per group.

The intervention materials consisted of standardized educational videos, a cardiac emergency education module, a leaflet, structured discussion scenarios, and a verbal teach-back guide. The materials covered recognition of cardiac emergencies, cardiovascular risk factors, warning signs of myocardial infarction and cardiac arrest, initial family responses, assessment of responsiveness and breathing, activation of emergency medical services, actions to avoid, and introductory principles of Hands-Only CPR. The content selection was informed by our preliminary assessment of 10 family members in the Nagari Singgalang Public Health Center catchment area. Seven could not differentiate myocardial infarction from cardiac arrest and did not know appropriate initial responses to acute chest pain, unresponsiveness, or absent normal breathing; only one was aware that chest compressions may be needed, and none reported prior structured cardiac-emergency education. Participants also reported fear and uncertainty concerning a

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family member's possible cardiac emergency. These needs informed the focus on recognizing warning signs, checking responsiveness and breathing, seeking emergency assistance, safe initial responses, actions to avoid, and an introduction to Hands-Only CPR. The information was organized into videos, a cardiac emergency module, a leaflet, structured discussion scenarios, and a verbal teach-back guide to promote consistent delivery and allow participants to explain what they understood. Three experts evaluated content validity before implementation, as reported in the manuscript. The clinical topics are consistent with the American Heart Association's 2020 resuscitation guidance (Panchal et al., 2020), while the use of teach-back is supported by the AHRQ Health Literacy Universal Precautions Toolkit (Agency for Healthcare Research and Quality, 2023). The researcher does not claim that the preliminary assessment tested practical CPR skill or that formal simulation training was provided.

Before implementation, the content validity of the educational materials was evaluated by three experts with expertise in cardiovascular nursing, emergency nursing, and community nursing. The experts independently assessed the relevance, accuracy, clarity, comprehensibility, and appropriateness of the materials for adult family members in the community using a four-point rating scale. Ratings of 3 or 4 were considered indicative of content relevance. The Item-Level Content Validity Index (I-CVI) was calculated as the proportion of experts rating each item as relevant, while the Scale-Level Content Validity Index using the average method (S-CVI/Ave) was calculated as the mean of the I-CVI values across all evaluated items. The I-CVI values ranged from 0.67 to 1.00, and the overall S-CVI/Ave was 0.98, indicating excellent overall content validity. Items that did not achieve full expert agreement were reviewed and revised based on the experts' qualitative comments and recommendations before the materials were used in the intervention. The intervention was delivered by three registered community nurses. Prior to implementation, the nurses underwent a standardization session to warrant consistency in understanding and delivery of the intervention. The session covered the intervention protocol, educational materials, sequence and duration of each session, scenario discussion, verbal teach-back procedures, and session checklist. All nurses used the same standardized materials and procedures throughout the study.

The data-collection instruments comprised a demographic questionnaire, the Cardiac Emergency Knowledge Questionnaire, and the Zung Self-Rating Anxiety Scale (the Zung SAS). The demographic questionnaire collected information on participants' age, sex, educational level, occupation, relationship to the patient. Family knowledge was measured using a 20-item Cardiac Emergency Knowledge Questionnaire developed by the researchers specifically for adult family members. The questionnaire covered cardiac emergency concepts, cardiovascular risk factors, warning signs, initial assessment, emergency-service activation, actions to avoid, and principles of Hands-Only CPR. Correct responses were scored 1 and incorrect responses 0, yielding a total score of 0–20, with higher scores indicating greater knowledge. As the questionnaire was originally developed in Bahasa Indonesia, translation and permission from an external author were not applicable. Pilot testing among 30 adult family members outside the study sample showed item–total correlations of 0.385–0.580, exceeding the critical value of 0.361, and good internal consistency (Cronbach's α=0.819). The original Zung SAS is in the public domain and does not require permission for research use, as confirmed through correspondence with Dunstan. The original Zung SAS was developed in English by William W. K. Zung and published in 1971 as a 20-item self-report instrument for anxiety symptoms. It covers affective and somatic symptoms. Each item is rated on a four-point frequency scale; the five positively worded items (5, 9, 13, 17, and 19) are reverse-scored. Summed raw scores range from 20 to 80, and multiplying the raw score by 1.25 gives an Anxiety Index ranging from 25 to 100, with higher values indicating greater anxiety symptoms. Regarding permission, Dr. Debra Dunstan confirmed in written email correspondence that the Zung SAS is in the public domain and may be used freely in research. Family anxiety was measured using the Indonesian version of the 20-item Zung SAS (Setyowati et al., 2019), The Indonesian version was developed through forward translation, expert review, back-translation, and pilot testing as described in the original validation study. Items were rated on a four-point Likert scale ranging from 1 to 4, with positively worded items (items 5, 9, 13, 17, and 19) reverse-scored. Item scores were summed to obtain a raw total score ranging from 20 to 80. For analysis and reporting, the raw score was converted to the Anxiety Index by multiplying it by 1.25, yielding a score ranging from 25 to 100, with higher scores indicating greater anxiety. The SAS has also been evaluated for use in adult community and clinical populations (Dunstan & Scott, 2020). Because the present study involved adult family members, additional pilot testing was conducted among 30 adult family members outside the study sample, showing corrected item–total correlations of 0.450–0.640 and acceptable internal consistency (Cronbach's α=0.785). The intervention group received a structured nurse-led cardiac emergency education program delivered through four home visits over four consecutive weeks, with one home visit conducted each week. Each session lasted approximately 45–60 minutes. The intervention was delivered by three registered community nurses using standardized videos, an

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educational module, a leaflet, a session guide, structured scenarios, and the same sequence of educational activities **(Table1)**.

Table 1. Data collection and intervention protocol.

Study phase	Intervention group	Duration/timing	Control group	Duration/timing
Baseline assessment	Informed consent, demographic questionnaire, knowledge pretest, and anxiety pretest	Before week 1	Same baseline assessments	Before week 1
First week	Recognition of cardiac emergencies, cardiovascular risk factors, warning signs, and differences between heart attack and cardiac arrest	45–60 minutes	Routine health services	—
Second week	Initial family response, safety, responsiveness and breathing assessment, seeking assistance, emergency service activation, and actions to avoid	45–60 minutes	Routine health services	—
Third week	Audiovisual and written education on cardiac arrest and Hands-Only CPR principles, without live demonstration, manikin practice, or participant return demonstration	45–60 minutes	Routine health services	—
Fourth week	Review of all material, video reinforcement, scenario discussion, question-and-answer session, and verbal teach-back	45–60 minutes	Routine health services	—
Post-intervention assessment	Knowledge and anxiety posttests	3–7 days after week 4	Same post-intervention assessments	Corresponding period
Wait-list intervention	—	—	Videos, module, and leaflet provided after data collection	After completion of all post-intervention assessments

The program was designed primarily to improve cognitive knowledge and reduce anxiety related to cardiac emergencies. However, the program did not include psychomotor CPR skills training, live instructor-led CPR demonstration, manikin-based practice, participant return demonstration, or objective assessment of practical CPR performance. Therefore, practical cardiac-emergency or CPR skills were not intervention outcomes in the present study. During the first week, participants received education about the recognition of cardiac emergencies. The session included definitions of cardiac emergencies, cardiovascular risk factors, signs and symptoms of myocardial infarction, differences between myocardial infarction and cardiac arrest, and warning signs requiring immediate professional assistance. Then in the second week, education focused on initial family responses to suspected cardiac emergencies. Topics included ensuring the safety of the patient and responder, assessing responsiveness and normal breathing, requesting assistance from people nearby, activating emergency medical services, and avoiding actions that could worsen the patient's condition. During the third week, participants received audiovisual and written education about the recognition of cardiac arrest and the principles of Hands-Only CPR. The material included recognition of an unresponsive individual who was not breathing normally, requesting immediate assistance, activating emergency medical services, and understanding the basic principles of chest compressions. No live CPR demonstration, manikin-based practice, or direct participant performance was conducted. At last, in the fourth week, all previous content was reinforced. Activities included review of key concepts, replaying important parts of the educational video, discussion of cardiac-emergency

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scenarios, question-and-answer sessions, and verbal teach-back. During teach-back, participants were asked to verbally explain what they would do if they encountered a family member who was unresponsive and not breathing normally. The teach-back activity assessed verbal understanding of the response sequence and was not considered an assessment of psychomotor CPR competence. The control group did not receive an educational intervention developed as part of the study protocol during the four-week intervention period. Participants continued to receive routine health services and general health information ordinarily available from the Nagari Singgalang Public Health Center. Thus, the control condition represented usual care rather than an active or attention-matched intervention. Control-group participants did not receive the structured home-visit cardiac emergency program, educational videos, module, or leaflet during the study period. After all post-intervention assessments had been completed, participants in the control group were provided with the same educational videos, module, and leaflet as a wait-list intervention.

Before baseline data collection, participants received verbal and written study information and provided written informed consent. The same adult family member completed the baseline assessment, four-week intervention, and post-intervention assessment. Knowledge and anxiety were assessed before week 1 and 3–7 days after week 4. Intervention fidelity was maintained through standardized materials, session sequence, duration, scenarios, teach-back procedures, and a structured checklist, with attendance documented for each home visit. Participants who did not complete all four sessions were considered non-completers. Intervention and control groups remained geographically separated, and intervention materials were withheld from controls until all posttests were completed. Due to the nature of the intervention, participants and intervention nurses could not be blinded to group allocation.

Data were analyzed using IBM SPSS Statistics version 29.0. Participant characteristics were summarized using frequencies and percentages for categorical variables and means with standard deviations or medians with interquartile ranges for continuous variables, as appropriate. Normality was assessed using the Shapiro–Wilk test, and homogeneity of variance was examined using Levene's test. Baseline characteristics and pre-intervention scores were compared to assess group comparability. Within-group changes in knowledge and anxiety from baseline to post-intervention were analyzed using paired-samples t-tests. Between-group intervention effects were evaluated by comparing change scores using independent-samples t-tests. Mean differences with 95% confidence intervals and effect sizes were reported. All statistical tests were two-tailed, with statistical significance set at $p<0.05$. No subgroup, sensitivity, or restricted analyses were prespecified. Ethical approval was obtained from the Health Research Ethics Committee of Universitas Perintis Indonesia before participant recruitment (Approval No. 1556/KEPK.F1/ETIK/2026). All participants provided written informed consent. Participant identities were replaced with study codes, and all data were treated confidentially. Participants were informed that participation was voluntary and that they could withdraw from the study at any time without consequences or loss of access to healthcare services. The study was registered with the Thai Clinical Trials Registry (TCTR; registration number TCTR20260806010). Ethical approval for the protocol was obtained from the institutional review board prior to study initiation. All collected data were stored securely on password-protected servers, accessible only to authorized research personnel. Finally, the study was conducted in strict adherence to the ethical principles outlined in the Declaration of Helsinki.

Results

A total of 106 eligible family members were enrolled, with 53 participants in each group. During follow-up, six participants in the intervention group and seven in the control group were repeatedly unavailable during scheduled home visits and did not complete the post-intervention assessment. Consequently, 93 participants were included in the complete-case analysis, comprising 47 participants in the intervention group and 46 in the control group. The overall retention rate was 87.7%, corresponding to an attrition rate of 12.3% **(Figure 1)**. Most participants in both groups were women, adult children of patients with cardiovascular conditions, graduates of senior secondary or vocational education, and farmers. No statistically significant baseline differences were detected between the groups in age, sex, relationship to the patient, educational level, occupation, knowledge scores, or Anxiety Index scores (all $p>0.05$). The baseline mean knowledge scores were 7.00 (SD=3.96) in the intervention group and 6.54 (SD=3.73) in the control group ($p=0.568$). The corresponding baseline Anxiety Index scores were 69.60 (SD=6.05) and 68.91 (SD=5.83), respectively ($p=0.578$) **(Table 2)**. Psychomotor cardiac-emergency and CPR skills were not prespecified study outcomes and were therefore not assessed at baseline or post-intervention. Accordingly, the outcome analyses were limited to cardiac-emergency knowledge and anxiety. Following the intervention, mean knowledge scores increased from 7.00±3.96 to 16.36±2.64 in the intervention group, representing a mean increase of 9.36±3.18 points ($p<0.001$). In the control group, scores increased from 6.54±3.73 to 8.02±3.59, with a mean increase of 1.48±1.81 points ($p<0.001$) **(Table 3).**

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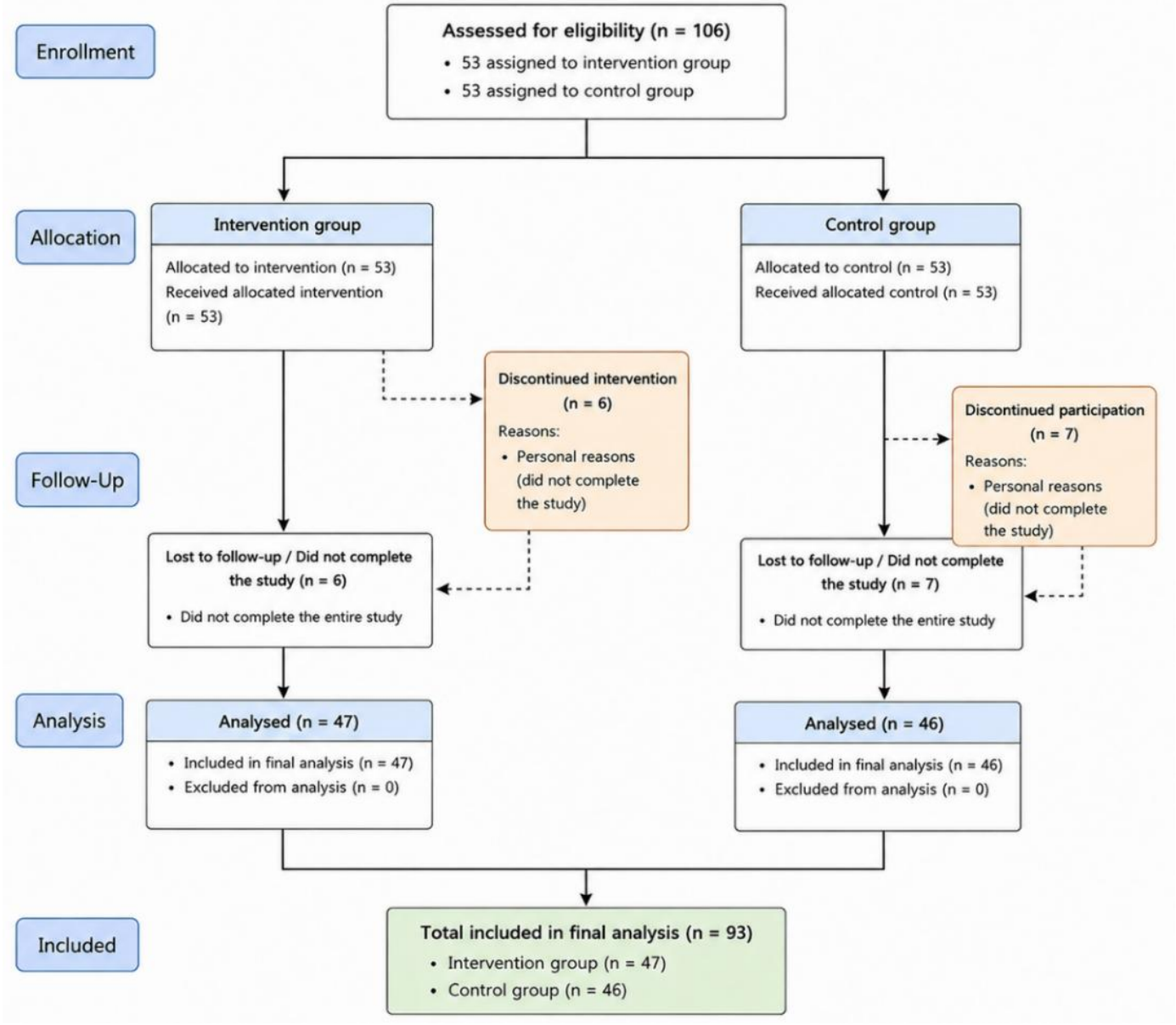


Figure 1. TREND Flowchart.

The improvement was significantly greater in the intervention group, with a between-group difference in mean change of 7.88 points (95% CI 6.82–8.95; p<0.001; Hedges' g=3.01) **(Table 4)**. Anxiety was reported using the Zung SAS, which ranges from 25 to 100, with higher scores indicating greater anxiety. At baseline, the mean Anxiety Index was 69.60±6.05 in the intervention group and 68.91±5.83 in the control group. There was no statistically significant difference between the groups at baseline (p=0.578). In the intervention group, the mean Anxiety Index decreased significantly from 69.60±6.05 at pretest to 49.02±5.56 at posttest, representing a mean reduction of 20.59±4.55 points (p<0.001). In the control group, the mean Anxiety Index decreased from 68.91±5.83 to 66.44±6.56, with a mean reduction of 2.47±3.29 points (p<0.001) **(Table 3)**. The reduction in anxiety was significantly greater in the intervention group than in the control group. The between-group difference in mean change was −18.11 points (95% CI=−19.75 to −16.48; p<0.001). The Hedges' g value was −4.52, indicating a very large intervention effect in reducing family anxiety **(Table 4)**. Overall, the home visit-based cardiac emergency education intervention resulted in a significantly greater improvement in family knowledge and a significantly greater reduction in family anxiety compared with the control condition. No adverse events or unintended effects related to the educational intervention were reported in either study group.

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Table 2. Baseline characteristics of participants.

Characteristics	Intervention (n=47)	Control (n=46)	*p*
Age, years, mean±SD	39.62±7.17	37.30±7.94	0.144[a]
Sex, n (%)			0.260[b]
Female	37 (78.7)	41 (89.1)	
Male	10 (21.3)	5 (10.9)	
Relationship with the patient, n (%)			0.685[c]
Child	33 (70.2)	35 (76.1)	
Spouse	7 (14.9)	6 (13.0)	
Grandchild	7 (14.9)	4 (8.7)	
Sibling	0 (0.0)	1 (2.2)	
Educational level, n (%)			0.203[c]
Primary school	1 (2.1)	0 (0.0)	
Junior secondary school	14 (29.8)	8 (17.4)	
Senior secondary/vocational school	32 (68.1)	37 (80.4)	
Bachelor's degree	0 (0.0)	1 (2.2)	
Occupation, n (%)			0.249[c]
Farmer	23 (48.9)	31 (67.4)	
Trader	9 (19.1)	6 (13.0)	
Housewife	12 (25.5)	6 (13.0)	
Student	2 (4.3)	1 (2.2)	
Government contract employee	1 (2.1)	0 (0.0)	
Teacher	0 (0.0)	1 (2.2)	
Administrative staff	0 (0.0)	1 (2.2)	
Baseline knowledge score, mean ± SD	7.00 ± 3.96	6.54 ± 3.73	0.568[a]
Baseline Anxiety Index, mean ± SD	69.60 ± 6.05	68.91 ± 5.83	0.578[a]

[a]Independent-samples t-test; [b]Fisher's exact test; [c]Fisher–Freeman–Halton exact test.

Table 3. Comparison of knowledge and anxiety outcomes between groups.

Outcomes	Group	Pretest, mean±SD	Posttest, mean±SD	Mean change±SD	Within-group
Knowledge	Intervention	7.00±3.96	16.36±2.64	9.36±3.18	<0.001[a]
	Control	6.54±3.73	8.02±3.59	1.48±1.81	<0.001[a]
Anxiety index	Intervention	69.60±6.05	49.02±5.56	−20.59±4.55	<0.001[a]
	Control	68.91±5.83	66.44±6.56	−2.47±3.29	<0.001[a]

[a]Paired-samples t-test.

Table 4. Between-group comparison of outcome changes.

Outcomes	Difference in mean change	95% CI	*p*	Hedges' g
Knowledge	7.88	6.82 to 8.95	<0.001[a]	3.01
Anxiety index	−18.11	−19.75 to −16.48	<0.001[a]	−4.52

[a]Independent-samples t-test.

Discussion

This study found that nurse-led home-visit cardiac emergency education improved family knowledge and reduced anxiety compared with usual care. These findings indicate that structured, home-based education delivers immediate cognitive and psychological benefits to family members who are likely to witness a patient's acute cardiovascular deterioration. However, because practical emergency-response and CPR skills were not assessed, the findings should not be interpreted as evidence of psychomotor competence or actual emergency-response performance. Hands-Only CPR was introduced only at the level of recognition and initial principles, rather than evaluated through a standardized practical-skills assessment. Objective CPR competency would require a separate practical protocol, such as manikin-based

demonstrations and assessment of compression placement, rate, depth, and recoil. Such assessment was outside the defined scope of this study and was not performed. Baseline comparability between the two groups suggests that the observed differences in outcomes may be associated with the intervention rather than with measured demographic characteristics. Unfortunately, the possibility of residual confounding cannot be ruled out because group allocation was non-random. Furthermore, the predominance of women and adult children among participants reflects their important roles in family caregiving in making decisions and responding to clinical deterioration. The higher proportions of women and adult children may reflect the household members who were most involved in day-to-day family care and available during home-based recruitment. In families, women undertake caregiving activities and adult children assist with symptom monitoring, healthcare access, and decisions about seeking help. Purposive recruitment of eligible and available family members influenced this distribution. However, the study did not measure caregiving allocation, household decision-making roles, or participants' reasons for enrolment. Family engagement is an essential component of cardiovascular care in communities where relatives are the first persons present during acute deterioration (Goldfarb et al., 2022; Kitko et al., 2020). The diversity of participants' educational and occupational backgrounds supports the use of individualized education. Home visits allow nurses to adapt language, clarify misconceptions, and relate emergency information to the family's daily circumstances. This approach is particularly relevant because family members are often the first to witness and respond to cardiac emergencies at home, yet their ability to provide immediate assistance may be constrained by limited access to conventional CPR training due to financial barriers, geographical distance, transportation challenges, and competing caregiving responsibilities (Abella et al., 2022).

The improvement in knowledge may be explained by the repeated, multimodal, and personalized nature of the intervention. Four weekly visits provided opportunities for reinforcement, clarification, and repetition. This approach is appropriate for cardiac emergency education because participants must understand several related topics but distinct concepts, including cardiovascular risk factors, warning signs, differences between myocardial infarction and cardiac arrest, assessment of responsiveness and breathing, emergency service activation, basic Hands-Only CPR principles. Repeated contact may reduce cognitive overload. Rather than receiving all information in a single session, participants can process the material gradually, reflect on previous content, and ask questions during visits. Reinforcement over several weeks may support retention more than a one-time educational encounter. The combination of direct explanation, videos, modules, and leaflets may also have addressed different learning preferences. In addition, scenario discussions and verbal teach-back allowed participants to review the sequence of appropriate emergency responses without constituting psychomotor CPR assessment. The benefit may result from the integration of verbal, visual, and written learning methods rather than from one educational medium alone. The findings are consistent with a study reported a structured Family and Friends CPR course improved theoretical emergency knowledge among relatives of patients with cardiovascular risk and maintained favourable outcomes at follow-up (Vargas-Sánchez et al., 2021). A study also demonstrated that patient-centred CPR education combining individualized counselling, instructor-guided practice, and follow-up improved knowledge, self-efficacy, and practical performance among family caregivers of patients with cardiovascular disease (Kim et al., 2016).

Although the present intervention did not include hands-on CPR practice, this study supports the importance of direct educator involvement. Videos and printed materials can standardize information, but they cannot determine whether participants have misunderstood the content. A nurse can identify inaccurate beliefs, respond to individual concerns, provide immediate feedback, and relate the information to the patient's condition and the family's available resources. A study summarized that effective caregiver interventions through the CARE framework: caregiver-centred care, active engagement, reinforcement, and education (Knowles et al., 2021). The present intervention incorporated several of these components through direct engagement with family caregivers, repeated reinforcement, communication, audiovisual and materials. Importantly, the improvement in theoretical knowledge should not be interpreted as evidence of practical CPR competence. CPR requires psychomotor skills that cannot be adequately evaluated through knowledge assessment alone. Previous research has identified uncertainty in recognizing cardiac arrest and fear of performing CPR incorrectly as important barriers among family members of patients with heart disease (Park & Jun, 2018). Individualized CPR education incorporating practical training has been shown to improve knowledge, self-efficacy, and practical performance among family caregivers of patients with cardiovascular disease (Kim et al., 2016). Although verbal teach-back can help educators confirm participants' understanding and identify information requiring further clarification (Agency for Healthcare Research and Quality, 2023), the teach-back used in the present study was limited to verbal understanding and did not assess psychomotor CPR competence. Practical CPR performance requires specific skills, including correct hand placement, appropriate compression depth and rate, adequate chest recoil, and minimal interruption. A study reported that CPR knowledge was not strongly associated with psychomotor

performance, whereas direct training was associated with better practical skills (Riggs et al., 2019). This distinction is especially meaningful when interpreting the findings of this study because the intervention used audiovisual and written education without manikin-based practice or participant return demonstration. Furthermore, CPR skills may deteriorate within several months after training, supporting the need for periodic reinforcement (Hsieh et al., 2018). Corrective feedback devices may also improve CPR skill acquisition and retention (Nicolau et al., 2024).

The reduction in anxiety may reflect the effects of structured information, professional contact, opportunities to clarify concerns, and greater familiarity with an appropriate emergency-response sequence. A study documented that caregiver preparedness was associated with greater caregiver confidence, which subsequently supported caregivers' contributions to symptom monitoring and management (Vellone et al., 2020). Reviews of interventions for heart failure caregivers also indicate that nurse-led psychoeducation, particularly when combined with home visits, follow-up communication, and supportive interaction, may improve preparedness, coping, and psychological outcomes (Cassidy et al., 2021; Evangelista et al., 2016). In the present study, repeated home visits may have reduced uncertainty by allowing family members to clarify concerns, receive reassurance, and become more familiar with how to respond to a potential cardiac emergency. Structured support has also shown potential to reduce caregiver anxiety and psychological distress, although the evidence remains inconsistent (Hwang et al., 2022). Because preparedness, perceived control, and self-efficacy were not directly measured, these mechanisms should be interpreted as plausible explanations rather than confirmed causal pathways. The item-level findings indicate that the intervention reduced both emotional and somatic manifestations of anxiety. This interpretation is consistent with the Zung SAS, which assesses psychological and physiological symptoms rather than worry alone (Dunstan et al., 2017; Zung, 1971). Reduced nervousness, autonomic symptoms, and sleep-related distress may reflect lower perceived threat and greater preparedness following repeated nurse contact. Previous study has identified anxiety, psychosocial exhaustion, and sleep disturbance among family caregivers of patients with heart failure, particularly when patients have more severe symptoms or caregivers lack adequate knowledge and support (Al-Rawashdeh et al., 2017). However, these mechanisms remain tentative because the Zung scale is a self-report screening measure rather than a diagnostic interview.

The reduction in anxiety is also consistent with evidence below that caregiver interventions may be more beneficial when education is combined with active engagement, coping support, communication, and continued professional contact. A recent systematic review and meta-analysis found that family-centred interventions improved caregiver burden, stress, depression, and quality of life, although their effects on anxiety were not statistically significant (Wang et al., 2024). Among heart failure dyads, the family-customized online FOCUS program improved caregivers' contributions to self-care and psychological outcomes by integrating communication, shared coping, and family participation (Yang et al., 2024). Supportive education based on the COPE model has also been shown to reduce caregiver burden and improve quality of life (Alaei et al., 2024). Similarly, multimedia education combined with nurse monitoring and communication has been found to reduce stress and burden among family caregivers of patients recovering from myocardial infarction (Abbasi et al., 2025). Recent evidence above therefore suggests that psychological benefits are not produced by information alone. Education, emotional support, active family participation, reinforcement, communication, and problem-solving appear to be important components of caregiver interventions. However, because intervention effects differ across psychological outcomes, the reduction in anxiety observed in the present study should be interpreted within the home visit program. The simultaneous improvement in knowledge and reduction in anxiety suggests a potential association through mechanisms such as perceived control and self-efficacy. Caregiver-focused education has been shown to improve disease knowledge and perceived control, while supportive educational interventions can strengthen caregivers' confidence in managing care demands (Aprilatutini et al., 2024; Clements et al., 2023). Recent longitudinal evidence also indicates that self-efficacy and anxiety develop in interconnected patterns among family caregivers of patients with heart failure (Lv et al., 2025). Nevertheless, the present study did not examine correlations, mediation, or temporal pathways between the two outcomes. It therefore cannot establish that increased knowledge directly caused the reduction in anxiety. Both outcomes may have been influenced independently by the educational content, repeated nurse contact, personalized communication, and reassurance.

The findings support expanding family education beyond routine information about medication, diet, and scheduled follow-up. Families of patients with cardiovascular disease also require education about recognition of acute deterioration and appropriate initial emergency responses. Nurses should identify the family member most likely to be present with the patient and provide education to that person's literacy, experience, and caregiving role. Simple language, visual materials, case examples, and teach-back should be used to confirm understanding. Home visits also provide an opportunity to create an individualized emergency plan. This may include emergency contact numbers, transportation arrangements, the nearest appropriate health facility, medication lists, patient identification documents,

and designated family responsibilities. Educational materials should remain accessible after the visit, but they should complement rather than replace direct teaching and practical training. A comprehensive program should ideally include recognition of cardiac warning signs, activation of emergency services, hands-only CPR, awareness of automated external defibrillation, manikin-based simulation, direct performance feedback, and refresher sessions. At the community level, primary health-care centres and local government can support implementation by identifying families of high-risk cardiovascular patients, integrating cardiac emergency education into existing home-visit and community program, and coordinating referral and emergency transportation pathways. Community health cadres, nursing or health students, and residents who have received appropriate basic life-support training may assist with reinforcement and community awareness under professional supervision. Such collaboration may be particularly important in geographically dispersed communities where professional emergency assistance may not be immediately available. Psychological assessment should also be incorporated into family education. Families with persistent or severe anxiety symptoms may require additional support or referral.

The study benefited from the use of intervention and control groups, baseline comparability in measured variables, repeated educational contact, multimodal learning materials, and the assessment of cognitive and psychological outcomes. Several limitations should be considered. First, the non-random cluster allocation limits causal inference and may have introduced unmeasured confounding. In addition, the primary analyses were conducted at the individual level and did not account for potential within *Jorong* clustering; therefore, the precision of the estimated intervention effects may be overstated. Outcome assessment was not blinded, creating the possibility of expectation and social-desirability effects. Reuse of the same knowledge instrument may have introduced testing effects, and high post-intervention scores suggest a possible ceiling effect. Practical cardiac-emergency and CPR skills were not assessed; therefore, increased knowledge cannot be equated with practical emergency competence. The follow-up period was short, limiting conclusions regarding the retention of knowledge gains and anxiety reduction. The control condition was not attention-matched, making it difficult to distinguish the effects of the educational content from those of repeated nurse contact. Anxiety was self-reported and should therefore be interpreted as symptom severity rather than a psychiatric diagnosis. Finally, the sample was drawn from a specific highland community and consisted predominantly of women and adult children of patients with cardiovascular conditions. The findings may not be directly generalizable to spouses, male caregivers, populations with very low literacy, or communities with different geographical characteristics and access to emergency services.

Conclusion

Nurse-led home-visit cardiac emergency education significantly improved family knowledge and reduced anxiety over the short term compared with usual care. Repeated nurse contact, individualized communication, audiovisual and written materials, and delivery in a familiar environment may contribute to these cognitive and psychological benefits. However, the findings should not be interpreted as evidence that participants acquired practical CPR competence or actual emergency-response capability because psychomotor skills were not assessed. Future programs should incorporate supervised hands-on CPR training, manikin simulation, objective feedback, refresher sessions, and longer-term follow-up to evaluate practical competence and retention particularly for those living in highland area.

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AI statements

During the preparation of this work, the authors used Scite AI to reference check. After using this tool, the authors reviewed and edited the content as needed and takes full responsibility for the content of the published article.

Author's declaration

All authors contributed to the conceptualization of the research topic and methodology, preparation of the research proposal, implementation of the study, data collection and analysis, and drafting and finalization of the manuscript for publication.

Availability of data and materials
The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Competing interests
The authors declare that there are no conflicts of interest related to this study.

Ethical clearance
Ethical approval for this study was granted by the Ethics Committee of Universitas Perintis Indonesia (Approval No. 1556/KEPK.F1/ETIK/2026).

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Publishers and journal's note
The findings of this study are important and interesting because the research involves a highland population where access to healthcare professionals during emergency situations can be challenging. The research design is also appropriate for evaluating the effects of the intervention on the two outcome variables investigated in this study. I believe that this article could serve as a reference for other countries seeking to implement community-based educational interventions in highland populations, particularly in areas where access to emergency healthcare services is limited.

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Authors' insight

Key points

- Nurse-led home-visit cardiac emergency education significantly improved family knowledge and reduced anxiety in an Indonesian highland community.
- The use of videos, educational modules, and leaflets provided a structured and accessible approach for delivering cardiac emergency information directly in the home setting.
- Community health nurses can play an important role in strengthening family preparedness to recognize cardiac emergencies, seek assistance, and respond appropriately before professional help arrives.

Emerging nursing avenues

- What strategies can be used to integrate structured cardiac emergency education into routine community health-center and family nursing services?
- Can this education improve family members' confidence in responding to cardiac emergencies, facilitate activation of emergency medical services, and promote appropriate response?
- How generalizable are the effects of this nurse-led home-visit intervention across rural, urban, and diverse communities?

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