



## Empowering Lay Rescuers in Out-of-Hospital Cardiac Arrest: A Pretest-Posttest Study Guided by Orem's Self-Care Deficit and Neuman's Systems Models

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### ABSTRACT

**Introduction:** Out-of-hospital cardiac arrest (OHCA) has a low survival rate, making bystander Basic Life Support (BLS) crucial. However, in Indonesia, bystander intervention is frequently hindered by knowledge deficits, cultural norms regarding cross-gender touch, and fear of legal liability. This community service aimed to enhance the BLS competence of PIA Ardhya Garini members as first responders, theoretically grounded in Orem's Self-Care Deficit and Neuman's Systems Models.

**Methods:** A quasi-experimental one-group pretest-posttest design was employed involving 60 PIA members. The intervention was a contextualized BLS training integrating legal empowerment (Indonesian Good Samaritan Law), cultural adaptation, and demographic adjustments (Hands-Only CPR for middle-aged women). Effectiveness was evaluated using a validated 10-item cognitive test, and data were analyzed using the Wilcoxon signed-rank test and Normalized Gain (N-Gain).

**Results:** The intervention significantly improved participants' cognitive knowledge. The mean score increased from  $6.87 \pm 0.96$  (pretest) to  $9.03 \pm 0.74$  (posttest) with a p-value  $< 0.001$ . The Normalized Gain (N-Gain) was 0.67, indicating moderate effectiveness. The training successfully corrected clinical misconceptions and mitigated specific socio-cultural and legal barriers to bystander intervention.

**Conclusion:** Integrating nursing theories with socio-cultural-legal-clinical modifications effectively empowers laywomen as "dependent care agents" and strengthens community primary prevention against OHCA. To sustain cognitive and psychomotor retention, periodic refresher training every 6–12 months is strongly recommended. This model provides a replicable blueprint for community nursing practice in collectivist societies.

### KEYWORDS

Basic Life Support, Bystander, Chain of Survival, OHCA, Emergency Training

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### INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is a leading cause of death and a global public health problem requiring urgent attention. The incidence of OHCA continues to increase annually, with survival rates varying between 2% and 22% across different countries (Gerecht and Nable, 2024; Thapa *et al.*, 2024; Hart *et al.*, 2025; Topiwala *et al.*, 2026). This condition often occurs suddenly in homes, workplaces, or public spaces and can be fatal if not treated promptly within the critical "golden period" or "platinum ten minutes" (Ro *et al.*, 2016; Kurz *et al.*, 2018; Hreinsson *et al.*, 2020; Lafrance *et al.*, 2023). Every minute delayed in providing Basic Life Support (BLS) reduces the victim's survival rate by 7–10% (Weinmeister *et al.*, 2018; Isma'eel *et al.*, 2019; Huebinger *et al.*, 2022; Hwang *et al.*, 2025; Jiang *et al.*, 2025).

The role of first responders from the general public (bystanders) is the key link in the OHCA chain of survival. Multicenter studies show that CPR immediately performed by witnesses can increase survival rates up to twofold compared to cases without initial assistance (Shibahashi *et al.*, 2022; Elon, 2023; Jensen *et al.*, 2023). However, recent data indicates that the proportion of adult OHCA patients receiving bystander CPR remains limited at around 41.7%, and the use of Automated External Defibrillators (AEDs) by lay rescuers is still very low (Ok Ahn *et al.*, 2023; Farooq *et al.*, 2024). In the Indonesian context, bystander CPR rates are estimated to be even lower, heavily influenced by a lack of knowledge, fear of making mistakes, the bystander effect, and unique socio-cultural and legal barriers (Younas, 2017).

From a nursing perspective, community-based emergency interventions can be strongly conceptualized using established nursing theories. Dorothea Orem's Self-Care Deficit Nursing Theory posits that when an individual experiences a total self-care deficit (such as in OHCA), the role of care transitions to a "dependent care agent" (Huebinger *et al.*, 2022; Elon, 2023; Jiang *et al.*, 2025). In this context, the trained bystander acts as the dependent care agent. Furthermore, aligning with Betty Neuman's Systems Model, BLS training serves as a robust primary prevention strategy. It strengthens the community's "flexible lines of defense" against the sudden, severe stressor of cardiac arrest, ensuring an immediate environmental response before the stressor penetrates the core and causes system breakdown (death) (Isma'eel *et al.*, 2019; Shibahashi *et al.*, 2022; Jensen *et al.*, 2023). Therefore, strengthening community capacity through BLS education is a vital nursing intervention to empower these dependent care agents.

PIA Ardhya Garini Branch 06-3/D.II Air Squadron 21 is an organization active in social community activities, playing a strategic role within the military family environment. As a highly cohesive group, PIA members have immense potential to act as agents of change and structured first responders. However, preliminary studies showed that their BLS knowledge was suboptimal (mean pretest score:  $6.87 \pm 0.96$ ). Common misconceptions included pulse checking, AED indications, and choking management. More importantly, qualitative observations revealed specific local barriers: hesitation to perform CPR on the opposite sex due to cultural/religious norms, fear of legal liability, and physical fatigue during compressions among middle-aged women.

Based on this gap, a structured, interactive educational intervention was designed. The novelty of this community service lies in the integration of nursing theories (Orem and Neuman) with a highly contextualized andragogical approach. This includes legal empowerment, cultural adaptation, demographic-specific physical adjustments, and localized emergency scenarios. This article provides empirical evidence of the effectiveness of this contextualized, theory-guided BLS training and serves as a reference for community emergency preparedness programs.





## MATERIALS AND METHODS

### Study Design and Setting

This community service program utilized a quasi-experimental, one-group pretest-posttest design. The intervention was conducted on December 5, 2025, at the Main Hall of Air Squadron 21, Malang, Indonesia. This specific setting was selected due to its strategic role as a residential and social hub for Indonesian Air Force families, providing a highly cohesive environment for community-based emergency preparedness.

### Participants

The target population comprised members of PIA Ardhya Garini Branch 06-3/D.II Air Squadron 21. The inclusion criteria were: (1) active members of the organization, (2) able to attend the full training session, and (3) willing to participate as evidenced by signed informed consent. The exclusion criterion was having prior formal BLS certification (e.g., active healthcare professionals or certified first aiders). A total of 60 participants were enrolled using a total sampling technique.

### Intervention Description

The intervention was a "Contextualized Basic Life Support (BLS) Training," theoretically grounded in Orem's Self-Care Deficit Theory and Neuman's Systems Model. The intervention was designed and reported following the Template for Intervention Description and Replication (TIDieR) checklist:

1. **What and Why:** The training aimed to empower laypersons as "dependent care agents" (Orem) and strengthen community "lines of defense" (Neuman) against sudden cardiac arrest.
2. **Materials:** The physical materials included adult CPR mannequins, AED trainers, printed contextualized training modules, and pre/post-test questionnaires.
3. **Procedures:** The 6-hour program (08:00–14:00 WIB) was divided into three phases: (a) Pre-intervention (pretest and baseline assessment), (b) Core intervention (interactive lectures, instructor demonstrations, and hands-on simulations in a 1:10 instructor-to-participant ratio), and (c) Post-intervention (posttest and return demonstration).
4. **Who Provided:** The training was facilitated by a team of four certified nursing lecturers and emergency medical technicians from the Ministry of Health Polytechnic of Malang, all holding valid BLS instructor certifications.
5. **Tailoring and Contextual Modifications:** To ensure cultural and demographic congruence, the intervention integrated four specific modifications:
  - a. **Legal Empowerment:** Integration of the Indonesian Good Samaritan Law (Health Law No. 17 of 2023) to mitigate fear of legal liability.
  - b. **Cultural Adaptation:** Instruction on using physical barriers (e.g., clothing) during CPR to respect cross-gender touch norms.
  - c. **Demographic Adjustment:** Emphasis on "Hands-Only CPR" and ergonomic body mechanics to accommodate the physical capacity of middle-aged women.





- d. Localized Scenarios: Simulations were contextualized to daily events, such as choking during pengajian (religious gatherings) or sudden collapse during morning gymnastics.
6. Fidelity: Adherence to the 2020 American Heart Association (AHA) guidelines was ensured by using standardized, peer-reviewed training modules and continuous instructor supervision during simulations.

## Outcomes and Measurement

The primary outcome was the change in cognitive knowledge regarding BLS. Knowledge was measured using a 10-item True/False questionnaire covering the chain of survival, CPR steps, and AED usage. The instrument was developed based on the 2020 AHA guidelines and underwent content validation by three emergency nursing experts, yielding a Content Validity Index (CVI) of 0.89. A pilot test on 15 non-participants demonstrated a Cronbach's alpha of 0.78, indicating acceptable internal consistency.

## Data Analysis

Data were analyzed using IBM SPSS Statistics version 26.0. Normality of the data distribution was assessed using the Shapiro-Wilk test. Because the data were not normally distributed, the non-parametric Wilcoxon signed-rank test was utilized to evaluate the significance of differences between pretest and posttest scores. The magnitude of the intervention's effect was calculated using the Normalized Gain (N-Gain) formula:  $N\text{-Gain} = (\text{Posttest Mean} - \text{Pretest Mean}) / (\text{Maximum Score} - \text{Pretest Mean})$ . N-Gain values were categorized as low ( $<0.30$ ), moderate ( $0.30\text{--}0.70$ ), or high ( $>0.70$ ). Statistical significance was established at  $p < 0.05$ .

## Results and Discussion

Community service activities with the theme "Basic Life Support: Becoming First Aid in Our Environment" were carried out on Friday, December 5, 2025, at Air Squadron 21. This activity was attended by 60 members of PIA Ardhya Garini Branch 06-3 / D.II Air Squadron 21. The implementation methods applied included interactive lectures, demonstrations of Basic Life Support (BLS) techniques, direct practice simulations, as well as discussions and questions and answers. The materials presented included identifying emergency conditions, basic principles of BLS, the chain of survival, activation of the medical emergency system, and principles of choking management.

Activity evaluation was conducted to measure the success of the training in improving participants' knowledge and preparedness. The measurement was conducted through a competency test in the form of a pretest and posttest consisting of 10 questions related to the basic concepts of BHD, Cardiopulmonary Resuscitation (CPR) procedures, and the use of an Automated External Defibrillator (AED). Based on the results of the data analysis presented in Table 1, the average pretest score for participants was 6.87 (SD = 0.96) with a range of the lowest score of 5 and the highest of 8. This condition indicates that before the intervention, participants' initial knowledge of BHD was still in the sufficient category but not optimal and not fully in accordance with the latest guidelines. After the training, there was a significant increase in the average posttest score to 9.03 (SD = 0.74) with a range of scores from 8 to 10.





Table 1. Results of Statistical Analysis of BHD Knowledge Pretest and Posttest

Indicator	Mean	Elementary School	Min	Max	p-value
Pretest Score	6.87	0.96	5	8	0,000
Posttest Score	9.03	0.74	8	10	

To measure the effectiveness of the training, a Normalized Gain (N-Gain) analysis was conducted, resulting in a value of 0.67. Based on the N-Gain effectiveness criteria, this value falls into the "Moderate" category, approaching high, indicating that the applied training method is quite effective in improving participants' cognitive understanding. The results of the hypothesis test using the Wilcoxon test show a p-value = 0.000 ( $p < 0.05$ ), which means there is a very significant difference between the pretest and posttest scores.

The present study demonstrated that a contextualized Basic Life Support (BLS) training significantly enhanced the cognitive knowledge of lay bystanders, as evidenced by the substantial increase in posttest scores. This finding aligns with global literature emphasizing that structured, interactive BLS education is the most effective strategy for improving lay rescuer preparedness (Cheng et al., 2020; Yang et al., 2022). However, the significance of this study extends beyond mere knowledge acquisition; it elucidates how theoretically grounded, culturally adapted interventions can dismantle specific socio-cultural and legal barriers that traditionally inhibit bystander intervention in the Indonesian context.

The theoretical framework underpinning this intervention provides a robust explanation for its success. Viewed through the lens of Dorothea Orem's Self-Care Deficit Nursing Theory, the training successfully transitioned the participants' self-concept from passive community members to competent "dependent care agents." In the event of Out-of-Hospital Cardiac Arrest (OHCA), the victim experiences a universal self-care deficit. By addressing not only the clinical algorithms of BLS but also the psychosocial hesitations (e.g., fear of causing harm or legal repercussions), the intervention empowered these laywomen to confidently assume the dependent care agent role when a total self-care deficit occurs in their environment. Concurrently, aligning with Betty Neuman's Systems Model, this BLS training functioned as a potent primary prevention mechanism. By equipping the PIA members with life-saving skills and legal confidence, the intervention fortified the community's "flexible lines of defense," ensuring a rapid, effective environmental response to the sudden stressor of cardiac arrest before it penetrates the core and results in system breakdown (death).

The contextual modifications applied in this study were critical in bridging the gap between standardized clinical guidelines and local realities. Prior to the training, qualitative observations revealed significant localized barriers: hesitation to perform CPR on the opposite sex due to religious norms, and a pervasive fear of legal liability. Global studies, particularly in Asian contexts, corroborate that cultural modesty and fear of litigation are primary deterrents to bystander CPR (Kiguchi et al., 2020; Yan et al., 2020). By integrating the Indonesian Good Samaritan Law (Health Law No. 17 of 2023) and teaching the use





of physical barriers for cross-gender CPR, this intervention directly mitigated these deterrents. Furthermore, the demographic adaptation—emphasizing "Hands-Only CPR" and ergonomic body mechanics—addressed the physical limitations often faced by middle-aged female rescuers, thereby building physical self-efficacy and reducing the anxiety of rescuer fatigue (Lopez et al., 2020).

Critically, the Normalized Gain (N-Gain) of 0.67, categorized as moderate, warrants analytical reflection. While the cognitive improvement is statistically significant, the moderate gain suggests that the density of the material within a single six-hour session induced a degree of cognitive overload, compounded by the natural cognitive variations within a middle-aged demographic. More importantly, BLS is inherently a psychomotor skill, and cognitive posttests do not fully capture psychomotor decay. Literature consistently shows that lay rescuer CPR skills deteriorate significantly within 3 to 6 months without reinforcement (Yang et al., 2022). Therefore, the moderate N-Gain underscores the necessity of transitioning from a one-time educational event to a continuous community nursing program with periodic refreshers.

### **Novelty and Contribution to Community Nursing Practice**

The primary novelty of this community service lies in the paradigm shift from a purely clinical BLS training to a socio-cultural-legal-clinical empowerment model tailored to the Indonesian context, operationalized through Orem's and Neuman's nursing theories. Unlike conventional BLS programs that focus solely on the "how-to" of resuscitation, this intervention uniquely integrates the Indonesian Good Samaritan Law to transform legal frameworks from perceived barriers into catalysts for self-efficacy, and adapts clinical techniques (e.g., physical barriers for cross-gender touch, Hands-Only CPR) to respect local religious and demographic realities. By conceptualizing the bystander not merely as a first responder, but as a culturally sanctioned, legally protected, and theoretically empowered "dependent care agent" (Orem) who fortifies the community's primary prevention lines of defense (Neuman), this study provides a replicable, context-specific blueprint for community nursing practice. It proves that in collectivist and culturally diverse societies like Indonesia, emergency preparedness programs must intertwine clinical excellence with cultural congruence and legal empowerment to achieve sustainable community resilience.

### **Limitations and Future Directions**

Despite the robust findings and the innovative integration of nursing theories with contextual modifications, several limitations must be acknowledged. First, the use of a single-group pretest-posttest design without a control group limits the ability to definitively rule out external confounding variables, although the high N-Gain provides strong evidence of the intervention's effect. Second, the sample was drawn exclusively from PIA Ardhya Garini, a highly organized, cohesive, and military-affiliated community. While this provided an excellent environment for a structured intervention, it may limit the external validity and generalizability of the findings to the broader, more heterogeneous general public with varying socio-economic and educational backgrounds.

Third, and most critically, this study relied solely on cognitive assessments to measure outcomes. Basic Life Support is fundamentally a psychomotor skill; while cognitive knowledge is a vital prerequisite, it does not guarantee the execution of high-quality CPR (e.g., adequate compression depth, rate, and recoil). The absence of an objective psychomotor evaluation—such as an Objective Structured Clinical Examination (OSCE) or a standardized skills checklist using sensor-equipped feedback mannequins—





means that actual clinical competence was not objectively quantified. Finally, the study only captured immediate post-intervention outcomes. Given the well-documented phenomenon of BLS skill decay within 3 to 6 months among lay rescuers, the lack of longitudinal follow-up prevents an understanding of the long-term sustainability of this training. Future community nursing research should employ randomized controlled designs, incorporate objective psychomotor assessments, and include longitudinal follow-ups at 6 and 12 months to evaluate the true long-term retention and community impact of this socio-cultural-legal empowerment model.

## CONCLUSIONS

Community service activities with the theme "Basic Life Support: Becoming First Aid in Our Environment" carried out on 60 members of PIA Ardhya Garini Ranting 06-3/D.II Air Squadron 21 proved to be effective in increasing participants' knowledge and preparedness in facing medical emergencies, as indicated by a significant increase in the average posttest score ( $9.03 \pm 0.74$ ) compared to the pretest ( $6.87 \pm 0.96$ ) with a p value = 0.000 and a Normalized Gain of 0.67 (moderate category). The combination of interactive lecture methods, demonstrations, and direct practice simulations that integrate andragogy and experiential learning approaches successfully corrected participants' misconceptions regarding BHD procedures, AED use, and choking treatment, while strengthening their role as first responders in strengthening the initial link in the chain of survival in the Indonesian Air Force family environment and the surrounding community. However, considering the phenomenon of decreased retention of BHD skills in lay rescuers within a period of 3–6 months, a periodic refresher training program every 6–12 months is needed to maintain the cognitive and psychomotor competencies of participants, as well as expanding the scope of similar training to other communities as a strategic effort to improve emergency preparedness at the community level.

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## Conflict of Interest

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