

Effects of a Hybrid Basic Life Support Program in Improving Nurses' Cardiopulmonary Resuscitation (CPR) Knowledge, Attitude, and Self-Efficacy

Nik Hasmumthaj Nik Hassan ^{1,2}, Siti Khuzaimah Ahmad Sharoni ^{2*}, Septa Katmawanti ³

**Corresponding Author*

¹Nursing Department, Universiti Malaya Medical Centre, Lembah Pantai, 59100 Kuala Lumpur, Malaysia

²Centre for Nursing Studies, Faculty of Health Sciences, Universiti Teknologi MARA, Cawangan Selangor, Puncak Alam Campus, 42300, Selangor, Malaysia

³Public Health Department, Faculty of Sport Science, Universitas Negeri Malang, Malang, East Java, Indonesia

hasmumthaj@ummc.edu.my, sitik123@uitm.edu.my, septakatma.fik@um.ac.id
Tel: +60172346699

Abstract

Cardiac arrest management heavily relies on Cardiopulmonary Resuscitation (CPR). This study evaluated the effectiveness of a Basic Life Support (BLS) program between a hybrid program and a face-to-face program. Conducted at Universiti Malaya Medical Centre (UMMC), the quasi-experimental time series study involved 70 nurses. A 58-item questionnaire was used to measure knowledge, attitudes, and self-efficacy. Results indicated moderate knowledge ($M = 11.86$, $SD = 2.63$), positive attitudes ($M = 76.09$, $SD = 9.16$), and high self-efficacy ($M = 84.54$, $SD = 15.51$). The Hybrid program effectively combines flexibility with traditional training and emphasizing the importance of refresher sessions to sustain CPR competency among nursing professionals.

Keywords: Knowledge; Attitude; Self-efficacy; Cardiopulmonary Resuscitation

eISSN: 2398-4287 © 2026. The Authors. Published for AMER by e-International Publishing House, Ltd., UK. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>). Peer-review under responsibility of AMER (Association of Malaysian Environment-Behaviour Researchers). DOI:

1.0 Introduction

Cardiac arrest is a life-threatening emergency that requires immediate intervention. Cardiopulmonary Resuscitation (CPR) is a critical component of the chain of survival, encompassing early recognition, prompt resuscitation and post-cardiac arrest care (Khaledi et al., 2024). The American Heart Association (AHA) and the European Resuscitation Council (ERC) emphasize evidence-based recommendations and hands-on Basic Life Support (BLS) training to enhance CPR knowledge, attitude and self-efficacy among healthcare providers (Chaudhary et al., 2023). However, the implementation of large-scale BLS training remains challenging due to costs, limited instructor availability and time constraints (Koyuncu et al., 2024).

Therefore, integrating computer-assisted learning, advanced manikins, and multimedia resources into simulation-based training can effectively enhance long-term retention of CPR knowledge and skills (Abbasi et al., 2025). Furthermore, the AHA recommends cost-effective educational strategies to improve access to training (Koyuncu et al., 2024).

Therefore, this study aimed to evaluate the effectiveness of a Hybrid Basic Life Support Program compared with a conventional face-to-face program in improving nurses' CPR knowledge, attitudes, and self-efficacy at Universiti Malaya Medical Centre.

2.0 Literature Review

CPR is a vital life-saving intervention during cardiac arrest, often initiated by nurses before advanced medical personnel arrive (Chaudhary et al., 2023). Studies in Malaysia reported high knowledge levels among healthcare professionals ranging from 84.0% to 91.7% (Ming et al., 2025; Chik et al., 2023), although 76.0% demonstrated moderate knowledge in another study (Ahmad et al., 2023). Furthermore, CPR knowledge was significantly associated with prior BLS training in Ethiopia (p -value < 0.05) (Mersha et al., 2020) and Nepal (p = 0.026) (Chaudhary et al., 2023). Overall, evidence suggests that regular BLS training and continuous competency development are essential for maintaining optimal CPR knowledge among nurses.

Attitude is a key determinant of nurses' willingness and effectiveness in performing CPR during cardiac emergencies, with negative attitudes potentially hindering resuscitation efforts (Tomas & Kachekele, 2023). Studies reported positive attitudes in Jordan (M = 7.8, SD = 6.3) (Oteir et al., 2025) and Malaysia (M = 38.07, SD = 6.15) (Ming et al., 2025). In contrast, Shah et al. (2022) found that 60% of nurses and doctors were unwilling to perform CPR voluntarily, while 30.0% performed BLS only when required, reflecting a negative attitude.

In addition, self-efficacy enhances nurses' knowledge, attitudes, and ability to deliver high-quality BLS care. A strong sense of self-efficacy positively influences nurses' decisions and the effort invested in patient care during cardiac arrest (Alaryani et al., 2021). Studies reported generally high self-efficacy levels among nurses in Saudi Arabia (89.4% and 63.8%) (Mohebi et al., 2023; Alaryani et al., 2021), Indonesia (86.7%) (Sasmitho et al., 2024), and Kenya (77.5%) (Angute et al., 2023). Self-efficacy was significantly associated with age and years of experience in Saudi Arabia (p = 0.001) (Mohebi et al., 2023), age in Indonesia (r = 0.447), and the number of cardiac arrest cases managed (r = 0.419) (Sasmitho et al., 2024). Overall, nurses generally demonstrate high self-efficacy in performing CPR, with training, clinical experience, and continuous professional development playing key roles in strengthening confidence and resuscitation performance.

Regular BLS training plays a role in maintaining CPR knowledge among nurses. According to Saidu et al. (2023), in Nigeria, both instructor-led training and video self-instruction, supported by a BLS Heart Code CD and manual provided seven days before training, significantly improved nurses' knowledge and skills immediately after training and at 3 months (p < 0.05). However, knowledge retention declined significantly at 6 months (p = 0.003), with no significant differences between the two teaching methods (p > .05), suggesting comparable short-term effectiveness.

Another study by Hsieh et al. (2021) in Taiwan compared situational simulation training with online teaching for first-aid knowledge and skills among nurses. Participants in the simulation group received 90 minutes of instructor-led training, including discussion and video review, while the online group learned independently. Post-intervention results showed no significant differences between groups in First-Aid Knowledge Test (FAKT) scores (p = 0.76) or First-Aid Skills Test (FAST) scores (p = 0.45), suggesting that online teaching is a cost- and time-efficient alternative to simulation-based training.

Siddiqi et al. (2023) in Pakistan found that the Peyton's Four-step BLS training programme (Group A) produced greater improvements in knowledge than non-standardized conventional training (Group B). Group A's mean knowledge score increased from 56.40 ± 17.66 pre-training to 70.50 ± 11.22 post-training, whereas Group B improved from 55.50 ± 14.20 to 59.60 ± 11.88 , demonstrating the superior effectiveness of the standardized 4-step approach.

In conclusion, simulation-based training provides realistic clinical practice using high-fidelity manikins and structured feedback, enhancing nurses' psychomotor skills, decision-making, confidence, and competence in procedures such as airway management and defibrillation. In contrast, online teaching offers greater flexibility and cost-effectiveness but lacks hands-on practice and immediate feedback. Despite these differences, both approaches improve cognitive outcomes, suggesting that a blended learning approach, combining online theoretical modules with periodic simulation sessions, may be the most effective strategy for sustaining BLS competency.

3.0 Methodology

A quasi-experimental time-series study was conducted among 70 nurses at Universiti Malaya Medical Centre (UMMC) from June to October 2025 to compare traditional and hybrid BLS training, with 35 participants per group determined using the Sakpal Formula with a 20% adjustment. Data were collected using a validated online questionnaire assessing demographics (10 items), CPR knowledge (20 items), attitudes towards CPR (16 items), and self-efficacy in performing CPR (12 items). The instrument, adopted from Moon and Hyun (2019), demonstrated acceptable reliability and validity, with Cronbach's α values of 0.63, 0.85, 0.87 and 0.93 for emotional, behavioural, cognitive attitudes, and self-efficacy. The knowledge domain was established through expert review, and a pilot study (n = 19) yielded Cronbach's alpha values of 0.50 (knowledge), 0.74 (total attitude), 0.75 (emotional attitude), 0.59 (cognitive attitude), 0.43 (behavioural attitude), and 0.90 (self-efficacy). The study obtained ethical approval from Universiti Teknologi MARA (UiTM), and UMMC was recruited, with participant inclusion criteria being registered nurses eligible for English proficiency and not attending the BLS program yet having no prior training in AHA 2020 BLS guidelines.

3.1 Intervention

The intervention group (IG) received a Hybrid BLS Program that allowed participants to complete seven days of self-paced online learning with WhatsApp-supported discussion before assessment, whereas the control group attended a one-day face-to-face program. The learning module is based on AHA (2020) guidelines for both groups. The Hybrid BLS Program module was highly rated by a multidisciplinary evaluation team of emergency physicians, nursing officers, tutors, ward managers, and nurses assessed using a 5-point Likert scale for objectives ($Mean$ = 4.29, SD = 0.95), content (M = 4.86, SD = 0.38), format (M = 4.86, SD = 0.38), language (M =

4.86, SD = 0.38), presentation (M = 4.86, SD = 0.39), usefulness (M = 4.86, SD = 0.39) and overall assessment. Both groups were assessed before training, immediately after, and at Week 12 for both groups (Figure 1).

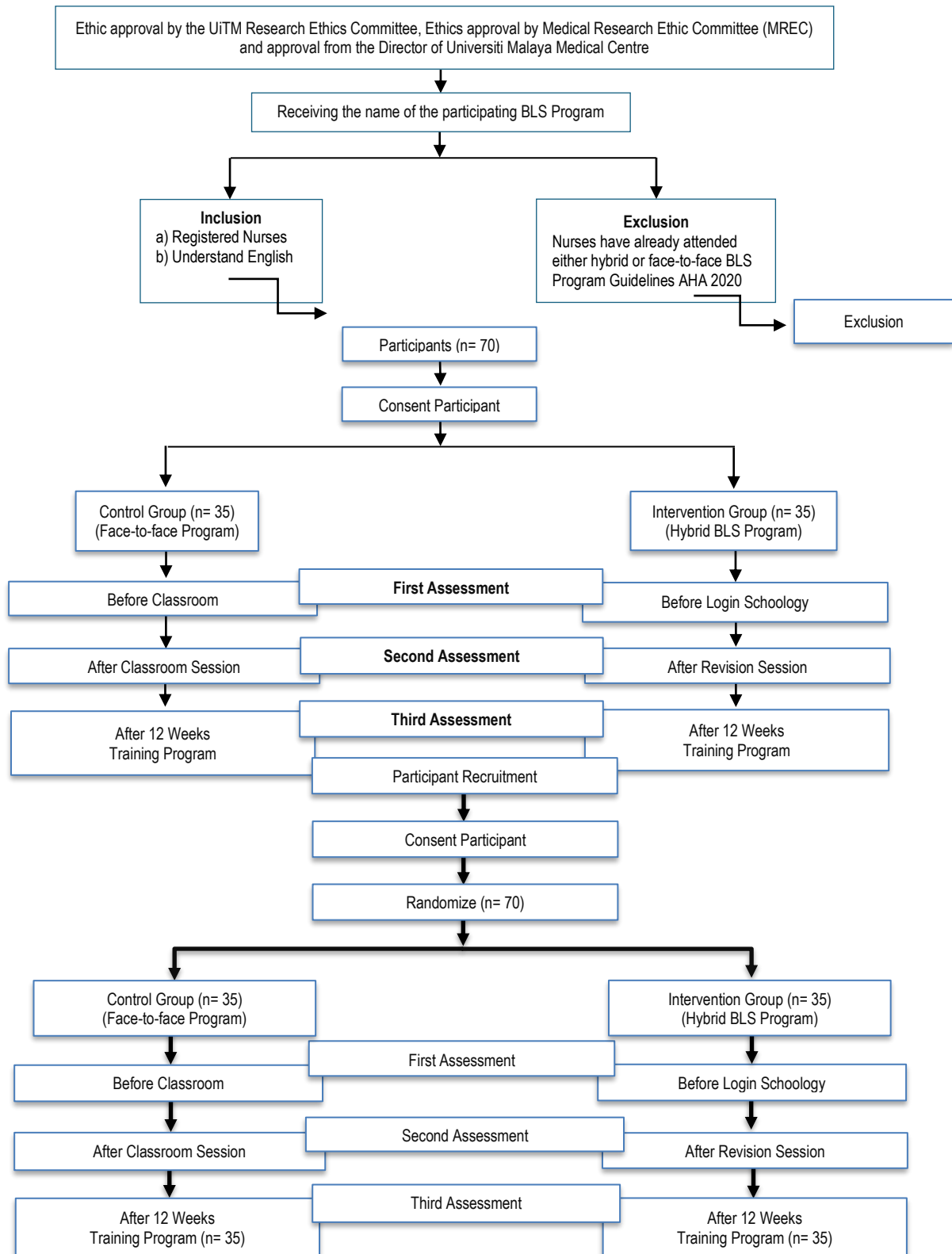


Figure 1: Consort Flow Chart of the assessment for the Intervention and Control Group

4.0 Findings

4.1 Demographic Data

Table 1 shows that 70 nurses were divided into CG and IG groups to assess characteristics before a BLS program. Baseline demographic and professional characteristics were comparable between groups, with no statistically significant differences in age ($p = 0.590$), gender ($p = 0.099$), education level ($p = 0.754$), working area ($p = 0.440$), years of service ($p = 0.280$), working hours ($p = 0.260$), CPR experience ($p = 0.620$), or exposure to cardiac arrest ($p = 0.620$). However, participants in the control group had attended significantly more previous BLS courses than those in the intervention group ($p = 0.010$).

Table 1: The comparison of demographic characteristics between the CG (Face-To-Face Program) and the IG (Hybrid Program) (N = 70)

Variable	Total (n= 70)	CG (n = 35)		IG (n = 35)		Variable	
		n	%	n	%	Test Statistics	p-value
Age (years) ^a	Mean (SD)	34.54 (9.16)		33.40 (6.95)		0.59	0.590
Duration of Services ^a	Mean (SD)	13.46 (8.09)		11.57 (6.30)		1.09	0.280
Gender ^c							
	Female	30	85.7	34	97.1	0.198	0.099
	Male	5	14.3	1	2.9		
Level Education ^c							
	Diploma/ Adv. Diploma	34	97.1	34	97.1	1.00	0.754
	Degree	1	2.9	1	2.9		
Clinical Practice ^b							
	Critical Care Unit	6	17.1	8	22.9	1.645	0.440
	General Ward	15	42.9	18	51.4		
	Others	14	40.0	9	25.7		
Working Hours ^b							
	Office Hours (8 am – 5 pm)	10	28.6	6	17.1	1.30	0.260
	Shift	25	71.4	29	82.9		
Have performed CPR within the last 12 Months ^b							
	No	24	68.6	22	62.9	0.25	0.620
	Yes	11	31.4	13	37.1		
Number of BLS Courses attended throughout Service ^a	Mean (SD)	3.09 (1.70)		2.20 (0.99)		2.66	*0.010
Number of Heart Attack cases treated in the last 12 months ^a	Mean (SD)	1.66 (4.35)		1.26 (1.77)		0.50	0.620

Note: ^a independent t-test was used to compare the means of two groups for normally distributed data; ^b Chi-square test was used to compare the proportion of two groups for categorical data; ^c Fisher's Exact Test was used to examine the association between categorical variables for the sample size was small (< 5);

*p-value < 0.05 = statistically significant

4.2 The baseline level of knowledge, attitude and self-efficacy

A survey of 70 respondents on CPR knowledge showed that 8.57% had good knowledge, 57.14% had moderate knowledge, and 34.29% had poor knowledge, as shown in Table 2. Table 2 shows that the average score of knowledge was 11.86 (SD = 2.63). The overall mean total attitude score is 76.09 (SD = 9.16), indicating a generally positive outlook, with scores ranging from 52 to 94. The emotional attitude score averages 53.37 (SD = 8.38), indicating aspects of performing basic CPR on patients with cardiac arrest. Behaviorally, nurses have a very positive stance toward CPR, with a mean score of 11.53 (SD = 0.85), indicating strong agreement and reflecting nurses' view of CPR as essential. The cognitive attitude score is also high at 11.19 (SD = 1.28), suggesting recognition of the importance of rapid CPR for patient outcomes. Overall, while attitudes toward CPR are favourable, areas such as confidence in specific scenarios may benefit from further training. The baseline self-efficacy scores of 70 nurses in CPR reflected generally high confidence, with a mean score of 84.54 (SD = 15.51).

Table 2: Baseline results of total knowledge, attitude and self-efficacy regarding CPR (N = 70)

Variable	Score	Total		Min	Max
		n/ Mean	%/ SD		
Poor Knowledge	0 - 10	24	34.29		
Moderate Knowledge	11 - 15	40	57.14		
Good Knowledge	16 - 20	6	8.57		
Total Knowledge		11.86	2.63	6.00	19
Total Attitude		76.09	9.16	52.00	94.00
Total Attitude Emotional		53.37	8.38	28.00	70.00
Total Attitude Behavioural		11.53	0.85	9.00	12.00
Total Attitude Cognitive		11.19	1.28	7.00	12.00
Total Self-efficacy		84.54	15.51	54.00	120.00

4.3 The effect of the Hybrid BLS on knowledge, attitude and self-efficacy of performing CPR among nurses in Universiti Malaya Medical Centre before and after the intervention program.

Table 3 summarizes knowledge, attitude and self-efficacy scores for the CG and the IG at Pre, Post, and 12-week Post. A mixed-design ANOVA was used to assess changes over time between groups. Knowledge scores increased following training in both groups and remained above baseline at 12-week follow-up despite a slight decline. The CG increased from 11.57 (SD = 1.82) to 13.42 (SD = 1.75), then dropped to 12.71 (SD = 2.07) at 12 weeks. The IG scores improved from 11.20 (SD = 3.18) to 13.17 (SD = 2.46), then decreased to 12.37 (SD = 1.93) at follow-up. Both groups indicated sustained knowledge retention.

Moreover, total attitude score improved after the training in both groups, CG from 77.91 (SD = 8.42) to 81.54 (SD = 8.61), then decreased to 79.31 (SD = 9.20), and IG rose from 74.26 (SD = 9.61) to 80.29 (SD = 8.50), stabilizing at 79.09 (SD = 7.45). In emotional attitude, CG improved from 55.51 (SD = 7.39) to 58.54 (SD = 7.59), then fell slightly to 56.80 (SD = 8.18), and the IG went from 51.23 (SD = 8.85) to 56.77 (SD = 7.91), then to 55.77 (SD = 7.17). Behavioral attitude remained relatively stable over time; the CG scores were 11.37 (SD = 0.97), 11.60 (SD = 0.88), and 11.31 (SD = 1.05), and the IG scores started higher at 11.69 (SD = 0.68), increased to 11.83 (SD = 0.57), then fell to 11.63 (SD = 0.81). Similarly, cognitive attitude improved slightly in CG from 11.03 (SD = 1.20) to 11.40 (SD = 1.14), then decreased to 11.20 (SD = 1.26), and the IG rose from 11.34 (SD = 1.35) to 11.69 (SD = 0.80) and remained at 11.69 (SD = 1.80) at 12 weeks. Indicating an understanding and sustained positive attitude following training.

Finally, self-efficacy demonstrated the greatest improvement following training in both groups, increasing markedly post-program and remaining above baseline at the 12-week follow-up despite a slight decline. The CG increased from 82.43 (SD = 2.64) to 93.09 (SD = 2.12) post-program, before declining to 89.89 (SD = 2.57), and the IG demonstrated a similar pattern, rising from 80.66 (SD = 2.63) to 95.71 (SD = 2.12), and then reducing to 89.97 (SD = 2.57). These findings suggest that both training formats effectively enhanced participants' confidence in performing CPR with sustained effects over time (Figure 2).

Table 4 showed significant Time effects for knowledge ($F(2, 136) = 16.851$, $p < 0.001$, partial $\eta^2 = 0.199$), total attitude ($F(2, 136) = 8.867$, $p < 0.001$, partial $\eta^2 = 0.115$), emotional attitude ($F(2, 136) = 9.008$, $p < 0.001$, partial $\eta^2 = 0.117$), and self-efficacy ($F(2, 136) = 30.680$, $p < 0.001$, partial $\eta^2 = 0.478$), indicating significant improvements over time, with self-efficacy showing the largest and sustained increase up to 12 weeks. In contrast, behavioural attitude ($F(2, 136) = 1.880$, $p = 0.157$, partial $\eta^2 = 0.027$) and cognitive attitude ($F(2, 136) = 2.421$, $p = 0.093$, partial $\eta^2 = 0.034$) did not show significant changes over time. All Time $\times$ Group interactions were non-significant for knowledge ($F = 0.016$, $p = 0.984$), total attitude ($F = 1.145$, $p = 0.321$), emotional attitude ($F = 1.370$, $p = 0.258$), behavioural attitude ($F = 0.071$, $p = 0.931$), cognitive attitude ($F = 0.209$, $p = 0.812$), and self-efficacy ($F = 0.925$, $p = 0.402$), indicating similar trajectories and comparable effectiveness of the Hybrid BLS and Face-to-Face BLS interventions across all outcomes.

Table 3: Descriptive statistics for knowledge, attitude and self-efficacy between the CG (Face-to-Face Program) and the IG (Hybrid Program) and time (N = 70)

Variables	Time	Total (n)	CG (n = 35)		IG (n = 35)	
			Mean	SD	Mean	SD
Knowledge	Pre Program	70	11.57	1.82	11.20	3.18
	Post Program	70	13.42	1.75	13.17	2.46
	12 Weeks Post Program	70	12.71	2.07	12.37	1.93

Variables	Time	Total (n)	CG (n = 35)		IG (n = 35)	
			Mean	SD	Mean	SD
Total Attitude						
	Pre Program	70	77.91	8.42	74.26	9.61
	Post Program	70	81.54	8.61	80.29	8.50
	12 Weeks Post Program	70	79.31	9.20	79.09	7.45
Emotional Attitude						
	Pre Program	70	55.51	7.39	51.23	8.85
	Post Program	70	58.54	7.59	56.77	7.91
	12 Weeks Post Program	70	56.80	8.18	55.77	7.17
Behavioral Attitude						
	Pre Program	70	11.37	0.97	11.69	0.68
	Post Program	70	11.60	0.88	11.83	0.57
	12 Weeks Post Program	70	11.31	1.05	11.63	0.81
Cognitive Attitude						
	Pre Program	70	11.03	1.20	11.34	1.35
	Post Program	70	11.40	1.14	11.69	0.80
	12 Weeks Post Program	70	11.20	1.26	11.69	1.80
Self-efficacy						
	Pre Program	70	82.43	2.64	80.66	2.64
	Post Program	70	93.09	2.12	95.71	2.12
	12 Weeks Post Program	70	89.89	2.57	89.97	2.57

Table 4: Test of within-subject effect knowledge, attitude, and self-efficacy (N = 70)

Variables	Source	Type III SS	df	MS	F	Sig.	Partial η^2
Knowledge	Time	130.124	2	65.062	16.851	0.001*	0.199
	Time $\times$ Group	0.124	2	0.062	0.016	0.984	0.001
Total Attitude	Time	838.895	2	419.448	8.867	0.001*	0.115
	Time $\times$ Group	108.343	2	54.171	1.145	0.321	0.017
Emotional Attitude	Time	670.629	2	335.314	9.008	0.001*	0.117
	Time $\times$ Group	101.981	2	50.990	1.370	0.258	0.020
Behavioral Attitude	Time	2.257	2	1.129	1.880	0.157	0.027
	Time $\times$ Group	0.086	2	0.043	0.071	0.931	0.001
Cognitive Attitude	Time	4.752	2	2.376	2.421	0.093	0.034
	Time $\times$ Group	0.410	2	0.205	0.209	0.812	0.003
Self-efficacy	Time	2461.207	2	1230.604	30.68	0.001*	0.478
	Time $\times$ Group	140.593	2	70.296	0.925	0.402	0.027

*p<0.05 statistically significant

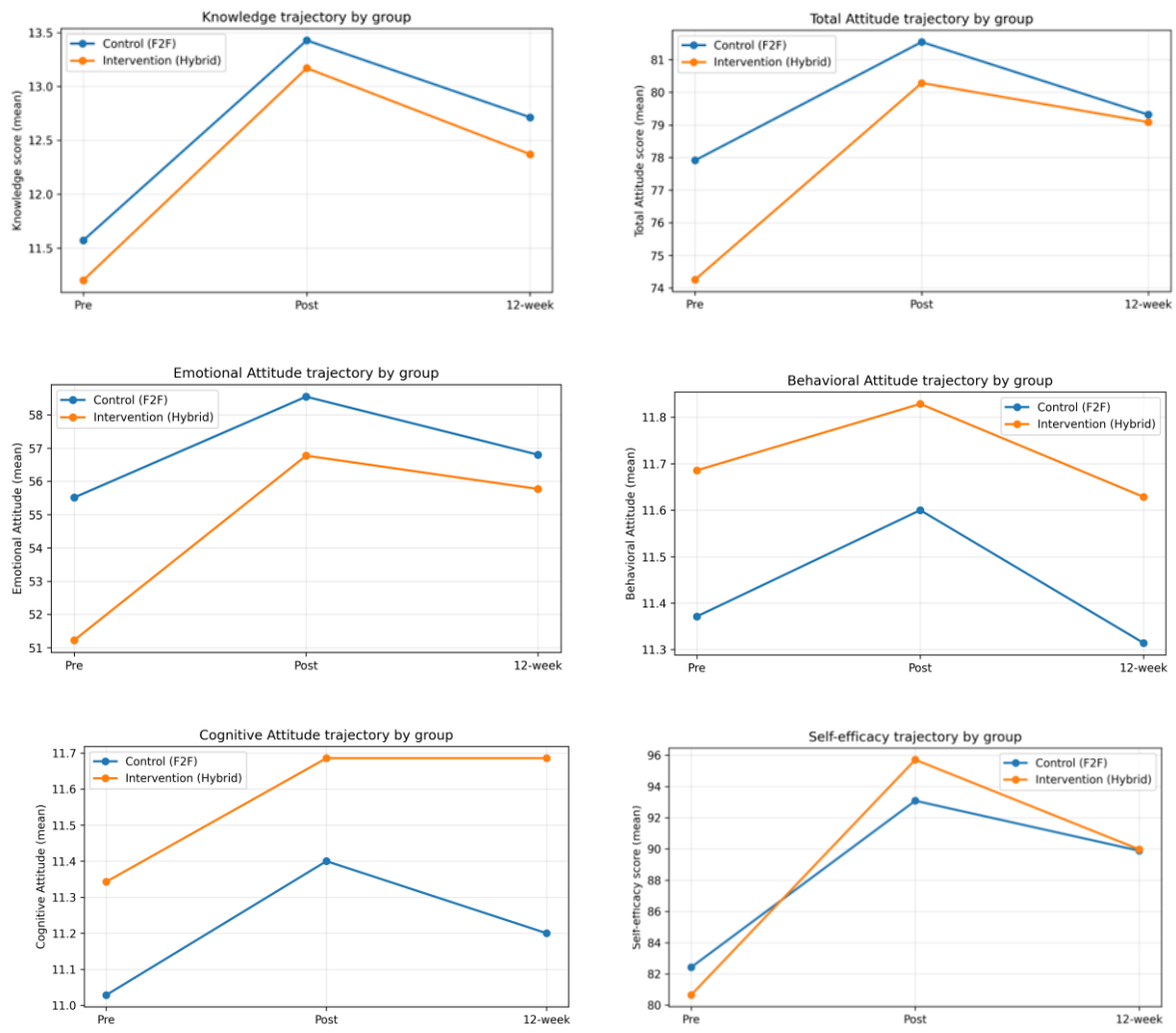


Figure 2: The Trajectory between Control Group and Intervention Group regarding knowledge, attitude and self-efficacy.

5.0 Discussion

5.1 Level of nurses' knowledge, attitude and self-efficacy regarding CPR

BLS and CPR are essential for effective emergency care. Although UMMC nurses demonstrated moderate knowledge of defibrillation and chest compressions, gaps in airway management and initial patient assessment indicate the need for targeted hands-on CPR training to enhance competency (Oteir et al., 2025). However, inconsistent knowledge retention and performance highlight the need for ongoing training among nurses (Chik et al., 2023). Moreover, variations across CPR components were observed, and while concerns regarding Automated External Defibrillator (AED) use persist, its availability has been associated with improved proficiency and survival outcomes (Oteir et al., 2025).

UMMC nurses demonstrated a generally positive attitude toward CPR, consistent with studies reporting high perceived importance and confidence in performing CPR. Willingness to perform CPR may be influenced by cultural and personal factors, while knowledge gaps in current BLS guidelines remain evident despite positive attitudes. Educational interventions can further enhance CPR readiness and AED utilization (Ming et al., 2025; Shah et al., 2022; Al-Sabri et al., 2024).

Moreover, UMMC nurses demonstrated positive behavioural attitudes toward CPR, reflecting readiness to perform life-saving interventions. However, negative attitudes toward certain resuscitation procedures, such as mouth-to-mouth ventilation without protective equipment, highlight the need for ongoing education and training to strengthen emergency preparedness (Ming et al., 2025; Tomas & Kachele, 2023). The cognitive attitude of UMMC nurses reflected positive beliefs and confidence in CPR knowledge. However, anxiety, fear of causing harm, lack of confidence, and inadequate training may reduce willingness to perform CPR, highlighting the need for continuous education and skills reinforcement (Silverplats et al., 2022).

Overall, nurses demonstrated positive cognitive and behavioral attitudes toward CPR. However, emotional factors, particularly confidence in emergency situations, may require additional support, and repeated educational interventions are essential to strengthen CPR attitudes and preparedness (Moon & Hyun, 2019; Ming et al., 2025). Enhancing CPR knowledge is essential, and simulation-based

training, supportive environment, clear CPR policies, and accessible training opportunities can improve nurses' CPR preparedness and attitudes (Ming et al., 2025; Oteir et al., 2025).

CPR is essential for the management of cardiac arrest, and nurses' self-efficacy reflects their confidence in performing resuscitation-related tasks. Participants demonstrated good CPR self-efficacy, influenced by training, legal concerns, and previous experiences. Nevertheless, high self-efficacy remains essential for effective cardiac arrest management and emergency response (Al-Sabri et al., 2024; Sasmito et al., 2024; Alamri et al., 2022; Alaryani et al., 2021). Lower confidence and negative perceptions toward CPR learning were evident among some healthcare providers. However, simulation-based training can enhance self-efficacy and knowledge retention, highlighting its value in CPR education (Sasmito et al., 2024). Continuous BLS education can enhance CPR competence, self-efficacy, and preparedness for cardiac arrest management (Alamri et al., 2022).

5.2 The effect(s) of the Hybrid BLS on knowledge, attitude and self-efficacy before and after the intervention program

Both training methods significantly improved nurses' CPR knowledge, attitudes, and self-efficacy over time, indicating that learning outcomes were not influenced by mode of delivery. However, a slight decline across all outcome measures at the 12-week follow-up highlights the need for periodic refresher sessions to maintain competency. Previous studies by Saidu et al. (2023) have similarly reported a decline in CPR skill retention over time, despite significant post-training improvements. Training interventions, including simulation and virtual learning approaches, have been shown to enhance resuscitation skills, engagement, and confidence compared with conventional methods (Abbasi et al., 2025).

Attitudes toward CPR improved over time, with increased confidence and positive perceptions. Simulation-based and blended learning approaches enhanced engagement and reflective learning, while cognitive attitudes showed minimal change, likely due to pre-existing positive beliefs about CPR. No significant differences were observed between training methods, indicating comparable outcomes in CPR attitudes and knowledge (Montoro-Pérez, 2025).

Self-efficacy improved significantly following training, with confidence remaining above baseline despite a slight decline at 12 weeks. The absence of significant group differences suggests that both training methods were equally effective in enhancing nurses' confidence in performing CPR. (Alamri et al., 2022). Moreover, previous studies have shown that CPR knowledge is positively associated with self-efficacy, while experience, frequent training, and mentorship contribute to greater confidence and competency in performing CPR, particularly among novice nurses (Alaryani et al., 2021; Ming et al., 2025).

Pairwise comparisons showed that improvements were greatest immediately post-intervention and largely maintained at 12 weeks, with self-efficacy demonstrating the largest sustained improvement. Slight declines in behavioural and emotional attitude were observed over time. These findings are consistent with Ahmad et al. (2023), who reported significant improvements in CPR knowledge and skills immediately after training ($p < .001$) followed by a decline at the 3-month follow-up. As behavioural attitude was the only significant predictor of performance, reinforcement strategies such as simulation drills and booster training are recommended to sustain CPR competence and action-oriented behaviours (Malureanu et al., 2021). Moreover, between time and group interaction, all domains presented no significant differences, suggesting that online teaching is a cost- and time-efficient alternative to simulation-based training (Hsieh et al., 2021). In addition, a study in Nigeria found that instructor-led training and video self-instruction showed no significant differences and had comparable short-term effectiveness ($p > .05$) (Saidu et al., 2023).

The Hybrid BLS program was as effective as traditional training in improving CPR knowledge, attitudes, and self-efficacy. Its flexible and engaging blended-learning approach may particularly enhance behavioral outcomes, although ongoing follow-up and reinforcement are needed to sustain CPR competence and confidence over time (Moon & Hyun, 2019; Khaledi et al., 2024).

6.0 Conclusion and Recommendations

The study found that the Hybrid BLS program significantly enhanced nurses' knowledge, attitudes, and self-efficacy in performing CPR. It underscored the value of structured training that combines theory with practical experience. Nurses showed marked improvements in emotional readiness and competence in life-saving actions, although some skills declined by the 12-week follow-up, highlighting the need for periodic reinforcement.

A limitation of this study was that it involved 35 participants in the intervention group from a single institution, limiting the generalizability of its findings. While valuable, the insights may not represent larger or more diverse populations. Future research with broader samples from multiple institutions is needed to improve validation. Self-reported measures of knowledge, attitude and self-efficacy may be biased by social desirability, raising concerns about the validity of these questionnaires and highlighting the need for additional assessment methods to improve accuracy.

The research emphasizes the importance of improved CPR skills for patient survival during cardiac arrest and suggests that blended learning methods (online and hands-on training) are effective in healthcare education. It also identified areas for further development, such as airway management. In conclusion, the Hybrid BLS model promotes innovative training methods and supports the integration of hybrid learning in BLS training, ultimately enhancing nurses' preparedness for emergency care and improving patient safety outcomes.

Acknowledgements

The author would like to express gratitude to the University of Malaya Medical Centre (UMMC) and the Nursing Department of UMMC for their support and cooperation throughout this study.

Paper Contribution to Related Field of Study

This evaluation provides the effect of the hybrid program on CPR knowledge, attitudes, and self-efficacy of healthcare professionals. It highlights the alternative for proper training standards to enhance the quality of care in the healthcare sector.

References

- Abbasi, M., Taghadosi, M., Atoof, F., & Hosseiniara, R. (2025). A quasi-experimental comparison of Kolb and Peyton educational approaches on CPR knowledge and performance among nurses. *BMC Medical Education*, 25(1), 530. <https://doi.org/10.1186/s12909-025-06996-0>
- Ahmad, N., Wider, W., Kadir, F., Hidrus, A., & Hassan, H. (2023). The effectiveness of modified conventional CPR training among North Borneo University Hospital healthcare providers. *Jurnal Ners*, 18(2), 124–130. <https://doi.org/10.20473/jn.v18i2.44667>
- Alamri, A. A., & Baker, O. G. (2022). Nurses' Self-Efficacy Regarding CPR: A. *Global Journal of Health Science*, 14(6). <https://doi.org/10.5539/gjhs.v14n6p1>
- Alaryani, Z. D., Alhotaian, A., & Elhady, M. (2021). The relationship between knowledge and self-efficacy of nurses regarding early initiation of CPR and automated defibrillation in Saudi Arabia. *Belitung Nursing Journal*, 7(5), 387–394. <https://doi.org/10.33546/bnj.1670>
- Al-sabri MAH, Elsayed SM, Elshanbary AA, et al. Knowledge, Attitude and Perceptions of Healthcare Workers in Arab Countries Regarding Basic Life Support; a Systematic Review and Meta-Analysis. *Arch Acad Emerg Med*. 2024; 12(1): e32. <https://doi.org/10.22037/aaem.v12i1.2223>.
- Angute, A., Gachathi, D. M., & Ramani, R. (2023). Association between nurses' perceived self-confidence in performing family witnessed resuscitation and implementation of the practice at Siaya County Referral Hospital in Kenya. *International Journal of Nursing Sciences*, 10(1), 117–120. <https://doi.org/10.1016/j.ijnss.2022.12.016>
- Chaudhary, G. P., Sah, K., Malla, J., Das, N., Chaudhary, S., Chaudhary, I., & Pandey, J. (2023). Knowledge regarding BLS among Health Care Workers of the Hospital of Nepal. *Journal of Healthcare Engineering*, 2023. <https://doi.org/10.1155/2023/9936114>
- Chik, M., Ahmad, A., Kunjukunju, A., Omar, M., Fariza, N., & Yusof, P. (2023). Knowledge and Practice of CPR (CPR) among Registered Nurses. *Open Access Journal of Nursing*, 6(2), 30–36. <https://doi.org/10.22259/2639-1783.0602005>
- Hsieh, P. Y., Lin, H. Y., Chang, C. H., Chang, Y. C., Cheng, H. P., Wang, C. Y., Wang, M. L., Wang, H. J., Liu, H. T., Chen, J. S., & Hsiao, F. H. (2021). Effects of situational simulation and online first-aid training programs for nurses in general medical wards: A prospective study. *Nurse Education Today*, 96. <https://doi.org/10.1016/j.nedt.2020.104621>
- Khaledi, A., Ghafouri, R., Anboohi, S. Z., Nasiri, M., & Ta'atizadeh, M. (2024). Comparison of gamification and role-playing education on nursing students' CPR self-efficacy. *BMC Medical Education*, 24(1), 231. <https://doi.org/10.1186/s12909-024-05230-7>
- Koyuncu, A., Pehlivan, K., Yava, A., Çetindaş, K., Karacan, H. I., & Ulaşlı, Z. (2024). New method for autonomous learning of BLS psychomotor skills: Pillow mannequin: Randomized controlled study. *Nurse Education Today*, 140, 106273.
- Malureanu, A.; Panisoara, G.; Lazar, I. The Relationship between Self-Confidence, Self-Efficacy, Grit, Usefulness, and Ease of Use of eLearning Platforms in Corporate Training during the COVID-19 Pandemic. *Sustainability* 2021, 13, 6633. <https://doi.org/10.3390/su13126633>
- Mersha, A. T., Gebre Egzi, A. H. K., Tawuye, H. Y., & Endalew, N. S. (2020). Factors associated with knowledge and attitude towards adult CPR among healthcare professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia: An institutional-based cross-sectional study. *BMJ Open*, 10(9). <https://doi.org/10.1136/bmjopen-2020-037416>
- Ming, C. J., Lam, S. K., & Jia, T. Y. (2025). Knowledge and Attitude towards Adult CPR among Nurses in Serdang Hospital: A Cross-sectional Study. *Malaysian Journal of Medicine & Health Sciences*, 21.
- Mohebi, S., Parham, M., Sharifirad, G., & Gharlipour, Z. (2023). Nurses' perception and self confidence of family presence during CPR in Saudi Arabia. *January*, 1–6. <https://doi.org/10.4103/jehp.jehp>
- Montoro-Pérez, N., Montejano-Lozoya, R., Rocamora-Rodríguez, C., & Perpiñá-Galvañ, J. (2025). Simulation-Based Educational Practices and Their Relationship with Emotional Intelligence and Stress Coping Skills: An Exploratory Case Study in First Aid Training for Physical Activity and Sports Sciences Students. *Trends in Higher Education*, 4(3), 50.
- Moon, H., & Hyun, H. S. (2019). Nursing students' knowledge, attitude, self-efficacy in blended learning of CPR: A randomized controlled trial. *BMC Medical Education*, 19(1). <https://doi.org/10.1186/s12909-019-1848-8>
- Oteir, A., Alqudah, Z., Almhawi, K., Hourani, Z., Alqudah, A., & Williams, B. (2025). Assessment of CPR knowledge and attitudes among allied health professionals: a correlational study. *Disaster and Emergency Medicine Journal*.
- Saidu, A., Lee, K., Ismail, I., Arulogun, O., & Lim, P. Y. (2023). Effectiveness of video self-instruction training on CPR retention of knowledge and skills among nurses in north-western Nigeria. *Frontiers in Public Health*, 11. <https://doi.org/10.3389/fpubh.2023.1124270>
- Sasmito, P., Purnamasari, E., Sumartini, S., & Purwanti, N. S. (2024). Determinants factors on Public Health Centre nurses ' confidence in performing CPR. 06(7), 581–590.
- Shah, A., Ullah, F., Noreen, N., Asad, M., & Khan, A. (2022). Knowledge, Attitude and Practices of BLS among Nurses: A Cross-Sectional Study in Malakand Division, Khyber Pakhtunkhwa. *Journal of Farkhanda Institute of Nursing And Public Health (JFINPH)*, 2(2), 19–23. <https://doi.org/10.37762/jfinph.66>

Siddiqi, F. A., Anwar, W., Saeed, B., Hussain, M., Abbas, N., & Khan, J. S. (2023). Comparison of the Four-step BLS Approach with Non-Standardised Training Approach in Achieving BLS Proficiency among the Healthcare Workers. *Pakistan Armed Forces Medical Journal*, 73(6), 1826–1829. <https://doi.org/10.51253/pafmj.v73i6.10375>

Silverplats, J., Strömsöe, A., Äng, B., & Södersved Källestedt, M. L. (2022). 'Attitudes towards cardiopulmonary resuscitation situations and associations with potential influencing factors—A survey among in-hospital healthcare professionals', *PLoS One*, 17(7), e0271686. <https://doi.org/10.1371/journal.pone.0271686>

Tomas, N., & Kachekele, Z. A. (2023). Nurses' Knowledge, Attitudes, and Practice of CPR at a Selected Training Hospital in Namibia: A Cross-Sectional Survey. *SAGE Open Nursing*, 9. <https://doi.org/10.1177/23779608231216809>

Note: Online license transfer

All authors are required to complete the E-B Proceedings exclusive license transfer agreement before the article can be published. This transfer agreement enables e-IPH, Ltd., UK to protect the copyrighted material for the authors, but does not relinquish the authors' proprietary rights. The copyright transfer covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microfilm or any other reproductions of similar nature and translations. Authors are responsible for obtaining from the copyright holder, the permission to reproduce any figures for which copyright exists.