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The Effectiveness of Peer Education vs. Leaflets on Basic Life Support Knowledge among High School Students

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ABSTRACT

Equipping high school students with Basic Life Support (BLS) skills is crucial for managing out-of-hospital cardiac emergencies, yet the comparative effectiveness of peer education versus conventional leaflet-based instruction in Indonesia remains underexplored. This quasi-experimental pretest-posttest study involved 60 twelfth-grade students at Senior High School 3 Banjarbaru. Participants were equally divided into an intervention group receiving peer-supported BLS training (n=30) and a control group receiving leaflet-based education (n=30). Knowledge was assessed using a validated 15-item questionnaire. While both interventions significantly improved BLS knowledge (Wilcoxon Signed-Rank Test: intervention, $p < 0.001$; control, $p = 0.003$), the peer-supported group demonstrated a greater score increase (from 1.83 ± 0.38 to 3.00 ± 0.00) compared to the control group (from 1.93 ± 0.25 to 2.23 ± 0.43). Furthermore, post-test knowledge scores were significantly higher in the intervention group (Mann-Whitney $U = 36.000$, $p = 0.030$). In conclusion, peer-supported BLS training is significantly more effective than leaflet-based education. Integrating peer-led or hybrid approaches into school curricula is recommended to optimize students' emergency preparedness.

Membekali siswa SMA dengan keterampilan Bantuan Hidup Dasar (BHD) sangat penting untuk penanganan henti jantung di luar rumah sakit, namun efektivitas pendidikan berbasis teman sebaya (peer education) dibandingkan instruksi leaflet di Indonesia masih jarang diteliti. Penelitian kuasi-eksperimental pretest-posttest ini melibatkan 60 siswa kelas XII di SMA Negeri 3 Banjarbaru yang dibagi rata menjadi kelompok pelatihan BHD berbasis teman sebaya (n=30) dan kelompok kontrol berbasis leaflet (n=30). Pengetahuan diukur menggunakan kuesioner 15 item tervalidasi. Meskipun kedua metode secara signifikan meningkatkan pengetahuan BHD (Uji Wilcoxon: intervensi, $p < 0,001$; kontrol, $p = 0,003$), kelompok teman sebaya menunjukkan peningkatan skor yang lebih besar (dari $1,83 \pm 0,38$ menjadi $3,00 \pm 0,00$) dibandingkan kelompok leaflet (dari $1,93 \pm 0,25$ menjadi $2,23 \pm 0,43$). Skor post-test antar kelompok juga menunjukkan perbedaan yang signifikan, di mana kelompok intervensi lebih unggul (Uji Mann-Whitney $U = 36,000$, $p = 0,030$). Sebagai kesimpulan, pelatihan BHD berbasis teman sebaya secara signifikan lebih efektif daripada pendidikan berbasis leaflet. Sekolah disarankan mengintegrasikan pendekatan ini ke dalam kurikulum guna mengoptimalkan kesiapsiagaan siswa dalam menghadapi kondisi kegawatdaruratan.

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Introduction

Cardiac arrest is a life-threatening medical emergency that often occurs suddenly without prior warning and can result in death if not managed promptly and appropriately. The majority of cardiac arrest events occur outside hospital settings; therefore, survival largely depends on the speed and accuracy of immediate assistance provided by bystanders at the scene (O'Keefe et al., 2025). Delays in emergency response frequently arise due to limited access to healthcare services and inadequate public knowledge of cardiopulmonary resuscitation (CPR). This is particularly critical given the very short golden period for cardiac arrest management, which is approximately the first 10 minutes following onset (Nguyen et al., 2024). Cardiovascular diseases remain the

leading cause of death worldwide. The World Heart Federation (2023) reported that approximately 17.9 million deaths annually are attributable to cardiovascular diseases, accounting for nearly 32% of total global mortality, with sudden cardiac death representing a major contributor (World Heart Federation, 2023). Survival rates following out-of-hospital cardiac arrest (OHCA) remain low, ranging from 8% to 10% in the United States and Europe, with even lower rates reported in the Middle East, estimated between 2% and 10% (Tabi et al., 2024).

According to the 2018 Basic Health Research (Riset Kesehatan Dasar/Riskesdas) conducted by the Indonesian Ministry of Health, the prevalence of heart disease among the Indonesian population was 1.5%, indicating that 15 out of every 1,000 individuals were affected. Although this percentage appears relatively low, the absolute number of affected individuals is substantial, with approximately 4.2 million cases recorded in 2021 (Wicaksono et al., 2025). In South Kalimantan Province, the prevalence of heart disease was reported at 0.66%. Data from the South Kalimantan Provincial Health Office as of October 28, 2024, indicated that there were 891 recorded cases of heart disease in 2023, including 357 cases in Banjarmasin City (Marisa et al., 2025). Data from the Banjarbaru City Health Office in 2023 recorded a total of 137 cases of individuals with coronary heart disease (CHD). The highest number of new CHD cases in Banjarbaru was reported in the service area of Banjarbaru Selatan Primary Health Center, with 48 cases. Furthermore, the results of a preliminary study conducted among 25 twelfth-grade students at Senior High School 3 Banjarbaru revealed that 80% of students had never received any information regarding Basic Life Support (BLS), while the remaining 20% had previously received information but had never participated in BLS training. These findings highlight the urgent need for systematic preventive measures and improved community preparedness for medical emergencies.

Basic Life Support (BLS) is a critical initial intervention in the management of cardiac arrest and respiratory arrest (Maria & Wardhani, 2024). BLS aims to maintain circulation and oxygenation until advanced medical care becomes available, thereby increasing survival rates and reducing the risk of permanent disability (Maria & Wardhani, 2025). The American Heart Association (2020) emphasized that the success of cardiopulmonary resuscitation (CPR) is highly time-dependent, as each minute of delay significantly reduces the likelihood of survival. Therefore, the ability of laypersons, including students, to perform BLS is essential (Nguyen et al., 2024). Health education is a key strategy for improving community knowledge and skills related to medical emergencies. Providing health education during adolescence is considered particularly effective, as it promotes the development of long-term healthy behaviors and enhances preparedness for emergency situations (Mathar et al., 2024). Senior high school students represent a strategic target group for BLS education because of their strong cognitive abilities, high levels of curiosity, and potential role as first responders within school settings and the broader community (Zenani et al., 2022).

One innovative and effective health education approach is peer education, a learning method that involves peers serving as educators. This approach has been shown to enhance learners' understanding, attitudes, and skills by fostering a more communicative and participatory learning environment (Dodd et al., 2022). The effectiveness of peer education can be theoretically explained by Bandura's *Social Learning Theory*, which emphasizes learning through observation and modeling from peers, and Vygotsky's *Zone of Proximal Development*, which highlights the benefits of peer scaffolding to support learners' skill acquisition (Spartinou et al., 2024). Evidence indicates that school-based peer education interventions significantly improve adolescents' health knowledge and attitudes compared to conventional educational methods, largely due to their interactive and participatory nature. A global systematic review further reported that peer education in school settings improves various adolescent health indicators, including knowledge and attitudes toward diverse health-related issues (Dodd et al., 2022).

Despite the growing body of research on BLS education in school settings, most studies focus on conventional instructional approaches, including lectures and leaflet-based education. Leaflets are commonly used in Indonesian school-based health promotion programs because they are inexpensive, easy to distribute to large groups of students, require minimal training for implementation, and can be integrated into routine health education activities conducted by teachers or healthcare personnel. However, their passive nature may limit learner engagement and knowledge retention. Empirical evidence comparing peer education with leaflet-based education, particularly within the Indonesian cultural and educational context, remains limited. Therefore, this study addresses a clear research gap by comparing peer education with leaflet-based education, which serves as

a standard control method in many school-based interventions. By doing so, the study aims to provide evidence-based insights into effective, scalable, and culturally appropriate strategies to enhance BLS knowledge and emergency preparedness among senior high school students.

Research Methodology

Research Design

This study employed a quasi-experimental design using a two-group pretest–posttest approach to compare an intervention group and a control group before and after the intervention. Prior to the implementation of Basic Life Support (BLS) health education, a pretest questionnaire was administered to all respondents to assess baseline BLS knowledge. Ten students were selected as peer educators based on teacher recommendations and students' willingness to participate, with consideration given to their communication skills and academic performance. These selected students participated in a one-day intensive BLS training program conducted by a lecturer certified in Basic Trauma and Cardiac Life Support (BTCLS). The training included both theoretical instruction and hands-on simulation covering safety assessment, victim responsiveness, activation of emergency medical services, circulation support, airway and breathing management, and the recovery position. To ensure the competency of peer educators prior to delivering the intervention, an assessment was conducted at the end of the training session. This assessment consisted of direct observation of practical BLS skills and a brief knowledge evaluation. Only students who demonstrated adequate understanding and correct performance of BLS procedures were assigned as peer educators. This procedure was implemented to maintain consistency of the intervention and to minimize potential threats to internal validity. Following the training and competency assessment, the peer educators delivered BLS education to students in the intervention group through interactive sessions that emphasized simulation-based learning and peer-led instruction. After completion of the peer education intervention, a posttest questionnaire was administered to assess changes in BLS knowledge. In contrast, the control group received BLS education exclusively through leaflet-based materials, which represent a commonly used, low-cost educational approach in resource-limited settings. No peer education or practical training was provided to this group. A posttest questionnaire was similarly administered to evaluate changes in knowledge following the leaflet-based education.

Research Instrument

The research instrument used to assess Basic Life Support (BLS) knowledge consisted of a 15-item questionnaire. A weighted scoring system was applied, where correct answers were scored 2 and incorrect answers were scored 1, resulting in a total raw score range of 15 to 30. Based on the scale interval length, these raw scores were then transformed into three ordinal categories of knowledge levels: Poor (scores 15–20, coded as 1), Sufficient (scores 21–25, coded as 2), and Good (scores 26–30, coded as 3). The statistical means reported in Table 3 were calculated based on these categorical codes (1, 2, and 3). The questionnaire was adopted from Astawa (2022), who reported acceptable validity and reliability. Because the instrument had previously been validated and the item content was not modified, no additional validity or reliability testing was conducted prior to administration.

Research Location and Period

The study was conducted from October 6 to October 10, 2025, at Senior High School 3 Banjarbaru.

Population and Sample

The study population consisted of twelfth-grade students at Senior High School 3 Banjarbaru. A total of 60 twelfth-grade students were recruited as the study sample using consecutive sampling based on the study's inclusion and exclusion criteria. The inclusion criteria were as follows: (1) twelfth-grade students at Senior High School 3 Banjarbaru, with respondents selected proportionally from each class; (2) ability to communicate effectively during interviews and questionnaire completion; and (3) willingness to participate in the study, including attending the educational sessions and training. The exclusion criteria included: (1) students with a history of heart disease; (2) students currently undergoing treatment for chronic illnesses; (3) students who were not enrolled in the twelfth grade at Senior High School 3 Banjarbaru; (4) students with communication impairments or who were uncooperative, making them unable to complete interviews or questionnaires; and (5) students who were unwilling to participate in Basic Life Support (BLS) training.

Data Analysis

Data analysis was conducted using statistical hypothesis testing to examine differences in students' knowledge levels. A significance level of $p < 0.05$ was used to determine statistical significance. If the significance value was less than 0.05, a statistically significant difference was concluded, and the null hypothesis (H_0) was rejected. Conversely, if the significance value was greater than 0.05, no statistically significant difference was identified, and the null hypothesis (H_0) was accepted. Although the initial Kolmogorov–Smirnov normality test indicated that the data were normally distributed (n = 60), non-parametric tests were employed because the knowledge level was analyzed as categorical ordinal data (1 = Poor, 2 = Sufficient, 3 = Good). The Wilcoxon Signed-Rank Test was applied to evaluate the intra-group differences between pre-test and post-test scores. Meanwhile, the Mann-Whitney U Test was used for inter-group comparisons to examine differences between the intervention and control groups' post-test scores.

Ethical Consideration

The Research Ethics Committee of STIKES Intan Martapura issued an ethical clearance approval for this study (Approval No. 067/KE/YBIP-SI/X/2025). To ensure the protection and safety of the participants, the study obtained all necessary permissions, and informed consent was provided and signed by all respondents prior to data collection.

Result

The results of the study regarding the demographic characteristics of the respondents, including gender, age, and prior exposure to Basic Life Support (BLS) training, are presented in Table 1 below.

Table 1.
The Characteristics of the Respondents

Characteristics	Intervention Group		Control Group	
	n	%	n	%
Gender				
Male	12	40	12	40
Female	18	60	18	60
Age (Years)				
16	1	4	0	0
17	28	92	29	96
18	1	4	1	4
Previous BLS Training				
Yes	0	0	0	0
No	30	100	30	100

(Primary Data, 2025)

Table 1 shows that a total of 60 respondents participated in the study, consisting of 30 students in the intervention group and 30 students in the control group. Based on the respondents' characteristics, the majority were female and aged 17 years in both groups. All respondents in both the intervention and control groups reported having no prior experience or training in Basic Life Support (BLS).

Table 2
Frequency Distribution of Students' Knowledge Levels

Knowledge Level	Intervention Group				Control Group			
	Pre Test	%	Post Test	%	Pre Test	%	Post Test	%
Good	0	0	30	100	0	0	7	24
Sufficient	24	80	0	0	28	94	23	76
Poor	6	20	0	0	2	6	0	0
Total	30	100	30	100	30	100	30	100

(Primary Data, 2025)

Based on Table 2, prior to the intervention, the majority of respondents in the intervention group demonstrated a sufficient level of knowledge (80%), while most respondents in the control group also exhibited sufficient knowledge (94%). After the intervention, all respondents in the intervention group achieved a good level of knowledge (100%). In contrast, following the intervention, the majority of respondents in the control group remained at a sufficient level of knowledge (76%).

Table 3
Mean Knowledge Score of Students

Group		N	Mean	Std. Deviation
Intervention	Pre	30	1.83	0.379
	Post	30	3.00	0.000
Control	Pre	30	1.93	0.254
	Post	30	2.23	0.430

(Primary Data, 2025)

Note: The Mean and Std. Deviation were calculated from transformed categorical codes (1 = Poor, 2 = Sufficient, 3 = Good). The Std. Deviation of 0.000 in the Intervention Post-test group indicates a "ceiling effect," where 100% of the respondents (n=30) successfully achieved the "Good" knowledge category (coded as 3) after the intervention.

Based on Table 3, there was an increase in the mean knowledge scores of students in the intervention group after the intervention compared to before the intervention. Although the control group also demonstrated an increase in mean knowledge scores from pretest to posttest, the magnitude of improvement was notably smaller than that observed in the intervention group.

Table 4
Results of the Normality Test.

		Unstandardized Residual
N		60
Normal Parameters[a]	Mean	0.0000000
	Std. Deviation	1.77343795
Most Extreme Differences	Absolute	0.112
	Positive	0.084
	Negative	-0.112
Kolmogorov-Smirnov Z		0.871
Asymp. Sig. (2-tailed)		0.433

(Primary Data, 2025)

Based on Table 4, the results of the normality test using the Kolmogorov–Smirnov method showed an asymptotic significance value of 0.433 ($p > 0.05$), indicating that the data were normally distributed.

Table 5
Wilcoxon Signed-Rank Test Results

Group		p-value
Intervention	Pre-Post	0.000
Control	Pre-Post	0.003

(Primary Data, 2025)

Based on Table 5, the results of the Wilcoxon Signed-Rank Test demonstrated a statistically significant difference in knowledge levels before and after the intervention in both groups. In the intervention group, the p-value was 0.000 ($p < 0.05$), indicating a highly significant improvement in knowledge following the peer education intervention. Similarly, the control group also showed a statistically significant difference between pre-test and post-test scores ($p = 0.003$), although the magnitude of rank change was smaller than that observed in the intervention group.

Table 6
Mann-Whitney U Test

Rank				
Pre	Group	N	Mean Rank	Sum of Rank
	Intervention	30	15.50	465.00
	Control	30	40.10	510.00
	Total	60		
Post	Intervention	30	1.50	45.00
	Control	30	30.25	305.00
	Total	60		

Test Statistics		
	Pre-test (Intervention vs. control)	Post-test (Intervention vs. control)
Mann-Whitney U	3.000	36.000
Wilcoxon W	218.000	308.000
Z	-5.108	-3.000
Asymp. Sig. (2 tailed)	0.00	0.03
Exact Sig. [2*(1 tailed Sig.)]	0.00	0.03

(Primary Data, 2025)

Table 6 presents the results of the Mann-Whitney U test comparing the Basic Life Support (BLS) knowledge levels between the intervention group (peer support-based BLS training) and the control group (leaflet-based education). At the pre-test stage, a significant baseline difference was observed between the two groups ($U = 3.000$; $Z = -5.108$; $p < 0.001$). Following the intervention (post-test), the Mann-Whitney U test revealed a statistically significant difference in knowledge levels between the intervention group (Mean Rank = 1.50) and the control group (Mean Rank = 30.25), with $U = 36.000$; $Z = -3.000$; $p = 0.030$. These findings indicate that peer-supported BLS training was significantly more effective in improving students' knowledge than leaflet-based education.

Discussion

Characteristics of respondents in the intervention and control groups

Based on the demographic data, the majority of respondents were female (60%), while 40% were male. Most respondents were 17 years old (95%), followed by those aged 18 years (3.33%) and 16 years (1.67%). These findings are consistent with the results of a study by Ramadia et al. (2021), which reported that the majority of respondents were female and predominantly 17 years of age (Ramadia et al., 2021). Regarding prior exposure to Basic Life Support (BLS) training, all respondents (100%) reported that they had never received BLS training before participating in this study. This finding is also consistent with previous research by Baklola et al. (2025), which demonstrated that the majority of respondents had no prior experience with BLS training (Baklola et al., 2025).

The Effectiveness of Peer Education on Basic Life Support Knowledge among Students

The level of knowledge among respondents in the intervention group prior to receiving Basic Life Support (BLS) training through the peer education method was predominantly categorized as sufficient (80%). After the peer education–based BLS training, all respondents in the intervention group achieved a good level of knowledge (100%). In the control group, before receiving BLS education, the majority of respondents also demonstrated a sufficient level of knowledge (93.33%). Following BLS education delivered through leaflet media, most respondents in the control group remained at a sufficient knowledge level (76.67%). These findings are consistent with the study by Pangestika et al. (2024), which reported that knowledge levels prior to education were predominantly sufficient (70%) and increased substantially to a good level (96.7%) following educational intervention (Pangestika et al., 2024).

The observed differences between the intervention and control groups can be attributed to the interactive and participatory nature of peer education. Peer education fosters social interaction and reduces power distance between students and instructors, allowing students to feel more comfortable asking questions and discussing difficult concepts with their peers rather than with teachers. This supportive peer dynamic may decrease anxiety,

encourage engagement, and enhance motivation, which are critical factors for effective learning, particularly for practical skills like BLS (Begjani et al., 2024).

The substantial improvement in knowledge observed in the intervention group, where all students achieved a good level of knowledge after the peer education intervention, may be explained by the active interactions that occurred among students during the learning process. Peer educators provided explanations using language that was familiar to their classmates, encouraged questions, and facilitated discussion of BLS concepts that students initially found difficult to understand. These learning behaviors are consistent with Bandura's Social Learning Theory, as students were able to learn by observing and modeling the explanations and demonstrations provided by their peers. Furthermore, the opportunity to receive guidance and clarification from peer educators may have supported students in mastering concepts that they could not fully understand independently, reflecting Vygotsky's Zone of Proximal Development. The manifestation of Vygotsky's scaffolding theory was clearly observed during the hands-on BLS simulation phase; peer educators initially provided high-level support by giving step-by-step verbal prompts and physically guiding the respondents' hand placement for high-quality chest compressions on the manikin. As the respondents gained psychomotor confidence and precision, the peer educators gradually withdrew this direct assistance (fading), shifting their role to observing and providing corrective feedback until the respondents could execute the entire resuscitation sequence independently. The interactive nature of peer education likely contributed to the greater increase in knowledge observed in the intervention group compared with the leaflet group, where learning primarily occurred through individual reading without direct discussion or feedback.

The authors posit that the observed differences in outcomes between the two groups are attributable to the greater effectiveness of the peer education method compared to leaflet-based education alone. Peer education facilitates social interaction among peers, which enhances participant engagement, motivation, and comprehension. This finding is supported by the study conducted by Sujana et al. (2024), which demonstrated that direct BLS training had a significant impact on participants' knowledge and skills, with 84% of respondents achieving a good level of knowledge after the intervention compared to baseline conditions. These results suggest that systematic, interactive, and practice-based health education interventions are more effective in improving cognitive outcomes than one-way educational approaches (Sujana et al., 2024).

Additionally, a study by Ambarika et al. (2024) reported that Basic Life Support health education significantly increased participants' knowledge based on pretest–posttest results ($p < 0.05$), further supporting the argument that structured and interactive education plays a crucial role in BLS learning (Ambarika et al., 2024). Although an improvement in knowledge was also observed in the control group, the magnitude of change was not as substantial as that in the intervention group. Knowledge of cardiopulmonary resuscitation (CPR), for instance, includes recognizing cardiac arrest when a victim is unresponsive, shows no chest movement, and has no palpable carotid pulse (Maria & Wardhani, 2025). Knowledge acquisition may be influenced by several factors, including age, gender, and prior exposure to BLS training.

Based on the Wilcoxon Signed-Rank Test conducted in this study, a statistically significant improvement in Basic Life Support (BLS) knowledge was observed in the intervention group following peer education ($p < 0.001$). These findings indicate that health education on Basic Life Support using the peer education method was effective in significantly improving the knowledge of twelfth-grade students at Senior High School 3 Banjarbaru. These findings confirm that peer-based educational interventions can substantially enhance students' understanding of BLS concepts and procedures. The effectiveness of the peer education method is assumed to be related to its interactive and communicative learning process, which allows students to feel more comfortable asking questions, engaging in discussions, and participating in simulations with their peers. Through peer education, students are not merely passive recipients of information but active participants in the learning process, which strengthens memory retention and conceptual understanding of BLS.

This finding aligns with the study by Ndruru et al. (2025), which reported a significant increase in Basic Life Support knowledge among senior high school students following educational training, highlighting the effectiveness of educational interventions in improving adolescents' understanding of BLS (Ndruru et al., 2025). Furthermore, research by Kusumawardhany et al. (2024) demonstrated that BLS training among high

school students resulted in a marked increase in the proportion of participants with good knowledge levels, reinforcing the conclusion that systematic educational interventions can significantly enhance BLS knowledge among adolescents (Kusumawardhany et al., 2024).

The results of this study also indicate that health education on Basic Life Support delivered through leaflet media in the control group was effective in improving students' knowledge, as evidenced by the Wilcoxon Signed-Rank Test result ($p = 0.003$). These findings indicate that, although leaflet-based education effectively increases knowledge, it is less efficacious than peer education. The limited impact of leaflets is likely due to their passive, one-way nature, where students primarily read materials without opportunities for interaction, discussion, or hands-on practice. This distinction is particularly important in resource-limited settings, where peer education may not always be feasible, and leaflet-based interventions can still provide meaningful improvements in knowledge.

This interpretation is consistent with the findings of Sujana et al. (2024), which showed that printed educational media such as leaflets or brochures have a more limited impact on participants' knowledge compared to interactive and participatory educational interventions (Sujana et al., 2024). Unlike peer education, which allows for direct information exchange, peer discussion, and experiential learning, leaflet-based education restricts active participant involvement, resulting in more limited comprehension (Asma, 2025).

Therefore, although leaflet-based education remains statistically effective in increasing knowledge, its impact is not as strong as that of the peer education method, which incorporates social interaction and practical learning. These findings emphasize that for health topics requiring both conceptual understanding and practical skills (such as Basic Life Support) interactive and participatory approaches that include discussion and simulation are more likely to produce stronger and more sustainable improvements in knowledge than printed educational materials alone. This distinction is important to consider when designing school-based health education programs, particularly when the primary objective extends beyond information dissemination to the development of practical skills and emergency preparedness.

The results of this study have important practical implications for school curricula. Implementing structured, interactive, and peer-led health education programs could enhance both cognitive understanding and practical preparedness among students. Schools may consider establishing a permanent "Peer Health Squad" or peer educator program to sustain health education initiatives, provide ongoing support, and serve as first responders within the school community. Such an approach not only improves knowledge retention but also encourages a culture of collaborative learning and peer support, which may positively influence students' confidence and willingness to act in emergency situations.

Overall, this study demonstrates that peer-supported BLS training is more effective than leaflet-based education in enhancing students' knowledge, engagement, and preparedness. While printed educational materials remain valuable, integrating peer education into school health programs is recommended to maximize learning outcomes, reduce anxiety, and promote practical skill development in emergency response.

Study Limitations

This study has several limitations. First, the study assessed students' knowledge only through an immediate post-test following the intervention. Therefore, it was not possible to determine whether students retained their knowledge and Basic Life Support (BLS) skills over the long term, such as one month after the intervention. Future studies should include follow-up assessments to evaluate long-term knowledge retention and skill maintenance. Second, the sample size in this study was relatively small ($n = 60$), which may limit the statistical power of the findings. In addition, the use of consecutive sampling rather than random sampling introduces a potential selection bias, reducing the generalizability of the results to other populations. Third, this study relied on self-reported assessments that measured only the cognitive aspect of preparedness (knowledge) and did not evaluate psychomotor skills or practical ability to perform BLS. Although the study title refers to "preparedness," readers should note that this research focuses exclusively on the cognitive domain of BLS preparedness, not on hands-on skill performance. Fourth, the preparation and implementation of the peer

education program were conducted within a limited timeframe. Consequently, practical BLS training sessions may not have been optimally delivered. Environmental factors during the intervention (such as classroom conditions, time constraints, and variations in students' attention) could not be fully controlled. Finally, the researchers were unable to objectively assess the communication skills or the level of content mastery of each student serving as a peer educator, which may have influenced the intervention's effectiveness. Additionally, the study was conducted in a single school with students of diverse characteristics, so the findings may not be generalizable to students in other schools with different backgrounds or contextual conditions.

Conclusion

Based on the findings of this study, Basic Life Support (BLS) health education delivered through the peer education method was effective in significantly improving the knowledge of twelfth-grade students at Senior High School 3 Banjarbaru ($p < 0.001$). Although both educational approaches improved students' knowledge, the peer education method produced greater gains than leaflet-based education, likely due to its interactive nature, opportunities for discussion, and active student engagement. These findings suggest that peer-led educational strategies may represent a valuable approach for enhancing BLS knowledge and emergency preparedness among adolescents. Therefore, schools are encouraged to consider implementing peer-led BLS education programs or combining peer education with printed educational materials to maximize learning outcomes. Future research should incorporate objective assessments of psychomotor skills through simulation-based evaluations, such as CPR performance testing using mannequins, to determine whether improvements in BLS knowledge translate into practical competence and emergency response readiness. In addition, longitudinal follow-up assessments are recommended to evaluate the long-term retention of both knowledge and practical skills following BLS education.

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CreDiT of Author Statement

Muhammad Wirandi: Conzeptualization, Project Administration, Software, Data Curation, Writing Original Draft. **Insana Maria:** First Advisor, Validation, Curation. **Taufik Hidayat:** Second Advisor, Methodology, Formal Analysis: **Martini Nur Sukmawaty:** Examiner.

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