

Original Research Article

BASIC LIFE SUPPORT TRAINING: THE EFFECTIVENESS AND RETENTION OF THE DISTANCE-LEARNING METHOD**Rifdhani Fakhruddin Nur^{1a}** , **Erlangga Prasamy¹**, **Arief Ikhwand¹**, **Prattama Santoso Utomo²** , **Sudadi¹** ¹ Department of Anesthesiology and Intensive Therapy, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia² Department of Medical Education and Bioethics, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia^a Corresponding author: rifdhani@mail.ugm.ac.id**ABSTRACT**

Introduction: Basic Life Support (BLS) training during the COVID-19 pandemic needed to be effective as well as prevent disease transmission between trainers and participants. The distance-learning method is one of the recommended modified training methods. However, there is still limited research that evaluates the effectiveness of the distance-learning method for BLS training for laypersons during the COVID-19 pandemic. **Objective:** To evaluate the effectiveness and retention of the distance-learning method for BLS training in improving the participant's knowledge and skills. **Methods:** This is a non-randomized quasi-experimental study (one group pre-test and post-test design). A total of 64 TAGANA (*Taruna Siaga Bencana*/disaster volunteer) members of Sleman Regency who had undergone the distance learning method for BLS training were the participants of this study. A knowledge questionnaire and observation checklist were prepared and tested for context validity by an expert group. Data on the participant's knowledge were collected before and after the training session, and data on the participant's skills were recorded after the training session. After the training, a social media group was created to provide a periodical refresher of the BLS materials and facilitate discussions between the speakers and the study's samples. Data on knowledge retention and skills were recorded six months post-training. **Results:** The distance-learning method for BLS training effectively increased the participants' knowledge of BLS, indicated by a significantly higher final knowledge score than before the training ($Z=-6.904, p < 0.001$). The method also provided sufficient BLS skills, indicated by most of the samples (93.7%) passing the skill observation test even though no participant had attended a similar training before. Moreover, the participant's knowledge and skills scores were significantly lower six months after the training session than immediately after training ($Z=-5.157, p < 0.001$; $Z=-4.219, p < 0.001$). **Conclusion:** The distance-learning method for BLS training effectively increased the participant's BLS knowledge and skills. However, their knowledge and skills decreased at six months post-training. Overall, the distance-learning method has been proven as a promising alternative to BLS training during and after the COVID-19 pandemic.

Keywords: Basic Life Support training; Cardiovascular Disease; COVID-19; Distance Learning; Education**ABSTRAK**

Pendahuluan: Pelatihan Bantuan Hidup Dasar (BHD) selama pandemi COVID-19 dituntut untuk tetap berjalan efektif sekaligus dapat mencegah transmisi penyakit antara pelatih dan peserta pelatihan. Salah satu modifikasi metode pelatihan yang direkomendasikan adalah metode *distance-learning*. Saat ini masih terbatas penelitian yang menilai efektivitas pelatihan BHD metode *distance-learning* untuk masyarakat awam di tengah pandemi COVID-19. **Tujuan:** Untuk menilai efektivitas dan retensi pembelajaran pelatihan BHD metode *distance-learning* dalam meningkatkan pengetahuan dan keterampilan peserta pelatihan. **Metode:** Penelitian dengan rancangan *non-randomized quasi-experimental (one group pre-test and post-test design)*. Sampel penelitian adalah 64 anggota TAGANA Kabupaten Sleman yang mengikuti pelatihan BHD metode *distance-learning*. Peneliti menyiapkan kuisioner pengetahuan dan daftar tilik observasi keterampilan sekaligus melakukan tes validitas isi untuk kedua instrumen penelitian ini bersama kelompok ahli. Data pengetahuan BHD diambil sebelum dan setelah pelatihan. Data keterampilan BHD diambil setelah pelatihan. Setelah pelatihan selesai, dibuat sebuah kelompok sosial media yang memberikan penyegaran materi BHD secara periodik dan memungkinkan diskusi antara pemateri dan peserta pelatihan. Enam bulan pascapelatihan, diambil data retensi pembelajaran. **Hasil dan Pembahasan:** Pelatihan BHD metode *distance-learning* efektif meningkatkan pengetahuan peserta ditunjukkan oleh nilai pengetahuan setelah pelatihan lebih tinggi secara bermakna dibandingkan sebelum pelatihan ($Z=-6,904, p < 0,001$). Metode *distance-learning* juga dapat memberikan keterampilan BHD yang cukup, ditunjukkan

dengan 60 sampel (93,7%) lulus evaluasi keterampilan setelah pelatihan meskipun peserta belum pernah mengikuti pelatihan sejenis sebelumnya. Nilai pengetahuan dan keterampilan enam bulan pascapelatihan lebih rendah secara bermakna dibandingkan segera setelah pelatihan ($Z=-5,157, p<0,001$; $Z=-4,219, p<0,001$). **Kesimpulan:** Pelatihan BHD metode *distance-learning* efektif meningkatkan pengetahuan dan keterampilan peserta. Namun demikian pengetahuan dan keterampilan ini menurun 6 bulan pascapelatihan. Metode *distance-learning* terbukti dapat menjadi alternatif untuk pelatihan BHD selama dan di luar pandemi COVID-19.

Kata kunci: Pelatihan Bantuan Hidup Dasar; Penyakit Kardiovaskular; COVID-19; *Distance Learning*; Pendidikan

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INTRODUCTION

The COVID-19 pandemic has increased the incidence of Out-of-Hospital Cardiac Arrests (OHCA) (1). Research in the United States, France, and Italy showed a significant increase in the incidence of OHCA during the pandemic compared to the same period a year before the pandemic. There has also been an increase in the morbidity and mortality of OHCA patients. Moreover, there was a reduction in survival rate at hospital admission, lower survival at hospital discharge, a decline in Return Of Spontaneous Circulation (ROSC), and a decrease in the number of sustained ROSC (2–4).

An important component in increasing the survival rate of OHCA patients is the provision of Basic Life Support by laypersons (5,6). Basic Life Support training prepares laypersons with the skills required to resuscitate OHCA patients. Effective training methods have been proven to increase the knowledge and skills of rescuers, improve the implementation of guidelines in daily practice, form a culture of helping, improve the quality of resuscitation, and potentially increase the survival rate of OHCA victims (7–9).

Various Basic Life Support (BLS) training methods for laypersons have been developed. Despite the limited data to determine the single most effective method, better outcomes are seen from an instructor-led training method accompanied by *hands-on* sessions and feedback (10).

The COVID-19 pandemic has affected the ideal BLS training method. BLS training must be effective while preventing disease transmission between trainers and participants (11). To overcome this challenge, the European Resuscitation Council (ERC) provided general guidelines for conducting BLS training for laypersons during the COVID-19 pandemic. The distance-learning method is a recommended modified training method to cope with the COVID-19 pandemic (12).

Various literature has shown the effectiveness of this method in increasing the participants' knowledge of BLS, their willingness to help, and motivating them to further study this topic (13–18). Unfortunately, most past literature used health workers as their samples and was conducted under normal non-pandemic conditions. There is still limited research that evaluates the effectiveness of the distance-learning method for BLS training for laypersons during the COVID-19 pandemic.

METHODS

Study Design

This study used a non-randomized quasi-experimental design (with one pre-test group and post-test group) to evaluate the effectiveness and learning retention of the distance-learning method for BLS training in improving the participant's knowledge and skills. The study was conducted at the Department of Anesthesiology and Intensive

Therapy, Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, between April and October 2021.

Sample Size and Study Participants

This study's participants are TAGANA members (*Taruna Siaga Bencana/Disaster Volunteer*) of Sleman Regency who had undergone Basic Life Support training with the distance-learning method. The inclusion criteria included being 15-40 years old, having gadgets, and being accustomed to using gadgets for online activities. The exclusion criteria were participants who had previously attended similar training. The participants were excluded from the sample if they withdrew from the study or did not attend the full training.

The minimum sample size was calculated using the G*Power[®] software (v.3.1.9.4). Based on the estimated effect size (d) of 0.5, $\alpha = 0.05$, and power of 0.95, the minimum number of samples for the paired t-test was 54 people. If it is estimated that 10% of the subjects would drop out, the minimum sample size is 60 people.

Ethics

This study received a recommendation from the Medical and Health Research Ethics Committee of the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada (Ref No: KE/FK/0287/EC/2021). The study's objectives and procedures were explained to all participants. We then asked for their consent to participate in the study and collected their informed consent through an electronic Google Form[®].

Data Collection

The researchers prepared a knowledge questionnaire and observation checklist that refer to the 2020 AHA guidelines (19). The

content validity of both instruments was tested by an expert group consisting of three specialists in Anesthesiology and Intensive Therapy and two final-stage Anesthesiology and Intensive Therapy resident doctors. They used a content validity index. Each expert assessed the instruments' items using four rating scales ranging from 1 (very unimportant) to 4 (very important). Ratings 1 and 2 were considered as disagree, and ratings 3 and 4 were counted as agree. The results of the Average Congruency Percentage/ACP of the knowledge questionnaire were 95%, and the skill observation checklist was 96%. Therefore, both instruments were valid.

As the assessment of BLS skills was conducted by many raters, to avoid bias, an inter-rater reliability test was conducted on the observation checklist instrument by using the intra-class correlation coefficient (ICC) in a preliminary study with 10 participants. The ICC score was 0.932, indicating no significant difference in BLS skills assessment results between raters.

The BLS knowledge questionnaire consists of 20 multiple-choice questions about the integrated emergency response system and BLS theory. The correct answer was given a score of 5, and the wrong answer was given a score of 0. The minimum score for the knowledge questionnaire was 0, and the maximum score was 100.

The observation checklist consists of 9 Basic Life Support steps. Each step comprises of four assessment categories. The lowest category was 'did not do it' with a score of 0, and the highest category was 'did it right' with a score of 3. Each step and question were weighted according to the complexity of the steps. The score for each step was the multiplication of the category score with the question's weight. The minimum score of the observation checklist was 0, and the maximum

score was 78. A minimum score of 50 indicates a pass.

Procedure

This study's procedure is shown in [Figure 1](#). Individuals who agreed to participate in the study and met the inclusion criteria were included in this study's sample. All participants were given an electronic training module to study two days before participating in the training. The module describes the integrated emergency response system and BLS theory according to the 2020 AHA guidelines ([19](#)).

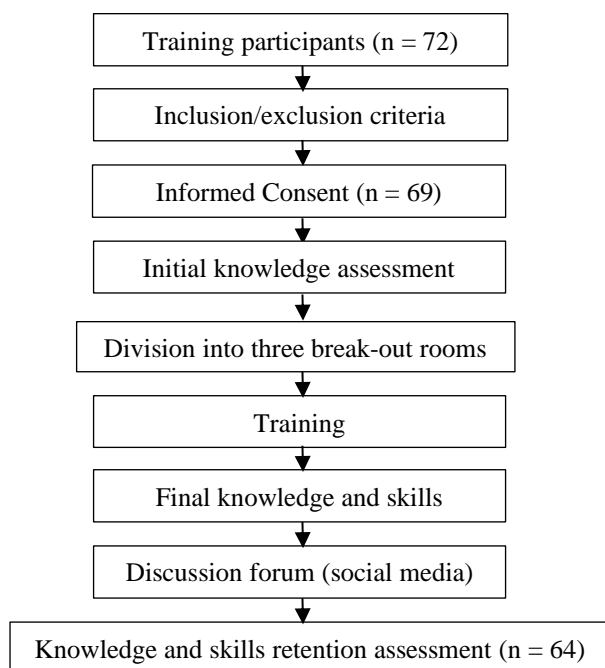


Figure 1. This study's procedure

Initial Knowledge Assessment

Researchers assessed the participant's initial knowledge using a knowledge questionnaire through the Quizizz® application. The participants answered these questions directly from their respective devices.

Training Implementation

All participants received an online BLS training session through the Zoom® application. The participants were divided into three classes using the breakout rooms feature in the Zoom® application. Each class consisted of 21-22 participants. The speakers were specialists in Anesthesiology and Intensive Therapy who are certified BLS training instructors. The training consisted of 4 sessions: a 40-minute lecture session, a 20-minute video simulation session, a 20-minute live simulation session, and a 40-minute discussion session.

Final Knowledge Assessment

The researchers assessed the participant's final knowledge using a knowledge questionnaire through the Quizizz® application. The participants answered these questions directly from their respective devices.

Final Skill Assessment

The researcher assessed the participant's final skills offline one day after the training session. The assessment process follows the health protocols recommended by the *European Resuscitation Council* and government policies. The participants were divided into five groups, and each consisting of 12-13 people. Each group was assessed by one rater. The participants practiced BLS on a ResusciAnne Laerdal® torso mannequin and were assessed using an observation checklist.

Social Media Discussion Forum

After the training, a WhatsApp® group was created for the presenter and participants. The presenter provided a periodic refresher of BLS materials and facilitated a discussion with all participants in the group.

Knowledge-skills Retention Assessment

Six months after the training, researchers assessed the participant's knowledge retention using a knowledge questionnaire and skills retention test by using an observation checklist.

Statistical Analysis

The data was analyzed using a Paired-Samples t-test if the data distribution was normal or a Wilcoxon signed-rank test if the data distribution was not normal. The difference was considered statistically significant if the p -value < 0.05 . Data analysis was performed using the IBM SPSS Statistics® version 25 (IBM Corp., Armonk, NY) software.

RESULTS AND DISCUSSION

Results

Personal Characteristics

A total of 72 people agreed to join the study, but three were excluded because they were not used to using gadgets and had attended similar training before. In total, 64 out of the 69 participants attended the entire training session and were included in the data collection.

The average age of the participants was 30.52 years, with more males than females (65.6% vs 34.4%). All participants had their own devices, with the majority (92.75%) being mobile phones (Table 1).

All of the assessment data are shown in Table 2. The normality test showed that all of the scores had a non-normal distribution.

Table 1. Sample Characteristics (N = 64)

| Characteristics | | n | % |
|-----------------|------------|--------------|--------|
| Gender | Man | 42 | 65.6% |
| | Woman | 22 | 34.4% |
| Age (years) | | 30.52 ± 6.90 | |
| Type of gadget | Smartphone | 60 | 92.75% |
| | Laptop | 4 | 6.25% |

Table 2. Assessment Data for All Assessments

| | Mean | SD | Med | Min | Max |
|---------------------|-------|-------|-----|-----|-----|
| Initial knowledge | 61.56 | 9.34 | 60 | 40 | 80 |
| Final knowledge | 89.45 | 10.32 | 90 | 50 | 100 |
| Final skills | 63.14 | 8.92 | 62 | 42 | 78 |
| Knowledge retention | 79.92 | 7.26 | 80 | 55 | 95 |
| Skill retention | 55.70 | 9.42 | 54 | 39 | 73 |

Basic Life Support knowledge and skills

The Wilcoxon signed-rank test analysis showed that there was a significant difference between the participant's initial knowledge and final knowledge scores. The median of final knowledge scores (Me = 90) was significantly higher than the median score of initial knowledge (Me = 60), $Z = -6.904$, $p < 0.001$. As many as 60 (93.7%) participants passed the final skills assessment.

Learning Retention

Table 3. Score Comparison of Each Basic Life Support Step's Skill Scores

| | BLS Step's Skill Scores | Final Skills | Skills Retention | p-value |
|---|---------------------------|------------------|------------------|---------|
| | | \bar{x} (%) | \bar{x} (%) | |
| 1 | Ensure a safe environment | 2.69 (89.58) | 2.16 (71.88) | 0.005 |
| 2 | Check for a response | 2.61 (86.98) | 2.42 (80.73) | 0.192 |
| 3 | Open the airway | 4.89 (81.51) | 4.38 (72.92) | 0.058 |
| 4 | Check for breathing | 4.72 (78.65) | 4.00 (66.67) | 0.011 |
| 5 | Alert emergency services | 6.47 (71.88) | 5.53 (61.46) | 0.054 |
| 6 | Chest compression | 11.95 (79.69) | 11.02 (73.44) | 0.003 |
| 7 | Rescue breathing | 11.25 (75.00) | 9.06 (60.42) | 0.000 |
| 8 | Continuity of CPR | 6.94 (77.08) | 6.70 (74.48) | 0.157 |
| 9 | Post-CPR management | 9.84 (82.03) | 10.44 (86.98) | 0.618 |

The median knowledge retention score (Me = 80) was significantly lower than the final knowledge score (Me = 90), $Z = -5.157$, $p < 0.001$, as analyzed by the Wilcoxon signed-rank test. However, it was still significantly higher than the score of initial knowledge (Me = 60), $Z = -6.642$, $p < 0.001$. The analysis also showed a significant decrease in the skills retention (Me = 54) score compared with the final skills score (Me = 62) $Z = -4.219$, $p < 0.001$. [Table 3](#) shows that almost all steps had decreased scores, except for the 9th step. A significant decrease was found in steps 1st, 4th, 6th, and 7th. However, the score increase on the 9th step was not significant.

Table 4. Basic Life Support Skills Assessment Results

| Skills | Pass | Fail |
|-----------------|------------|------------|
| Final skills | 60 (93.7%) | 4 (6.3%) |
| Skill retention | 51 (79.7%) | 13 (20.3%) |

[Table 4](#) indicates that 44 (68.7%) participants passed the skills retention assessment. There was no significant difference in the number of participants who passed the final skills assessment and those who passed the skills retention test.

Discussion

During the pandemic, the European Resuscitation Council did not recommend holding face-to-face Basic Life Support (BLS) training or mass training for laypersons. Some recommended modified training methods include self-directed learning and distance-learning because they reduce the risk of infection for participants and trainers ([12](#)).

This study showed that the distance-learning method of BLS training for laypersons effectively increases the participants' knowledge of BLS. The increase in knowledge is indicated by a significantly

higher final knowledge score (Me = 90) than the initial knowledge score (Me = 60). This increase is comparable to the traditional face-to-face learning method as studied by Castillo *et al.*, which reported that face-to-face BLS training led to a significant increase in knowledge scores from 6.27 (1.65) at the start to 8.36 (1.23) at the end of the training ([20](#)).

These results are also consistent with previous research by Tobase *et al.*, who found that online training methods are an effective teaching-learning method for increasing the BLS knowledge of nursing students ([13](#)). Therefore, extensive applications of this method can increase the coverage of people exposed to BLS theory and increase the community's competence and motivation to resuscitate OHCA victims ([21](#)).

In addition to increasing knowledge, this study also proved that distance-learning method training could provide participants with sufficient BLS skills. This is indicated by the fact that most of the participants (93.7%) passed the skill observation test, despite never attending similar training.

Furthermore, Ali *et al.*'s meta-analysis concluded that the online training method provides participants with better skills in recognizing environmental safety, asking for help, and response time in resuscitation ([17](#)). These results make the online training method an effective alternative to BLS training for laypersons during the COVID-19 pandemic ([17,22](#)).

This study also assessed BLS knowledge and skills retention after learning through the distance-learning method. A statistical test showed a decrease in knowledge six months post-training (Me = 80) compared to knowledge at the end of training (Me = 90). However, retention of this knowledge was still significantly higher than initial knowledge

before training (Me = 60). Moreover, the statistical test showed a decrease in skills six months after training (Me = 59) compared to skills at the end of training (Me = 64). The percentage of passing skills observation also decreased from 93.7% at the end of the training to 68.7% six months after the training.

Interestingly, a similar decrease also occurred in the conventional face-to-face learning method, as reported by Srivilaithon *et al.* They found that BLS knowledge decreased 1.29 times six months after BLS training was given to medical students. Moreover, Sufiyah *et al.* reported a decrease in BLS skills after the conventional learning method. They found that a year post-training, only 26% of medical students could complete all BLS steps, and less than 50% of the participants successfully did 3 out of 10 assessment points (23,24).

According to Anderson *et al.*, to maintain learning retention, short but routine training once a month using mannequins and visual feedback is required (25).

Overall, this study has demonstrated the effectiveness of the distance learning method for BLS training for laypersons, which is comparable to the level 3 evaluation stage based on Kirkpatrick's evaluation criteria. Thus, it is hoped that participants will also experience changes in their behavior, not just their knowledge and skills in Basic Life Support (26).

CONCLUSION

The distance-learning method for BLS training effectively increased the participant's knowledge and skills of Basic Life Support. However, their knowledge and skills decreased six months post-training. The distance-learning method has been proven to be a promising alternative to BLS training during and after the COVID-19 pandemic. Further studies with larger sample sizes, longer observation

periods, and qualitative perceptions of training participants should be performed to obtain a wider perspective on the effectiveness of distance-learning on BLS training.

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Conflict of Interest

The authors declared no conflict of interest in this study.

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Authors' Contribution

All authors have contributed to all processes in this study.

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