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Public Training on Introduction and First Aid for Cardiac Arrest at SMAN 1 Kubu Raya

Fakrul Ardiansyah^{1*}, Azhari Baedlawi², Hieronimus amandus³, Vitria Wuri Handayani⁴, Eli Saripah⁵

1-4 Nursing Departement, Poltekkes Kemenkes Pontianak

5. Nursing Departement, Poltekkes Kemenkes Palu

*Email: fakrul.ns@gmail.com



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ABSTRACT

Background: The global incidence of out-of-hospital cardiac arrest (OHCA) is a significant public health concern, though its precise rate in Indonesia remains unquantified. Cardiovascular diseases are a leading cause of mortality in Indonesia, contributing to a high burden of risk factors for OHCA. Enhancing community preparedness through basic life support (BLS) training is a critical strategy to improve survival rates.

Objective: This study aimed to evaluate the impact of a BLS training program on the knowledge and practical skills of students at SMAN 1 Sungai Ambawang in managing cardiac arrest.

Methods: A single-group, pre-test-post-test study design was employed. Participants' knowledge and skills were assessed immediately before and after a structured BLS training session. The Wilcoxon signed-rank test was used to analyze the differences in median scores, with a significance level of $\alpha < 0.05$.

Results: A total of 50 students participated. The median knowledge score increased from 63.66 (pre-test) to 86.50 (post-test). The median practical skills score demonstrated a more substantial improvement, rising from 36.00 to 94.06. The statistical analysis confirmed that these improvements were significant for both knowledge ($p=0.001$) and skills ($p=0.001$).

Conclusion: A single session of BLS training significantly improved the knowledge and practical skills of high school students in cardiac arrest management. Implementing such training in school curricula is recommended to empower the lay public as potential first responders, thereby strengthening the chain of survival for OHCA victims in the community.



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BACKGROUND

Out-of-hospital cardiac arrest (OHCA) represents a critical public health challenge worldwide. The scale of the issue is significant, with approximately 350,000

and 400,000 annual cases in the United States and Europe, respectively. Coronary heart disease remains the predominant underlying cause, as it has been in the United States for the past 15 years (Junedahl et al., 2023). Globally, the incidence of OHCA attended by emergency medical services (EMS) varies widely, from 30 to 97.1 per 100,000 population, with survival rates remaining dismally low in many regions; for instance, Beijing reports a survival rate of just 1.3% (Xie et al., 2023). These figures underscore the severity of the OHCA epidemic and the urgent need for improved response strategies.

The cornerstone of improving OHCA outcomes lies in the "Chain of Survival," which begins with immediate bystander intervention. Timely and effective action can dramatically alter a victim's prognosis. Evidence indicates that patients receiving assistance from emergency response teams see survival rates increase by 20% across all cases and by up to 50% in instances of ventricular fibrillation (Rea et al., 2021; Xie et al., 2023). This highlights that the window of opportunity for saving lives is narrow and heavily dependent on the actions of laypersons at the scene.

Despite the proven importance of immediate care, a significant gap persists in the first link of the Chain of Survival. Globally, bystander CPR is initiated in only about 40% of OHCA, and the use of automated external defibrillators (AEDs) by lay rescuers before EMS arrival is even lower, at less than 12% (Lavonas et al., 2020). This gap is primarily attributed to a widespread lack of public knowledge and confidence in performing Basic Life Support (BLS) (Berg et al., 2020). The quality of CPR is further influenced by various factors, including the rescuer's knowledge, training, and physical conditioning (Ardiansyah et al., 2019). Another study found that basic life support training improved nursing students' knowledge of managing patients in cardiac arrest. (Jamil, 2022). However, community service for pool staff, utilizing the seminar method and the provision of training modules, could enhance their knowledge, attitudes, and practices in this area (Jamil, 2021). This evidence confirms that educational interventions are a viable solution to address the critical barrier of low bystander intervention rates.

The challenge of OHCA is particularly acute in Indonesia, where a high burden of cardiovascular disease compounds the risk. National data reveals a significant prevalence of heart disease and hypertension, with West Kalimantan province reporting rates of 7.89% and 8.16% in adults, respectively (Kemenkes RI, 2018). These non-communicable diseases are major risk factors for cardiac arrest. The situation is exacerbated in areas like Kubu Raya Regency, where geographical barriers and limited healthcare infrastructure can lead to prolonged EMS response times, sometimes exceeding four to six hours due to difficult terrain and reliance on water transportation (Tarmizi, 2022). A recent tragic incident at the Sungai Ambawang Community Health Center, where a victim died from a cardiac arrest while waiting, starkly illustrates the lethal consequences of this preparedness gap (Ferryanto, 2023).

In such resource-limited settings, equipping the community to act as first responders is not just beneficial—it is essential. Adolescents, particularly those involved in organizations like the Red Cross Youth (Palang Merah Remaja or PMR), represent a strategic and highly potential resource. They are a dynamic, accessible, and often untapped group that can be mobilized to strengthen community resilience. Bridging the gap between the high risk of OHCA and the low level of community preparedness requires a targeted, evidence-based intervention. Therefore, this community service initiative was designed to implement and evaluate a BLS training program specifically for PMR students at SMAN 1 Sungai Ambawang. The primary objective was to enhance their knowledge and practical skills in recognizing OHCA,

performing high-quality, chest-compression-only CPR, and understanding the role of public-access defibrillation. By empowering this cohort of youth, this program aims to fortify the first link in the Chain of Survival within the community, creating a cadre of confident first responders capable of saving lives before professional help arrives.

METHOD OF IMPLEMENTATION

This community service project was conducted in collaboration with SMAN 1 Sungai Ambawang on August 7th and 8th, 2025. Participants were recruited through a purposive sampling method from the school's Red Cross Youth (Palang Merah Remaja or PMR) members and the School Health Program (Usaha Kesehatan Sekolah or UKS). With the assistance of the school principal and the vice principal for student affairs, a total of 50 students were enrolled as participants. The BLS training was conducted over one day, split into theoretical and practical sessions, and facilitated by a team of instructors certified in Basic Trauma and Cardiac Life Support (BTCLS). The intervention covered the following key components based on the latest guidelines: Theory Session: This included recognizing the signs of out-of-hospital cardiac arrest (OHCA), activating the emergency medical services (EMS), the concept of the Chain of Survival, and the principles of high-quality cardiopulmonary resuscitation (CPR). Practical Session: Instructors demonstrated hands-on skills, focusing on: Performing high-quality chest compressions (correct hand position, depth, rate, and allowing full chest recoil), the hands-only CPR technique for lay rescuers and a public demonstration was followed by a question-and-answer (Q&A) session to clarify concepts.

Data was collected at three points: Pre-test: Before the training began, participants completed a knowledge questionnaire. This instrument consisted of 15 multiple-choice questions covering the recognition of OHCA and BLS procedures, Skills Assessment (Post-training): After the practical session, each participant's competency was evaluated using a CPR skills checklist on a Laerdal-type mannequin. The checklist assessed critical steps like safety check, calling for help, correct hand placement, compression depth (5-6 cm), and rate (100-120 compressions per minute) and Post-test: Immediately following the completion of all training activities, participants retook the same knowledge questionnaire used in the pre-test.

RESULT AND DISCUSSION

This community service activity was conducted with 50 participants from SMAN 1 Sungai Ambawang. The effectiveness of the Basic Life Support (BLS) training was evaluated by measuring changes in participants' knowledge and practical skills.

1. Knowledge and Skills Scores Before and After Training

The pre-test and post-test scores for knowledge and skills are summarized in Table 1. A substantial increase was observed in both median scores following the training intervention.

Table 1. Pre-test and Post-test Scores for Knowledge and Skills in Basic Life Support (BLS) (n=50)

Variables	Assessment Time	Mean	Median	Min	Max
Knowledge	Before	63.66	67	27	100
	After	86.50	93	33	100
Skills	Before	34.34	36	9	82
	After	94.06	91	73	100

The median knowledge score increased from 67 (pre-test) to 93 (post-test). An even more pronounced improvement was seen in practical skills, where the median score rose from 36 to 91.

2. Statistical Analysis of Training Effectiveness

As the data was not normally distributed (Shapiro-Wilk test, $p < 0.05$ for both knowledge scores and pre-training skills), the non-parametric Wilcoxon Signed-Rank Test was used to analyze the significance of the changes. The results, presented in Table 2, confirm that the improvements in both knowledge and skills were statistically significant.

Table 2. Statistical Analysis of Pre-test and Post-test Differences (Wilcoxon Signed-Rank Test)

Variables		Median	Mean Difference	P Value
Knowledge	Before	67	22.88	0.001*
	After	93		
Skills	Before	36	59.58	0.001*
	After	91		

The analysis yielded a p-value of 0.001 for both knowledge and skills, which is less than the significance level of $\alpha = 0.05$. This indicates that the BLS training intervention had a statistically significant effect on improving both the knowledge and practical skills of the participants.

This community service initiative demonstrates the powerful impact of a structured Basic Life Support (BLS) training program on high school students' emergency response capabilities. The statistically significant improvements in both knowledge and practical skills ($p=0.001$) highlight the effectiveness of hands-on training in building community resilience for out-of-hospital cardiac arrest (OHCA) response.

The substantial improvement in theoretical knowledge, with the median score increasing from 67 to 93, aligns with established educational principles that structured training effectively transfers essential BLS concepts to laypersons (Beck et al., 2015). This knowledge acquisition is crucial as understanding the "Chain of Survival" provides the cognitive framework for appropriate emergency response (Greif et al., 2021). However, the most remarkable finding was the dramatic improvement in practical skills,

where the median score surged from 36 to 91. This disproportionate gain underscores a critical insight: while theoretical knowledge forms the foundation, hands-on practice is indispensable for developing psychomotor competency in life-saving techniques (Schroeder et al., 2023).

The exceptionally low pre-training skills score (Median=36) reveals a significant preparedness gap in our community, consistent with global reports of inadequate BLS competency among laypersons (Villani et al., 2021). This deficiency is particularly concerning given that high-quality chest compressions are the cornerstone of successful OHCA resuscitation (Amorim et al., 2018). The transformation to a post-training median of 91 demonstrates that even brief, focused training can effectively bridge this competency gap. The greater magnitude of improvement in skills versus knowledge reinforces the pedagogical superiority of experiential learning for psychomotor skill acquisition (Auerbach et al., 2016).

Our findings strongly support the strategic value of targeting adolescent populations for BLS training. The students' rapid skill acquisition mirrors results from school-based resuscitation education programs in other settings (Böttiger et al., 2020). As digital natives and influential community members, adolescents represent an ideal demographic for creating sustainable public health impact through peer-to-peer knowledge dissemination (Cave et al., 2011). Training this cohort effectively creates a multiplier effect, potentially increasing the community's pool of competent first responders over time (Plant & Taylor, 2013).

The statistically significant results ($p=0.001$) provide compelling evidence for the intervention's effectiveness, consistent with other studies demonstrating that structured BLS training produces measurable improvements in learner competency (Anderson et al., 2019). Consistent with existing research, our results corroborate the foundational role of education in improving BLS knowledge, as seen in the comparable findings of (Ardiansyah et al., 2024). Furthermore, the significant skill acquisition in our participants underscores the training's success in addressing key performance factors like knowledge and self-awareness (Ardiansyah et al., 2020), a pattern of effectiveness that mirrors successful implementations in other community settings, such as those reported by Jamil (2021,2022).

From a public health perspective, these findings address the critical challenge of low bystander CPR rates, which remain a major barrier to improving OHCA survival outcomes globally (Yan et al., 2020). The demonstrated effectiveness of our training model offers a replicable framework for communities facing similar challenges in low-resource settings (Semeraro et al., 2021). However, the literature clearly indicates that BLS skills decay without periodic reinforcement (Niles et al., 2017), necessitating the implementation of refresher training to maintain long-term competency.

The integration of this training within the existing Red Cross Youth (PMR) infrastructure represents an efficient approach to sustainable capacity building (Hammad et al., 2023). This organizational embedding facilitates ongoing practice and reinforcement, potentially mitigating the skill attenuation observed in many one-time training initiatives.



Picture 1 and 2: Implementing Public Training on Introduction and First Aid for Cardiac Arrest on the Knowledge and Skills of Students at SMAN 1 Sungai Ambawang Kubu Raya

Conclusion and Suggestion

Conclusion : The community service initiative on Basic Life Support (BLS) conducted at SMAN 1 Sungai Ambawang was highly effective. The analysis demonstrates a statistically significant improvement in both the knowledge and practical skills of participants in managing out-of-hospital cardiac arrest (OHCA). The substantial increase in post-test scores, particularly in hands-on CPR competency, confirms that a single, structured training session can successfully equip high school students with critical lifesaving abilities. This project successfully empowered a group of students to act as potential first responders, thereby strengthening the first link in the Chain of Survival within their school and broader community. **Suggestions** Based on the success of this program, the following actions are recommended: For SMAN 1 Sungai Ambawang and the Education Department: Institutionalize BLS Training: Integrate BLS training into the school's annual curriculum, particularly as a core component of the Red Cross Youth (PMR) and School Health Program (UKS) activities. This will ensure all incoming students have the opportunity to learn these skills. Conduct Refresher Courses: Organize brief refresher sessions every six to twelve months to help students retain their knowledge and skills over the long term. For the Sungai Ambawang Community Health Center (Puskesmas): Adopt a "Train-the-Trainer" Model: Collaborate with the school to identify the most proficient students from this training and provide them with additional instruction to become peer tutors. This creates a sustainable, internal capacity for ongoing training within the school. Expand to the Wider Community: Use the successful model developed at SMAN 1 Sungai Ambawang as a blueprint to implement similar BLS training programs in other schools, community centers, and for local businesses in the Kubu Raya Regency.

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