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Review Article

Training Methods of Basic Life Support in Laypeople to Prevent Death Due to Cardiac Arrest: Scoping Review

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ABSTRACT

Introduction: Most major deaths worldwide are caused by cardiac arrest outside the home. Cardiac arrest is a fatal event and is still a major topic of public health. One effort that can be made to increase community knowledge and skills is to provide Basic Life Support (BLS) training using interesting methods. The purpose of this scoping review is to identify methods of BLS training in laypeople to prevent death from heart attacks. **Methods:** We conducted a Scoping Review to identify BLS training methods in the community with a search process using appropriate populations, concepts, and contexts. The databases used for article searches are Science Direct, SAGE, PlosOne, Pubmed, NCBI, and Google Scholar. The selection process was carried out using the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) method and conducting a Critical Appraisal using The Joanna Briggs Institute checklist. **Results:** From 2,996, 11 articles were selected in this review**.** Some of the training methods that can be carried out are in-person training, using mobile applications, CPR videos, and Virtual reality compression. **Conclusion:** The BLS training methods can be used to increase the knowledge and skills of ordinary people.

Keywords: Training, Basic Life Support, Laypeople.

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INTRODUCTION

Most of the main deaths worldwide are caused by cardiac arrest outside the home [1]. Cardiac arrest is a fatal event and is still a major topic of community health worldwide [2–4]. Annual incidence rates and clinical outcomes of cardiac arrest are an indicator of a country's health [5–7]. Reports around the world through meta-analysis explain that the incidence of cardiac arrest is 45-83,7 per 100.000 population [1]. According to data from the American Heart Association in 2016, there were more than 350.000 incidents of CPR outside the hospital with a salvageable rate of 12%, while there were 209.000 incidents of CPR within the hospital with a salvageable number in adults of 24,8% [8,9].

According to the Swedish cardiopulmonary resuscitation council, the incidence of out-of-hospital cardiac arrest in Sweden is approximately 54 per 100.000 person-years. The majority of all cardiac arrest victims occur at home, where the prognosis is worse compared to cardiac arrests that occur in other locations in the community [10,11]. One of the results of research in Indonesia that cardiovascular disease is included in the high risk category (52.5%) which occurs in informal sector workers [12]. Cardiopulmonary Resuscitation (CPR) increases the chances of survival two to three times [2,13–16]. It is therefore important that as many individuals in the community as possible acquire sufficient CPR skills [16–18].

Survival is much more likely when out-of-hospital heart failure victims receive immediate Cardiopulmonary Resuscitation (CPR) from bystanders [19,20]. Therefore contacting Emergency Call and CPR given immediately by a bystander can increase the number of people who are given a chance to survive (2,6,19,20). This is in line with some data, namely the number of OHCA victims who survived by bystanders was 31,7 percent. Meanwhile, according to the American Heart Association (2015), 40,1% of OHCA victims were saved after cardiopulmonary resuscitation (CPR) by bystanders. Knowledge and skills are things that must be owned by everyone, both medical personnel and ordinary people because heart failure events outside the hospital can occur anywhere and anytime [20,21].

There are many methods of BLS training provided to laypeople. According to [19] that if laypeople are given education, it can be effective if given seriously, studies conducted show that the understanding and skills of ordinary people are good if they are trained seriously and use methods [22–24]. One method that is given to laypeople is BLS training using Visual Feedback from the device. Results Use of real-time visual feedback in BLS/ courses can improve CPR quality participants and their adherence to the guidelines [25]. Research [14] using the blended method provided the same even higher level of knowledge and skills immediately after the course and six months later.

The results of other studies show that the SGD (Small-Group Discussion) updating program is more effective than the PWW (Practice-While-Watching) program for improving BLS skills [26]. There are various BLS training methods for ordinary people, so a further literature review is needed to determine the right method for increasing the knowledge and skills of the common people. Currently, there is a lack of literature review regarding BLS training methods for laypeople. Therefore, this *scoping review* aims to identify methods of BLS training in laypeople to prevent death from cardiac arrest.

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METHODS

Protocol Study

The protocol in this scoping review uses PRISMA for scoping reviews, http://prisma-statement.org/Extensions/ScopingReviews.

Ethics Approval

This study was based only on published articles, so ethical approval was not obtained.

Eligibility Criteria

This study selected articles with the following criteria:

a. Discuss basic life support training

b. The population in the article is adults or common people

c. Articles published in English

d. Articles published from 2012-2022

Search Strategy

Articles are selected through indexed databases at reputable institutions; Scopus, Web of Science, and Directory of Open Access Journals (DOAJ), including Science Direct, SAGE, PlosOne, Pubmed, NCBI, and Google Scholar. The initial search was carried out on January 15 - April 2, 2022. The search process in this review refers to predetermined clinical questions, namely PCC [Population (P), Concept (C), and Context (C)]. The population in this study is ordinary people, the research concept is Basic Life Assistance Training (BLS), and the context is the research conducted in the community. The keywords used are "Training" AND "Basic Life Support" OR "Cardiopulmonary Resuscitation" AND "Laypeople" AND "Community". From the search results through these keywords, relevant articles were found according to the inclusion criteria. The selection of articles in this study followed a method called Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) (27)

Study Selection

Articles found in the initial search containing 2.996 items based on keywords previously described articles were excluded due to duplication and not by the title and abstract; 2.798 articles were included in the screening stage. Items that are complete and considered feasible total 198 items. Then 139 items were excluded because the results were irrelevant. Then there were 59 remaining articles, but 48 articles were excluded with the reason that 17 only contained abstracts and 31 articles based on exclusion criteria and 11 reports that met the requirements for review are presented in Figure 1 and Table 1.1.

The researcher read 11 articles read in full which were selected with critical judgment using the JBI checklist (The Joanna Briggs Institute) for Cluster Randomized Trials (CRTs), Randomized Controlled Trials, and Feasibility Studies. This method uses several criteria to assess the quality of the article to decide whether the article can be processed at the synthesis stage or not. These criteria include sample and research subjects, type of intervention, and statistical analysis. No studies were excluded based on this quality assessment.

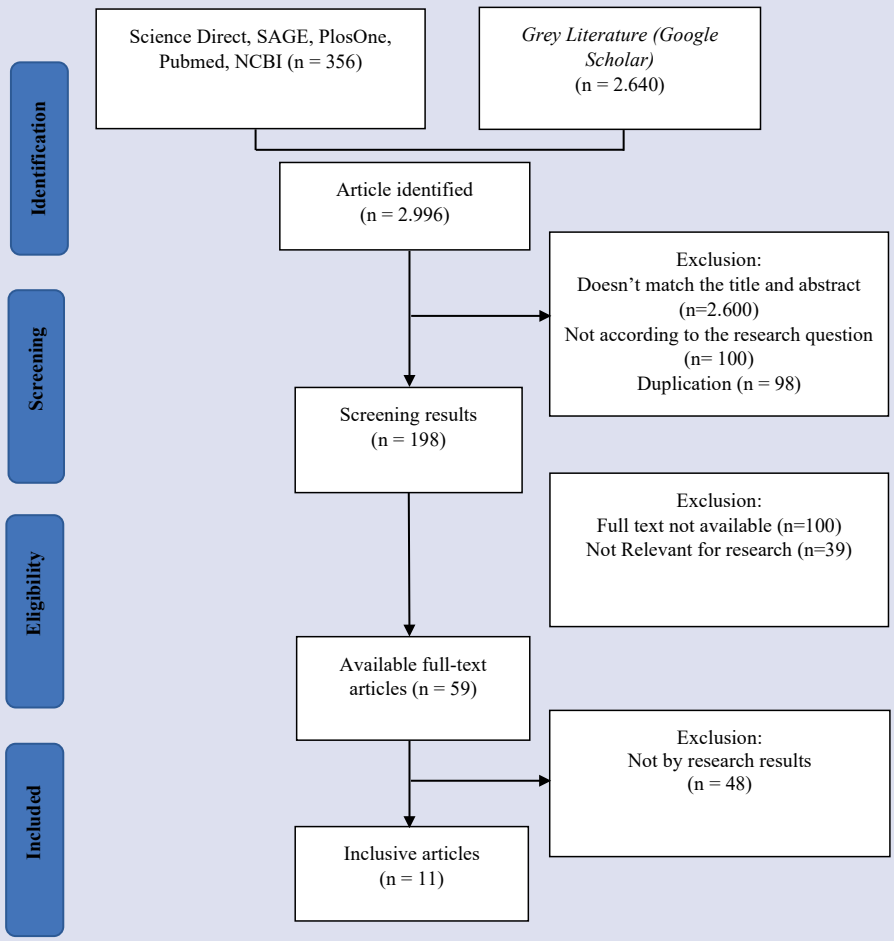

Figure 1. Flowchart for inclusion and exclusion studies.

Table 1. Grid Synthesis.

No	Title	Researcher	Design	Sample	Intervention	Results and Recommendations
1	Very brief training for laypeople in hands-only cardiopulmonary resuscitation. Effects of real-time feedback	González-Salvado et al. (2019)	Randomized Control Trial	Nurses and the community within the scope of the hospital	Short Direct BLS Training with only giving CPR without Ventilation	With very brief training supported by instructor-led suggestions and visual feedback, laypeople can perform good-quality CC-CPR. Simple instructions, feedback, and motivation were key elements of this strategy, which made it possible to train large numbers of citizens.
2	Protocol of a Multicenter International on Different Protocols of Cardiopulmonary Resuscitation for Laypeople (MANI-CPR)	Baldi et al. (2018)	Randomized Controlled Study	Laypeople	Live BLS Training at a Training Center using several different CPR protocols	This is a prospective randomized trial conducted at eight training centers. Laypeople who pass the BLS course will be randomized to one of four CPR protocols in a simulated 8-minute cardiac arrest scenario on a manikin: (1) 30 compressions and 2 seconds of rest; (2) 50 compressions and 5-second pause; (3) 100 compressions and 10-second pause; (4) compression only. The calculated sample size was 552 people. The primary outcome is the percentage of chest compressions performed to the correct depth evaluated by a computer feedback system (Laerdal QCPR).
3	Real-time visual feedback during training layspersons' CPR quality	Baldi et al. (2017)	A randomized controlled manikin study	Laypeople	Evaluation using a Manikin with visual feedback	There was a significant increase in compression percentage with correct depth in the feedback-receiving group compared to the others. Real-time visual feedback improves the quality of layman CPR, and we recommend using it in every BLS/AED of course for laypersons as it can help achieve the goal.
4	Retention of Basic Life Support in Lay People	Boet et al. (2017)	Mastery Learning vs. Time-based Education	General students Except Health Students	Live Training	There was no advantage to mastering learning (ML) compared to the BLS time-based (TB) course for the acquisition and four months of retention of knowledge or skills among lay people.
5	Incorporating cardiopulmonary resuscitation training into a cardiac rehabilitation program	Cartledge et al. (2018)	A feasibility study	Patient's family	Live Training	Cardiac patient participation rates in CPR classes were high (n = 56 and 72.7% of eligible patients) with a further 27 family members attending the training. Patients were predominantly male (60,2%), and family members were predominantly female (81,5%), both with a mean age of 65 years. Confidence to perform CPR and willingness to use skills significantly increased post-training (both p < 0,001). Post-training participants showed an average compression rate of 112 beats/min and an average depth of 48 mm. The range of the training was doubled when participants shared the video self-instruction kit with a further 87 people. Patients, family members, and cardiac rehabilitation staff received positive feedback about the training.
6	Comparison of a virtual reality compression-only Cardiopulmonary Resuscitation (CPR) course to the traditional course with content validation of the VR course – A randomized control pilot study	Hubail et al. (2022)	Randomized Controlled Trial	Volunteer	Virtual reality compression-only Cardiopulmonary Resuscitation (CPR)	Virtual Reality training can interestingly provide CPR skills and acquire the same skills in each volunteer as compared to traditional methods. The assessment was carried out objectively and subjectively. As for the content, the positivity of experience, usability, and suitability of the participants showed the same satisfaction before and after use.
7	Complete chest recoil during laypersons' CPR: is it a matter of weight?	Contri et al. (2017)	A randomized controlled manikin study	Laypeople	Hands-on BLS training	This training has a positive impact on the participants. Anthropometric variables not only affect the depth of chest compressions but also the presence of complete chest expansion. CPR instructors must adapt their attention during training to different aspects of the chest and compressions depending on the participant's physical characteristics.

No	Title	Researcher	Design	Sample	Intervention	Results and Recommendations
8	Comparative evaluation of video-based online course versus serious game for training medical students in cardiopulmonary resuscitation: A randomized trial	De Sena et al. (2019)	A Randomized Controlled Trial	First-year student	CPR self-training using video-based Apple Keynote presentations	Video-based self-training has higher effectiveness than theoretical and practical self-training.
9	A pragmatic randomized trial of cardiopulmonary resuscitation training for families of cardiac patients before hospital discharge using a mobile application.	Blewer et al. (2020)	Cluster randomize study	The patient's family is treated in a ward at the hospital	Mobile Applications	In a large prospective trial of CPR skill retention for family members of cardiac patients, mApp training was associated with lower CC quality. So additional approaches are still needed to improve CPR skill retention.
10	Video-Only Cardiopulmonary Resuscitation Education for High-Risk Families Before Hospital Discharge (2016)	Blewer et al. (2016)	Cluster randomized trial of CPR education (A Multicenter Pragmatic Trial)	Families of patients who are hospitalized	Providing Training with CPR Videos	In this large, prospective CPR skills retention trial, VO training resulted in non-inferior differences in CC rates compared to VSI training. The compression depth was greater in the VSI group. These findings suggest a potential trade-off in efforts for widespread dissemination of basic CPR skills; VO training allows for increased scalability and dissemination but with the potential for reduced CC depth.
11	Medical Students Can be Trained to be Life-Saving First Aid Instructors for Laypeople	Ismail et al. (2019)	A Feasibility Study from Gaza, Occupied Palestinian Territory	Student	BLS training by recruiting medical students as instructors	This training is Eligible to recruit local medical students for practical BLS and CPR training targeting laypeople in a community that is currently having a lot of activity. The impact of training on participant understanding and evaluation of patient outcomes needs further research.

RESULTS

Research Designs

A total of 11 articles identified in this scoping review match the criteria for the method used in conducting basic life support training in patients who have experienced cardiac arrest. The article consists of 9 articles using the randomized controlled study research design and 2 articles using a feasibility study.

Types of Basic Life Support training intervention methods

a. In-person training

Training conducted [28] practiced hand CPR on a manikin and was afterward evaluated during a 2-minute chest compression test. During the training, brief instructions were given regarding hand position, compression level, and depth according to current guidelines, and thereafter feedback was provided regarding the timing used. Research conducted [25,29] simulated cardiac arrest and practiced CPR for 8 minutes and 10 minutes. Training that pays attention to chest depth and development is also important [30,31]. Research [23,32] still requires further research regarding the benefits, understanding, and evaluation results of the CPR training conducted.

b. Training using mobile applications

(33) conducted Basic Life Support intervention training using the mApp using videos without practicing using a manikin and videos with practicing using a manikin. CPR skills were evaluated 6 months post-training. Research [34] conducted training with the video and game-based Apple Keynote application in a 3D environment.

c. Training using CPR videos

(35) conducted a validated video training program and video self-instruction (VSI) kit. Both groups used hand-only CPR as the instruction mode (chest compressions without ventilation). The control group received a VSI kit that included a head mannequin and a 22-minute instructional DVD. The experimental group received training videos on DVD (without the manikins). After the training session, a survey was conducted to assess the comfort level of the participants in the training process.

d. Training using Virtual reality compression

The training conducted (36)) in the traditional teaching or CPR practice group directly became the control group and the intervention group that received Virtual Reality (VR) teaching. At this training, led by an experienced instructor, where participants wear a VR headset and hand sensor (HTC Vive) and then follow verbal and visual instructions that focus more on the hands-on experience of a CPR manikin. Each session lasts approximately 5–7 minutes and is conducted twice for each participant. After that, an evaluation was carried out using a questionnaire of all participants.

DISCUSSION

From the 11 articles reviewed, several training methods were obtained that could be carried out to increase the knowledge and skills of ordinary people in preventing death from heart attacks, namely: hands-on training in the form of theory and practice, using mobile applications, CPR video, and Virtual reality compression. After receiving basic life support training, the best way to find out what participants are capable of is to do a simulation c. Simulation-based interventions offer the possibility of being positively evaluated to enhance students' skills in recognizing and dealing with emergencies. Additional studies are needed to measure the long-term retention of acquired skills, as well as the effects of training on healthcare professionals [37].

According to research conducted [38] that BLS simulation training sessions are associated with significant skill and performance improvements among Jordanian nurses. Initial BLS training sessions for nurses are highly recommended to ensure nurses are prepared for a

real CPR event. BLS training increases the confidence and willingness of laypeople to perform CPR on strangers. However, some challenges from BLS training given to laypeople are that they are more willing to perform CPR with hand compressions alone than to perform standard CPR (CPR and Mouth to mouth Ventilation) on strangers regardless of BLS training. Most respondents, who reported they would refuse to perform standard CPR, stated that fear of responsibility and fear of disease transmission were determining factors after BLS training [28,39].

Technological developments make it easier for some groups or individuals to conduct training, such as research conducted [33] that training using a mobile application (mApp) can be effective in increasing the CPR abilities of ordinary people in large prospective trials on retention of CPR skills for members families of heart patients, mApp training is associated with low-quality Chest Compression (CC) so additional approaches are still needed to improve the retention of these .It's just that this training method still has to be accompanied by additional approaches such as giving simulations using a manikin directly so that ordinary people can easily perform CPR procedures. In contrast to research conducted [34] that CPR self-training using video-based Apple Keynote presentations has higher effectiveness compared to only theoretical and practical explanations.

A training method that does not require a large amount of money, namely using the Vidoe-Only method, such as research conducted [35] that in this large and prospective CPR skill retention trial, VO training resulted in a non-inferior difference in CC levels compared to with VSI training. CC depth was greater in the VSI group. These findings suggest a potential trade-off in efforts for widespread dissemination of basic CPR skills; VO training allows for increased scalability and dissemination but with the potential for reduced CC depth [41]. Several simulation strategies are given to trainees such as manikin simulations, videos, and several other simulations. As was done [42] in their research that the experimental group had statistically significantly higher skill performance scores and reported greater learning and self-confidence. Incorporating video conferencing into simulated practice is an effective strategy for enhancing learning [43]. The 100-120 CPM rate, as recommended by international guidelines, is the optimal chest compression rate for cardiopulmonary resuscitation performed by lifeguards. Levels above 120 CPM are associated with a dramatic decrease in the depth of chest compressions and the quality of overall chest compressions [44].

Research [36] shows that there is an objective and subjective significant increase in PCR skills by using virtual reality compression. This is in line with research conducted by [45] that the use of VR applications in school children in addition to improving skills, also strengthens time flexibility and accessibility in CPR training. [46] revealed that VR has an influence on the interest and number of participants, as well as having the opportunity to conduct repeated independent training. [47] suggested that providing online access can save costs and can be used as an innovation in the form of VR glasses. In addition, the findings of [48] combined traditional teaching and VR teaching methods for the younger generation to maintain CPR and easily share knowledge with the people around them.

CONCLUSION

Basic life support training is very important to reduce the likelihood of people with heart failure dying, basic life support training has a positive impact on increasing BLS knowledge and skills by the participants. Some of the training methods that can be carried out are in-person training, using mobile applications, CPR videos, and Virtual reality compression. The BLS training method can be used to increase the knowledge and skills of ordinary people. However, the reviewed studies have several limitations, such as limited research the absence to test the interventions in a diverse population, most of the studies are still rarely evaluated in the long term after the intervention. Therefore, further research is expected to conduct the interventions in diverse populations from various backgrounds and evaluated in the long term after the intervention so that can provide strong and accurate results.

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