Jurnal Ners

Volume 18, Issue 2, June 2023, p. 124-130
http://dx.doi.org/10.20473/jn.v18i2.44667

ORIGINAL ARTICLE OPEN ACCESS

The effectiveness of modified conventional CPR training among North Borneo University Hospital healthcare providers

Nazrin Ahmad[1], Walton Wider[2]*, Fairrul Kadir[2], Aizuddin Hidrus[2], and Hamidah Hassan[3]

[1] Nursing Services Department, Hospital Universiti Malaysia Sabah, Sabah, Malaysia

[2] Faculty Medicine Health Science, Universiti Malaysia Sabah, Sabah, Malaysia

[3] Department of Nursing, Universiti Tunku Abdul Rahman, Selangor, Malaysia

*Correspondence: Walton Wider. Address: Faculty Medicine Health Science, Universiti Malaysia Sabah, Sabah, Malaysia. Email: walton.wider@newinti.edu.my

Responsible Editor: Ferry Efendi

Received: 4 April 2023 ○ Revised: 9 June 2023 ○ Accepted: 17 June 2023

ABSTRACT

Introduction: Numerous studies reported that healthcare providers are not as effective in rendering high-quality CPR over time, despite receiving basic life support (BLS) or advanced cardiac life support (ACLS) training (Silverplats et al., 2022). Thus, to overcome the issue and develop a more feasible implementation of CPR training model, this study aims to identify the effectiveness of a modified conventional training (MT-CPR) method.

Methods: This was an experimental study conducted to 72 healthcare providers in a teaching hospital in north Borneo. Subjects underwent MT-CPR and data were collected using a validated questionnaire and skills assessment checklist adopted from AHA (2020). Data then was analysed using Friedman, Wilcoxon and McNemar test aided with IBM's Statistical Package for the Social Science (SPSS) statistic software.

Results: This study reported that MT-CPR significantly improved the knowledge and skills on CPR (p-value: <0.001). However, the training module significantly incapable to retain the knowledge and skills as early as 3 months post initial MT-CPR (p-value: <0.001). There was a statistically significant difference between the MCQ test scores (pre-course, post-course, and post 3 months-course) with $\chi 2$ (2) = 36.2 (2), p-value = <0.001. There is an association between post-course overall results and post 3 month overall results using McNemar test (p-value < 0.002).

Conclusions: Overall, this study indicated that modified CPR training (MT-CPR) were able to develop and improve the CPR knowledge and skill. The adaptation of conventional CPR training method seen effective as it has the capability for better engagement between trainer and participants.

Keywords: cardiac arrest, cardiopulmonary resuscitation, experimental, healthcare providers, modified conventional training method

Introduction

Cardiopulmonary resuscitation (CPR) refers to a chain of survival to be performed on a victim or patients who experience cardiac arrest, respiratory arrest and airway obstruction (Chen et al., 2017). It comprises of the combination of effective ventilation and manual chest compression to a person known to be pulseless and having abnormal breathing and gasping. The CPR course educates the participants to identify the signs of cardiac arrest, provide a high-quality of chest compression as well as operate the automated external defibrillator (AED) (Mersha et al., 2020). Adequate knowledge and skills on CPR is fundamental for healthcare providers (HCP) who work in a healthcare

setting. Without proper and prompt action to cardiac arrest victims, it may lead to severe implications and could cause death. Therefore, early recognition of cardiac arrest events followed by effective CPR is important for a better outcome.

Cardiopulmonary resuscitation (CPR) is the only procedure recommended by international and local resuscitation protocols to be performed on cardiac arrest victims (Kleinman et al., 2018). The outcome of cardiopulmonary resuscitation depends on the competence of the first responder who initiated the procedure (Silverplats et al., 2022). The parameters used to evaluate CPR quality are chest compression rate and depth (AHA, 2020). Despite receiving basic life support (BLS) or advanced cardiac life support (ACLS) training, several studies have demonstrated that nurses, as the dominant healthcare providers, become less effective at providing high-quality CPR over time (Silverplats et al., 2022). During CPR skills and knowledge evaluations, nurses frequently cannot perform adequate compression depth and rate in accordance with guidelines (du Plessis et al., 2022).

Nurses are the closest healthcare provider to the hospitalized individual and, therefore, they are usually the primary rescuer to initiate CPR for patients who develop cardiac arrest. Unfortunately, it was reported that nurses were poor in the recognition of the impending deterioration of patient condition due to cardiac problems which leads to sudden cardiac arrest (SCA) (Chaudhary et al., 2023), identification of abnormal cardiac arrest rhythms (Aljohani, 2022) and immediate action in the event of SCA (Varughese and Silva, 2019). These weaknesses form the essential reason for providing an adequate and structured model of CPR training for nurses. Periodic and structured CPR training has improved the CPR competencies among nurses (Nu et al., 2023). However, there is still a need to attend the refresher course as the guideline will routinely be modified (AHA, 2020).

Refresher CPR courses have long been used to maintain the skills of healthcare professionals. To determine the competency of participants and the efficacy of each new training model, however, multiple versions of the mode and content of CPR training have been implemented. The conventional method of CPR training is unquestionably the most effective method of instruction (Sand et al., 2021). It was defined as a physically attended and face-to-face course that requires multiple sets of equipment for training. This model typically takes one to two days to complete, depending on whether the participants are novices or merely seeking a refresher course. Despite the fact that numerous health institutions have begun incorporating artificial intelligence into CPR training, both models were deemed equally effective in terms of competency outcomes (Ali et al., 2021). However, not all institutions were found capable of developing training software or subscribing to the existing CPR training application. This study aims to identify the effectiveness of a modified traditional training method for better knowledge and skill sustainability in tertiary health facilities to address the issue and develop a more practical model for CPR training implementation.

Most victims of sudden cardiac arrest die due to poor prognosis and poor CPR performance by first responders or bystanders (Alnutaifi, 2021). Poor performance is defined as a delay in initiating CPR and insufficient chest compression depth and rate (Masood et al., 2020). Poor CPR outcome is often a result of rescuers' reluctance and apprehension in performing CPR (Chien et al., 2020). The majority of health institutions in Malaysia continue to implement CPR training using the conventional approach (Ali et al., 2021b). Even though they use similar American Heart Association (AHA) and National Committee of Resuscitation Team (NCORT) guidelines, each institution has been found to implement training differently. Due to the diverse clinical backgrounds and work experience of hospital participants, CPR training in hospitals necessitates different pedagogical principles and instructional strategies (Ali et al., 2021a). In comparison to those who work in a tertiary hospital, those who work in a district area will encounter fewer cardiac arrest cases. Lack of proper training would, inevitably, make acquiring and maintaining CPR skills difficult. To organize effective CPR training, however, it is essential to have access to knowledgeable trainers and useful equipment (Elmali and Balkan Kiyici, 2022). Therefore, limited resources necessitate some modifications to the conventional method of CPR instruction. In this study, the conventional method of training has been adapted to fit the needs of health institutions dealing with a similar issue. In Malaysia, CPR training programs adhere to the simplified and essential portion of adult BLS, which includes early recognition of SCA and activation of the emergency response system, early CPR with an emphasis on hands-on techniques, and rapid defibrillation (AHA, 2020; NCORT, 2020). Some institutions cannot use the standard certification training model for large-scale CPR training due to training costs, the lack of expert trainers (Ali et al., 2021b), and time constraints (Rabanales-Sotos et al., 2022). For busy tertiary health institutions to be feasible,

cost-effective, and time-friendly, it is necessary to develop a modified conventional training method. As the number of health providers increases, numerous health institutions seek to increase the proportion of CPR-trained health providers (Chien et al., 2020). Numerous studies have indicated that theoretical CPR training is ineffective for developing practical skills (Onan et al., 2019). According to some sources, a modified CPR training model, such as instructor-led instruction and video-assisted education emphasizing hands-on training, could effectively maintain trained participants (Alnutaifi, 2021). In addition, receiving direct instruction from the instructor may result in a higher level of competency for CPR training that is both sustainable and effective (Masood et al., 2020).

Materials and Methods

Study design

This was a quasi-experimental study aimed to identify the effectiveness of a modified traditional training method for better knowledge and skill sustainability in tertiary health facilities so as to address the issue and develop a more practical model for CPR training implementation. It was conducted in May 2022 until September 2022 (4 months) in the clinical simulation unit of a teaching hospital in northern Borneo. It consists of the traditional method, modified module and the dependent variable which measures the competency level of healthcare providers focused on cognitive knowledge and hands-on skills. Hands-on skills are defined as the ability to recognize and perform immediate CPR emphasizing on hand placement, depth, and rate.

Sample

The study population consisted of medical officers, nurses, assistant medical officers, and nursing assistants from a teaching hospital in north Borneo. The site study was selected as it was the first teaching hospital in north Borneo of Malaysia that required an effective method of CPR training for the staff. The sample population selection was chosen based on the usual composition of a resus team in local clinical setting. The inclusion criteria were 1) healthcare providers in University Malaysia Sabah, 2) not pregnant, 3) underwent formal CPR training for less than five (5) years and the exclusion criteria were vice versa.

Intervention

In the first phase of the study, the subjects participated in a modified BLS training course; in the second phase, three months later, they were evaluated for their knowledge and skill retention. Pregnant subjects who refused to participate in this study were excluded from the analysis. All the potential participants who met the inclusion criteria read the consent form. The author answered the questions from the participants related to the study before they decided to take a part. The author described the study purpose, the significance of the study, and the expected time of completing the study questionnaires for all participants. In addition, participant's rights, including voluntary participation, the right to withdraw from the study at any time, and confidentially of the participants were assured.

Table 1. Distribution of sample based on demographic data (n=33)

	Respondents (*n*)	Respondents (%)
Age group		
20-30	22	66.7
30-40	11	33.3
Gender		
Male	4	12.1
Female	29	87.9
Designation		
Doctor	4	12.1
Nurse (RN)	22	66.7
Assistant Medical Officer (AMO)	5	15.2
Assistant Nurse (AN)	2	6.1
Year of experience		
< 1 year	2	6.1
1 - 2 years	7	21.2
2 - 3 years	4	12.2
3 - 4 years	15	45.5
> 5 years	5	15.2

n = numbers, % = percentage

Study instrument

This was a partial validated instrument called modified conventional CPR training (MT-CPR). It consists of theoretical and practical session, pre- and post-test for MCQ and post-test only for the practical part. The theoretical and practical content was based on the American Heart Association (2020) guideline for healthcare providers. MT-CPR was purposely designed to be implemented in eight (8) hours total and potentially can be reduced depending on the number of participants. To reduce the theoretical session time consumed, a lecture handbook was given two weeks prior the course being implemented.

Knowledge measurement

In phases one and two, subjects were required to answer the 50 MCQ questionnaires related to CPR knowledge. A scoring key was designed where each correct answer was awarded 1 mark and the wrong answer 0. Thus, the item maximum score was 50 and the minimum was 0. Consequently, the participants were required to get >43 scores to be considered as pass. Since health workers should have sufficient knowledge

Table 2. Distribution of participants based on the level of knowledge

Level of knowledge	Score (Maximum=50)	Respondents					
		Pre-course		Post-course		Post-3 months	
		n	%	n	%	n	%
Adequate knowledge	>43 or >86%	5	16.7	17	56.7	6	20
Moderate knowledge	35 - 42 or 70 - 84%	23	76.7	10	33.3	14	46.7
Poor knowledge	<34 or < 68%	2	6.7	3	10	10	33.3

in this very critical area, knowledge scores of above 43 or 86% were considered "adequate" knowledge, scores 35 - 42 or 70 - 84% were considered "moderate" knowledge, and scores of below 34 or < 68% were considered as "poor" knowledge.

Skills measurement

The practical skills were evaluated using four parameters: rate, depth, pause duration between compression and ventilation techniques. The AHA (2020) skills assessment checklist was utilized to evaluate the practical skills which consisted of assessment (recognition sign of SCA and activation of ERT and high-quality chest compression (rate 100-120 cpm, depth at least 5cm, minimize interruptions, avoid excessive ventilation, complete chest recoil, opening the airway using head tilt chin lift). The skills assessment was done by the certified trainer among medical officers and assistant medical officers. The participants were considered passed or failed based on the expert judgment with the emphasis on the correct sequence of looking for danger, checking for response, calling for help and performing high quality chest compression

Data collection

Prior to data collection, participants were briefed and given the opportunity to enquire about the implementation of the study. Ethical consideration was taken from Medical Research Ethics Committee of UMS [Approval Code: JKEtika 1/22(14)]. Collected data were checked for their completeness before the analysis process took place

Data analysis

The results of the participants' theory test and performance on the practical skills test were entered into a data collection form as numeric values. Data collection forms were reviewed and transferred to an Excel spreadsheet. Statistical Package for the Social Sciences (SPSS version 25) was utilized to analyze the data.

Results

The majority of respondents were in the age of 20-30 years old (66.7%) followed by 33.3% of the 30-40 age group. The mean age for the study participants was 28 of 33 respondents, where 29 (87.9%) were females and four (4) (12.1%) were males. This study reveals that 22 (66.7%) respondents were nurses, followed by five (5) assistant medical officers (15.2%), four (4) doctors (12.1%) and two (2) assistant nurses (6.1%). Based on work experience, this study demonstrates that the maximum year of experience is of 3- 4 years (15,45.5%), followed by 1-2 years' experience (7, 21.2%), more than five (5) years 5, (15.2%), 2-3 years (4, 12.2%) and less than 1 year (2, 6.1%).

Table 2 represents that pre-course indicated most of the respondents as having moderate knowledge (23, 76%), followed by adequate knowledge (5, 16.7%) and poor knowledge (2, 6.7%). After undergoing the MT-CPR, the distribution of knowledge reported to be positive was 17 (56.7%) having adequate knowledge, 10 (33.3%) with moderate knowledge and three (3) (10%) with poor knowledge. Unfortunately, the level of knowledge deteriorated three months after training, which revealed 14 (46.7%) as having moderate knowledge, six (6) (20%) having adequate knowledge and 10 (33.3%) with poor knowledge.

Based on Table 3, there was a statistically significant difference between the MCQ test scores (pre-course, post-course, and three months post-course) with $\chi2(2) = 36.2$, $p < 0.001$. For the post-hoc test to determine where the differences among these three scores were, the Wilcoxon signed-rank test was performed on the different combinations of the three score groups (Table

Table 3. Comparison of MCQ test result (pre-, post-, 3 months post-course)

	Median (IQR)	χ^2 (df)	*p*-value
MCQ Test score		32.6 (2)	<0.001
Pre-course	38.0 (5)		
Post-course	43.0 (5)		
Three months post-course	39.5 (7)		

Note: Friedman test was performed, and *p*-value obtained was significant.

Table 4. Comparison of MCQ test result (pre- vs post-course, pre- vs post-3 months, post- vs post-3 months)

Comparisons	Median difference	Z	*p*-value
Pre- vs Post-course	-5	-4.185[a]	<0.001
Pre- vs Post-3 months	-1.5	-0.189[a]	0.850
Post- vs Post-3 months	3.5	-4.501[b]	<0.001

Note: *Wilcoxon Signed-Rank* test was performed.
[a]Based on negative ranks.
[b]Based on positive ranks.

Table 5. Comparison of post-course and post-3 months practical skills

Variables	Post-3 months practical skills		*p*-value
	Pass	Fail	
Post-course practical skills			
Pass	18	10	0.002
Fail	0	0	

Table 6. Comparison of post-course and three months post-course overall results

Variables	3 months post course overall results		*p*-value
	Pass	Fail	
Post-course overall results			
Pass	6	21	< 0.001
Fail	0	1	

4). From the post hoc test, the median change of score for pre- and post-course significantly differed from zero ($p < 0.001$), which indicates that the score was significantly increased after the course. However, there was no significant difference between pre- and three months post-course ($p = 0.850$), which indicates that the score between pre- and three months post-course were almost the same. There was a significant difference between post- and three months post-course ($p < 0.001$) indicating that the score was significantly decreased three months after the course compared to the post-course score.

Table 5 displays the association between the post-course practical skills and the practical skills of participants after three months, as analysed by McNemar test. A total of 28 participants passed the post-course skills station, while 0 participants failed. After three months, 18 participants passed the practical skills again, while 10 failed. The p-value obtained from the test was 0.002, indicating a statistically significant association between the two variables.

Table 6 displays the association between the post-course overall results and the post-3 months overall results of participants, as analyzed by McNemar test. A total of 27 participants passed the post-course overall results, while one (1) participant failed. After three months, six (6) participants passed the overall results, while 22 failed. A McNemar test was performed to determine if there was a significant association between post-course overall results and the post-3-months overall results. The p-value obtained from the test was < 0.001, indicating a statistically significant association between the two variables.

Discussions

The MT-CPR model was created by an emergency department expert with the primary goal of educating and ensuring that healthcare providers acquire adequate CPR knowledge and skills. This model was created in response to current hospital operations, taking into account the availability of expert trainers, equipment, budget, and time constraints. The study found a significant difference between the pre-, post-, and post-3-month MCQ knowledge assessment courses. The preliminary results of the pre-course show that the majority of the subjects had a low level of knowledge before undergoing the MT-CPR. However, the level of knowledge drops dramatically after three months. Ahn et al. (2016) reported that CPR knowledge and skill deteriorate as early as three months without practice. This result was similar to practical skills performance wherein it deteriorates as early as three months post initial training.

Following MT-CPR, the subjects' CPR practical skills were deemed adequate. However, the MCQ assessment result showed a similar pattern of deterioration in practical skills after three months. The assessor (after three months) commented that most of the subjects were unsure and found it difficult to recall the DRSCAB sequence (danger, respond, shout for help, compression, airway, breathing), and that the rate of chest compression was irregular and could be less than 100 compressions per minute. There is no doubt that modified and simplified traditional CPR training is highly recommended to improve trainee knowledge and skills (Alnutaifi, 2021). However, there is no guarantee that the participants would use the traditional training method on a regular basis due to several constraints such as time, course availability, and the fee to attend this type of training approach. Because CPR certification courses are in high demand, most government public health institutions are focusing on this aspect. Some critical clinical departments, such as emergency and anesthesia, may have key performance indicators (KPIs) that must be met in order to organize CPR training on an annual basis. However, due to the workload, the availability of expert trainers, and the lack of equipment, the KPI were difficult to meet. Nonetheless, lack of CPR practice due to lack of SCA cases leads to poor hands-on performance by the HCP.

Nonetheless, the recent COVID-19 pandemic, which prohibits any physical contact, and the strict rules requiring the use of proper PPE, has exacerbated the implementation of traditional physical training approaches (Castillo et al., 2022). Aside from modifying the traditional training approach for improved and sustained competency, the study recommends simplifying the sequence of CPR training to only include

the core components such as look for danger, check for response, call for help, and hands-on chest compression. It is well-known that a simple and straightforward training module can have a positive impact on overall training results, implementation, and retention of CPR competency (Grief et al., 2021). This training model could also be used by the community for training purposes. International resuscitation guidelines recommended optimizing the use of technology in CPR training as alternatives to the traditional training approach (Lim et al., 2022). With the current COVID-19 pandemic situation and other barriers mentioned earlier, numerous studies have been conducted to determine the efficacy of this technology-based training. In Europe, smartphones were widely used as primary tools in technology-based CPR training to increase the survival rate during out-of-hospital cardiac arrest (OHCA). CPR training can also be done in hybrid mode, which is a combination of technology and traditional training methods. The theory portion of the hybrid training model will be delivered via web-based learning, instructional video, mobile apps, and computer programs. VR and AR systems can be used to supplement physical practice. Nonetheless, the incorporation of technology in an appropriate device not only aids in training, but is also beneficial when confronted with a cardiac arrest event (Dong et al., 2020). The advantages of incorporating the traditional method into a technology-based approach may empower the user to do self-directed learning and reduce reliance on instructor availability. This advanced approach is also cost-effective because it does not necessitate additional trainers or equipment, depending on the technology-based training module used (Rabanales-Sotos et al., 2022). Aside from that, this alternative approach to supplementing current standardized and modified CPR training can help healthcare providers and communities overcome time constraints.

Limitation

A larger sample size is recommended for better and more consistent results. The sample size in this study, however, was small. As a result, it does not represent all healthcare providers in the study setting. Larger sample sizes should be considered in future studies to provide more consistent and generalizable results. This will help to ensure that the findings apply to a larger population of healthcare providers and communities.

Conclusions

Overall, this study found that modified CPR training (MT-CPR) was effective in developing and improving CPR knowledge and skills. The adaptation of traditional CPR training method is seen as effective because it allows for greater engagement between trainer and participants. Numerous studies reported that competency could deteriorate as early as three months. Therefore, it is recommended to retrain HCP in monthly basis using the MT-CPR or other simplified training approach. Organizing eight hours of MT-CPR is feasible in this study setting as it has a potential to be organized for a few sessions on weekly basis. Thus, more HCP will be able to refresh their competency. However, the implementation of MT-CPR on monthly basis still depends on a few factors such as the availability of expert trainer, equipment, workload, and budget.

The retention of competency after initial training is still debatable. As a result, it is advised to supplement current training methods with technology-based training methods. For better psychomotor and cognitive outcomes, important elements such as instructor guidance, real-time feedback, interaction between trainer and participants, hands-on practice and assessment, and an interesting method of training implementation are still required. On top of that, the MT-CPR could be implemented in hybrid mode to minimize the weakness of traditional training methods such as the availability of expert trainer and cost issue. Therefore, it is critical to organize regular simplified and easier implementation of training in order to maintain competency for both healthcare providers and the community.

References

AHA. (2020). CPR & ECC Guidelines | American Heart Association CPR & First Aid. Retrieved from https://cpr.heart.org/en/resuscitation-science/cpr-and-ecc-guidelines

Ahn, C. *et al.* (2016). Evaluation of smartphone applications for cardiopulmonary resuscitation training in South Korea. BioMed Research International, 2016. https://doi.org/10.1155/2016/6418710

Ali, D. M. *et al.* (2021a). Cardiopulmonary resuscitation (CPR) training strategies in the times of COVID- 19 : a systematic literature review comparing different training methodologies. December. https://doi.org/10.1186/s13049-021-00869-3

Ali, D. M. *et al.* (2021b). Cardiopulmonary resuscitation (CPR) training strategies in the times of COVID- 19 : a systematic literature review comparing different training methodologies. 1–16. https://doi.org/https://doi.org/10.1186/s13049-021-00869-3

Aljohani, M. S. (2022). Competency in ECG Interpretation and Arrhythmias Management among Critical Care Nurses in Saudi Arabia : A Cross Sectional Study.

Alnutaifi, N. (2021). Knowledge and skills of cardiopulmonary resuscitation among critical care nurses in Kuwaiti Hospitals. American Journal of Nursing Research, 9(2), 64–70. https://doi.org/10.12691/ajnr-9-2-4

Castillo, J. *et al.* (2022). Competencies in basic life support after a course with or without rescue ventilation: Historical cohort study. Healthcare, 10(12), 1–6. https://doi.org/10.3390/healthcare10122564

Chaudhary, G. P. *et al.* (2023). Knowledge regarding Basic Life Support among Health Care Workers of the Hospital of Nepal. 2023.

Chen, M. *et al.* (2017). Public Knowledge and Attitudes towards Bystander Cardiopulmonary Resuscitation in China. 2017. https://doi.org/10.1155/2017/3250485

Chien, C. *et al.* (2020). Traditional versus blended CPR training program : A randomized controlled non-inferiority study. Scientific Reports, 1–9. https://doi.org/10.1038/s41598-020-67193-1

Dong, X. *et al.* (2020). Effect of a real-time feedback smartphone application (TCPRLink) on the quality of telephone-assisted CPR performed by trained laypeople in China: A manikin-based randomised controlled study. BMJ Open, 10(10), 1–10. https://doi.org/10.1136/bmjopen-2020-038813

du Plessis, N., Lamacraft, G., & Joubert, G. (2022). Training, knowledge, experience and perceptions regarding cardiopulmonary resuscitation of doctors at an academic hospital in central South Africa. African Journal of Emergency Medicine, 12(4), 344-351.

Greif, R. *et al.* (2021). European Resuscitation Council Guidelines 2021: Education for resuscitation. Resuscitation, 161, 388–407. https://doi.org/10.1016/j.resuscitation.2021.02.016

Elmali, Ş., & Balkan Kiyici, F. (2022). Technology-Based Professional Development Program: Experiences of Science Teachers. Journal of Educational Technology and Online Learning, May. https://doi.org/10.31681/jetol.1081367

Kleinman, M. E. *et al.* (2018). 2017 American Heart Association focused update on adult basic life support and cardiopulmonary resuscitation quality: An update to the American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation, 137(1), e7-e13. https://doi.org/10.1161/CIR.0000000000000539

Lim, X. M. A. *et al.* (2022). The effectiveness of technology-based cardiopulmonary resuscitation training on the skills and knowledge of adolescents: Systematic review and meta-analysis. Journal of Medical Internet Research, 24(12). https://doi.org/10.2196/36423

Masood, A. *et al.* (2020). Awareness, knowledge and critical resuscitation skills among health care professionals of a tertiary health care facility. International Journal of Cardiac Science and Research, 108.

Mersha, A. T. *et al.* (2020). Factors associated with knowledge and attitude towards adult cardiopulmonary resuscitation among healthcare professionals at the University of Gondar Comprehensive Specialized Hospital , Northwest Ethiopia : an institutional- - based cross- - sectional st. 1–11. https://doi.org/10.1136/bmjopen-2020-037416

NCORT. (2020). Guidelines for Resuscitation Training.

Nu, M. *et al.* (2023). Effectiveness of Basic Life-Support Programme and Public Cardiopulmonary Resuscitation (CPR) Training Event Among Medical Students : A Pilot Quasi-Experimental Study. 15(1), 59–71. https://doi.org/10.21315/eimj2023.15.1.5

Onan, A. *et al.* (2019). The effectiveness of traditional Basic Life Support training and alternative technology-enhanced methods in high schools. Hong Kong Journal of Emergency Medicine, 26(1), 44–52. https://doi.org/10.1177/1024907918782239

Rabanales-Sotos, J. *et al.* (2022). Development and validation of a novel ultra-compact and cost-effective device for basic hands-on CPR Training: A randomized, sham-controlled, blinded trial. International Journal of Environmental Research and Public Health, 19(22), 1–10. https://doi.org/10.3390/ijerph192215228

Sand, K. *et al.* (2021). Cardiopulmonary resuscitation retention training for hospital nurses by a self-learner skill station or the traditional instructor led course: A randomised controlled trial. Resuscitation plus, 7, 100157. https://doi.org/10.1016/j.resplu.2021.100157

Silverplats, J. *et al.* (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

Varughese, S., & Silva, B. D. (2019). Knowledge and Perspective on Cpr Among Staff Nurses Knowledge and Perspective on Cpr Among Staff Nurses. February 2018, 3–6. https://doi.org/10.9790/1959-0701071214

How to cite this article: Ahmad, N., Wider, W., Kadir, F., Hidrus, A., and Hassan, H. (2023) 'The effectiveness of modified conventional CPR training among North Borneo University Hospital healthcare providers', *Jurnal Ners*, 18(2), pp. 124-130. doi: http://dx.doi.org/10.20473/jn.v18i2.44667