Original Article/*Özgün Araştırma*
doi: 10.54875/jarss.2025.50465

Effectiveness of Face-to-Face Applied Training in Improving Basic Life Support Knowledge and Skills of Distance-Educated Medical Students

Uzaktan Eğitim Alan Tıp Öğrencilerinin Temel Yaşam Desteği Bilgi ve Becerilerinin Geliştirilmesinde Yüz Yüze Uygulamalı Eğitimin Etkinliği

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ABSTRACT

Objective: Basic Life Support (BLS) training is an indispensable element of medical education. Today, in addition to classical face-to-face education, online education has also begun to be used in many areas of medical education. Due to the earthquake disaster in our country, medical faculty students received BLS training only online.

The primary aim of this study is to investigate how medical students who received online BLS training improve their knowledge and skills with face-to-face practical BLS training. Our secondary objective is to evaluate the adequacy of BLS knowledge and skills of students who have received distance education.

Methods: In this prospective cross-sectional study, a questionnaire containing 14 questions was administered to the medical students who received online BLS training before and three weeks after face-to-face training. Basic life support skill levels were evaluated by two observers, both before and after the training, using training mannequins with continuous visual and auditory feedback.

Results: Two hundred-eleven students participated in the study, but the data of 185 students who met the participation criteria were analyzed. After face-to-face training, BLS knowledge levels and performances increased significantly (p<0.001). After the training, compared to before, the decision-making time for cardiopulmonary resuscitation was shortened from 45 seconds to 32 seconds in 97.8% of the students (n=181) (p<0.001).

Conclusion: Online education alone has been inadequate in acquiring BLS knowledge and skills. Face-to-face training with a manikin significantly improves students' information and skill levels.

Keywords: Basic life support, cardiopulmonary resuscitation, medical education

ÖZ

Amaç: Temel Yaşam Desteği (TYD) eğitimi tıp eğitiminin vazgeçilmez bir unsurudur. Günümüzde klasik yüz yüze eğitimin yanı sıra online eğitim de tıp eğitiminin birçok alanında kullanılmaya başlanmıştır. Ülkemizde yaşanan deprem felaketi nedeniyle tıp fakültesi öğrencileri TYD eğitimini sadece online olarak almışlardır.

Bu çalışmanın birincil amacı online TYD eğitimi alan tıp fakültesi öğrencilerinin yüz yüze pratik TYD eğitimi ile bilgi ve becerilerini nasıl geliştirdiklerini araştırmaktır. İkincil amacımız ise uzaktan eğitim alan öğrencilerin TYD bilgi ve becerilerinin yeterliliğini değerlendirmektir.

Yöntem: Bu prospektif kesitsel çalışmada, online TYD eğitimi alan tıp öğrencilerine yüz yüze eğitimden önce ve üç hafta sonra 14 soru içeren bir anket uygulanmıştır. Temel yaşam desteği beceri düzeyleri, eğitimden önce ve sonra iki gözlemci tarafından, sürekli görsel ve işitsel geri bildirimli eğitim mankenleri kullanılarak değerlendirilmiştir.

Bulgular: Çalışmaya iki yüz on bir öğrenci katılmış, ancak katılım kriterlerini karşılayan 185 öğrencinin verileri analiz edilmiştir. Yüz yüze eğitimden sonra, TYD bilgi düzeyleri ve performansları önemli ölçüde artmıştır (p<0,001). Eğitim sonrasında, öncesine kıyasla, kardiyopulmoner resüsitasyon için karar verme süresi öğrencilerin %97,8'inde (n=181) 45 saniyeden 32 saniyeye kısalmıştır (p<0,001).

Sonuç: Online eğitim, TYD bilgi ve becerilerinin edinilmesinde tek başına yetersiz kalmaktadır. Manken ile yüz yüze eğitim, öğrencilerin bilgi ve beceri düzeylerini önemli ölçüde artırmaktadır.

Anahtar sözcükler: Temel yaşam desteği, kardiyopulmoner resüsitasyon, tıp eğitimi

Received/Geliş tarihi : 28.12.2024
Accepted/Kabul tarihi : 13.02.2025
Publication date : 30.04.2025

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Cite as: Celik F, Dagli R, Lale HN, Aksu A, Altuntas G, Yildiz Altun A, Ozcan S, Bolat E, Demirel I. Effectiveness of face-to-face applied training in improving basic life support knowledge and skills of distance-educated medical students. JARSS 2025;33(2):94-103.

INTRODUCTION

Basic Life Support (BLS) training is one of the basic steps of the medical education curriculum to train medical doctors with sufficient knowledge and skills.

Today, the International Liaison Committee on Resuscitation, the primary authority on cardiopulmonary resuscitation (CPR), emphasizes three key components to increase survival rates in cases of cardiac arrest (1). Comprehensive training of the resuscitation provider, creating a rapid and successful "chain of life," and applying CPR by current guidelines. Current guidelines emphasize that rescuers should acquire the correct BLS skills in their training (2,3).

Although medical education practices vary depending on the economic conditions of the countries, they are based on current guidelines, especially for BLS education (4,5). Nowadays, methods such as classical face-to-face education, online education, and computer-aided simulation training are widely used in the medical education system (3,6). Studies indicate that online distance education is as effective as traditional instructor-led methods in improving CPR performance (7,8). However, face-to-face practical training is vital to acquire BLS skills. The outcome of online and face-to-face applied training approaches should be measured to benefit from all resources during the education of young physician candidates.

In the current literature, it appears that there are different methods for CPR training and that these methods have their limitations. Even if instructors think they provide resuscitation training at an optimal level, students may not reach adequate performance levels. They may have difficulty applying the skills they learned when responding to an actual victim (3,6,9). Although knowledge and skills increase significantly after BLS training, they may decrease after six months (10). The decline in skill may even drop below 50% after six weeks (11). Additionally, many studies have shown that physicians have difficulty performing BLS by guidelines and provide poor quality resuscitation (12-14). Therefore, it is a matter of concern that medical doctors have inadequate BLS knowledge and skills. A trained rescuer will be the primary determinant of survival during resuscitation (15).

On 6 February 2023, Turkey experienced two earthquake disasters of 7.7 and 7.6. The earthquake killed about 50.000 people and injured 250.000 (16). In this process, mobilization was throughout the country. All educational institutions in the country, except for mandatory fields, switched to the on-line education model. During this period, the BLS teaching was performed for the 2nd and 3rd year students of our Faculty of Medicine via online video (applied on an adult manikin). After face-to-face training, second-year medical students reported in their feedback that they lacked confidence in handling cardiac arrest. Therefore, the faculty administration decided to add a face-to-face practical course to the existing BLS curriculum.

The primary aim of this study is to investigate the effectiveness of face-to-face practical training in improving the BLS knowledge and skills of distance-learning medical students. Our secondary objective is to evaluate the adequacy of BLS knowledge and skills of students who have received distance education.

MATERIAL and METHODS

Participants

This study was conducted at Fırat University Faculty of Medicine in January 2024. Of 213 second-year medical students receiving BLS education via the distance education model, 211 students agreed to participate in the study. Based on the study design, 26 participants were excluded from the assessment: those who did not complete the BLS survey, those who had participated in any prior form of CPR, those who wished to withdraw from the study, and those who had received prior in-person BLS training.

Ethics

Fırat University Non-Interventional Research Ethics Committee gave ethical approval to this study (date: 20.12.2023, decision no: 20580). Volunteer participants were interviewed face-to-face and provided with information about the research. Students provided informed consent.

Design

This study was a prospective cross-sectional study planned to assess and improve the effectiveness of CPR training (Figure 1).

The research design consists of three stages:

1. Evaluation of students who received distance BLS education: A survey was applied to evaluate the knowledge level of students who received video-based distance BLS training eight months ago and recorded as BLS Survey-1 (Appendix 1). Then, the Objective Structured Practical Examination (OSPE) prepared for performance evaluation was applied (Appendix 2). Students were requested to explain and demonstrate out loud what they would do to a victim as the sole rescuer in a simulated scenario (What would you do if you saw a grown man collapse in the park?). The BLS skills they applied were evaluated as (Performance - 1).

2. Face-to-face practical BLS training: Training to strengthen BLS skills was conducted in line with the European Resuscitation Council (ERC) 2021 Guidelines and the American Heart

Association (AHA) Adult Basic and Advanced Life Support Cardiopulmonary Resuscitation and Emergency Cardiovascular Care 2020 Guidelines (4,5). The training took 40 minutes, face-to-face and hands-on, on a manikin. Face-to-face training was delivered using the four-step skills teaching method described by Walker and Peyton: a) "demonstration" of the skill from beginning to end at the usual speed and without comment; b) "Telling" the skill in detail, step by step, emphasizing key points; c) the student "doing-understanding" each step of the skill under the supervision of the instructor's; and d) "checking" the skill until it is applied correctly independently (17,18). An adult CPR training manikin was used

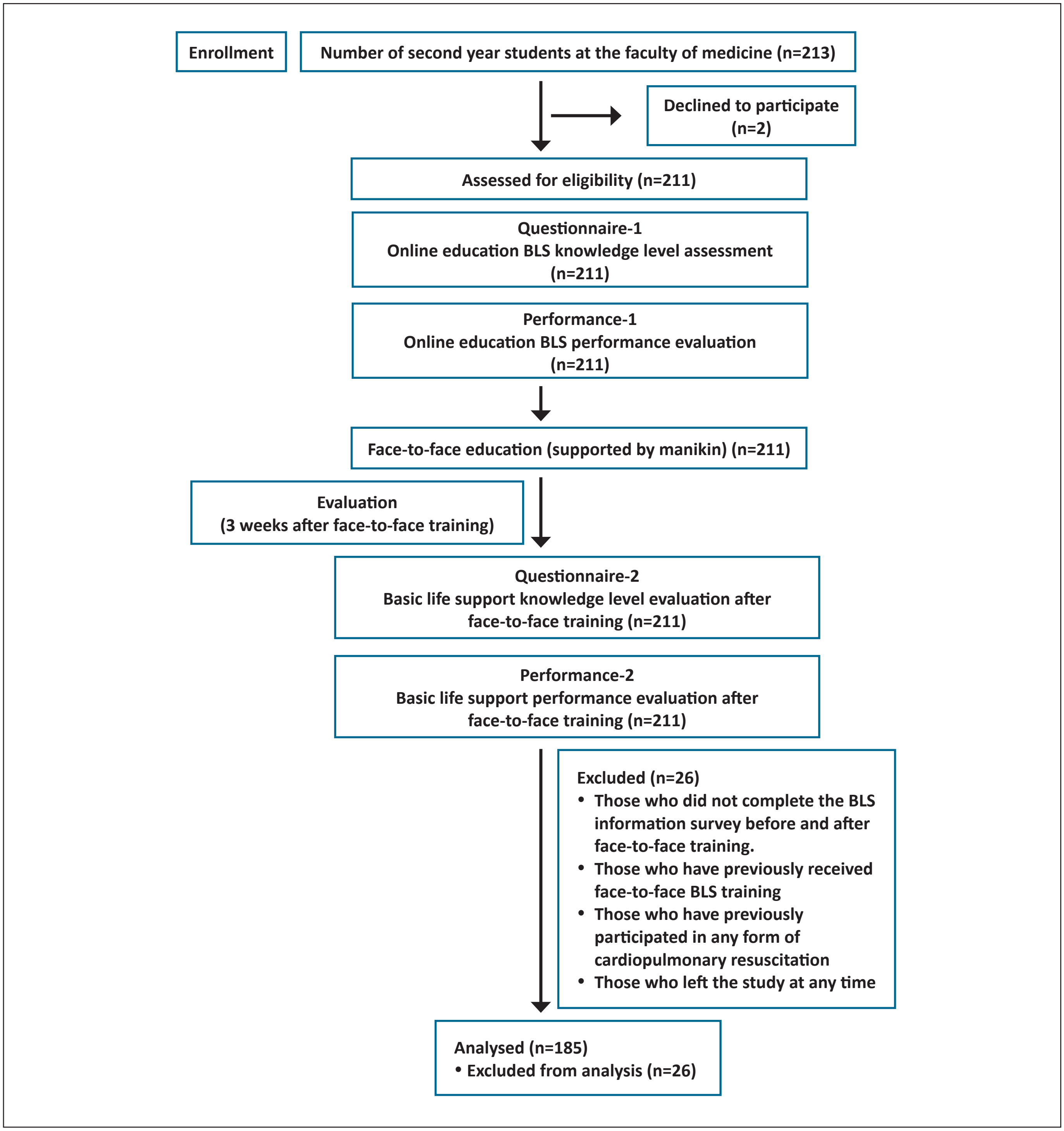

Figure 1. Flow diagram. **BLS:** Basic life support.

for the study (PP-FM-300M-MS, Prestan Professional Manikin Collection, Mayfield Village, OH, USA).

3. Evaluation after face-to-face practical BLS training: The same questionnaires were distributed to volunteer participants again three weeks later to assess their knowledge of BLS. Data were recorded as BLS Survey-2. Basic life support skill acquisition was re-assessed three weeks later with the same OSPE as the sole rescuer. Students' BLS skills were recorded as Performance-2.

Training and Evaluation Process

Two BLS skill stations were prepared to accommodate training. For four days, students were given practical training on mannequins in two groups, each consisting of eight students.

Questionnaire

Basic life support survey questions were designed by reviewing the relevant literature and considering the education levels of survey participants (12,19).

A survey was developed about BLS, containing a total of 14 questions in 3 separate sections (Appendix 1:BLS survey): 1) Demographics: 2 questions; 2) Prior in-person BLS training or CPR experience: 2 questions; 3) Basic life support knowledge: 10 questions (life-saving chain, recognizing cardiopulmonary arrest, etc.).

Basic life support survey forms were distributed to the students before and after the face-to-face practical training, and they were asked to answer within 15 minutes. The evaluation was over ten points (correct answer one point, wrong answer zero points).

Basic life support skill assessment

Basic life support proficiency was assessed through the OSPE (Appendix 2). The BLS steps have been simplified to increase training efficiency and facilitate assessment. The headings ''safety-check (consciousness-airway-breathing) -emergency call-compression/ventilation'' formed the basis of the training. Basic life support skill was assessed according to the OSPE Checklist (15 parameters in total) (Appendix 2) (4).

Students were evaluated after at least 10 minutes of CPR (at least 3 minutes of compression/ventilation). The students demonstrated the recovery position with their bodies on a blanket spread on the floor. Resuscitation performances were defined by a 3-grade system according to the correct, sequential, and uninterrupted application of all steps and evaluated over 32 points:

1. Needs development (0 points): The step is not applying, performed incorrectly, or not in the correct order.
2. Sufficient (1 point): The step is implemented correctly and in the correct order, but the trainer's help is necessary.
3. Mastered (2 points): Performing the step correctly and in the correct order without pausing and without needing the help of the trainer.

Two anesthesiology and reanimation physicians jointly evaluated each student's OSPE performance. Physicians who were trainers did not take part in the skill acquisition assessment.

Basic life support training manikin provides a healthy evaluation opportunity thanks to the visual and auditory feedback system that shows the accuracy of compression application point, speed, and depth. Number of compressions per minute: red light: <60, yellow light: 60-79, single green light: 80-99, double green light: 100-120, presence of yellow light between two green lights: >120.

Each student began the intervention after the scenario presentation. A stopwatch was used for measuring CPR decision time. Instructors observed the student's hand-arm position and whether they placed their hands correctly on the chest. The rate of chest compressions, correct application point, and depth were evaluated by continuous feedback system (target compression depth is 5-6 cm, target compression rate is 100-120 compressions per minute).

The student took a deep rescue breath for each ventilation. He tilted the manikin's head back, pinched its nose, and breathed into its mouth. It was observed whether the student performed chest monitoring for ventilation effectiveness. The students performed chest compressions and mouth-to-mouth ventilation for at least 3 minutes. Additionally, it was observed whether the student had taken the correct body position (hands, elbows, shoulders, legs) during CPR. Students performed in the isolated OSPE room. To prevent the transfer of knowledge and skills, the students whose BLS performance was measured were kept separate from the others.

Statistical Analysis

The primary outcomes of the research were the BLS knowledge levels, BLS performances, and CPR decision-making times (seconds). The data obtained before the face-to-face training were compared with those received after.

The IBM SPSS Statistics Version 25.0 (IBM Corp, Armonk, NY, USA) package program was used in the statistical analysis of the data. Categorical measurements were expressed as number (n) and percentage (%), while numerical measurements were presented as mean, standard deviation, median, minimum, and maximum values. Whether the numerical measurements met the normal distribution assumption was evaluated with the Kolmogorov-Smirnov test, and it was determined that they did not conform to the normal distribution. The McNemar test was used to compare categorical measurements between dependent groups. The Wilcoxon Signed Rank test compared two dependent numerical measurements that did not show normal distribution. Since some of the numerical measurements did not fulfill the assumption of normal distribution, the correlation between these continuous measurements was analyzed using Spearman's correlation coefficient. In all tests, p-values less than <0.05 were considered significant.

RESULTS

Of the 213 students in the class, 211 agreed to participate in the study. After excluding 26 students who did not meet the inclusion criteria, 185 students were included in the statistical evaluation (consort flow diagram, Figure 1). Of these 185 students, 53% (n=98) were male, 47% were female (n=87), and the mean age was 21.06 ± 1.83.

As the essential outcome of the research data, BLS knowledge levels, performances, and CPR decision times before and after face-to-face training were compared (Table I). The changes in these three data after training are as follows in Table II. Accordingly, BLS knowledge levels and performances increased positively after the training (p<0.001). After the training, the time to decide on CPR was shorter in 97.8% (n=181) of the students (p<0.001).

In Table III, the questions used to determine the BLS knowledge levels of the students are evaluated based on each

Table I. Comparison of Students' BLS Knowledge Levels, Performance Levels and CPR Decision-Making Times Before And After Face-To-Face Training

		Pre-training	Post-training	p*
Decision time to CPR (sec)				
	Mean ± SD	45.06 ± 6.80	32.08 ± 7.66	<0.001
	Median (min-max)	45 (30-59)	32 (15-55)	
BLS knowledge levels				
	Mean ± SD	4.10 ± 1.70	7.91 ± 1.36	<0.001
	Median (min-max)	4 (0-9)	8 (4-10)	
BLS performances				
	Mean ± SD	4.29 ± 3.52	21.45 ± 6.27	<0.001
	Median (min-max)	4 (0-15)	21 (5-32)	

*Wilcoxon test. **CPR:** Cardiopulmonary resuscitation, **BLS:** Basic life support.

Table II. Changes in Students' Knowledge Levels, Performance Levels and Decision-Making Times for CPR Before and After Face-to-Face Training

	Post-test - pre-test	n	Rank mean	Z	P*
Decision time to CPR (sec)	Negative ranks	181	94.95	-11.776	<0.001
	Positive ranks	4	4.75		
	Equal ranks	0			
BLS knowledge levels	Negative ranks	1	26.50	-11.708	<0.001
	Positive ranks	181	91.86		
	Equal ranks	3			
BLS performances	Negative ranks	2	7.50	-11.778	<0.001
	Positive ranks	183	93.93		
	Equal ranks	0			

*Wilcoxon test. **CPR:** Cardiopulmonary resuscitation, **BLS:** Basic life support.

question. Accordingly, after the training, it was clear that the knowledge level of the students increased significantly in almost all of the questions. Although there was an increase in the number of correct answers after the training only in question 3, no statistical significance was determined. Table IV shows that the change in BLS performance after the training is positive (all p<0.001).

The correlation between BLS knowledge levels, performances, and CPR decision times after training was analyzed using Spearman's rho test. There was no relationship between BLS knowledge level and BLS performances (r=0.067, CI=(-0.082)-(0.213), p=.0364) and between CPR decision-making times (r= 0.030, CI=(-0.199)-(0.178) p=0.682) (Table V).

DISCUSSION

The main aim of this study was to eliminate the concerns of medical students who received distance education about performing CPR, to improve their skills, and to evaluate the effectiveness of face-to-face applied CPR training. Due to the nature of face-to-face hands-on training, students and trainers identified and improved together the misinformation and practices known to be correct during CPR. Our results showed

Table III. Comparison of Students' Knowledge Levels Before and After Face-To-Face Education

Information	Pre-training Correct n (%)	Post-training Correct n (%)	p*
1. To be able to sort the rings of the life-saving chain correctly: Early diagnosis and call for help (112) - Early initiation of cardiopulmonary resuscitation - Early defibrillation - Postresuscitative care	148 (80)	178 (96.2)	<0.001
2. Ability to recognize cardiopulmonary arrest in a victim/patient who does not respond to verbal or tactile stimuli	67 (36.2)	117 (63.2)	<0.001
3. To recognize cardiopulmonary arrest in the absence of respiration or abnormal (slow and forced) respiration.	128 (69.2)	137 (74.1)	0.306
4. To be able to list the basic life support steps correctly in a patient with cardiopulmonary arrest C (Compressions-Compression) A (Airway) B (Breathing-Rescue breaths)	16 (8.6)	152 (82.2)	<0.001
5. To recognize the ideal artery to feel the pulse in an adult patient. -Carotid artery	109 (58.9)	162 (87.6)	<0.001
6. Correctly expressing the depth of chest compressions for an adult victim/patient 5-6 cm	30 (16.2)	129 (69.7)	<0.001
7. To be able to correctly express the compression/ventilation ratio that should be applied in case of cardiopulmonary arrest in an adult patient as a single rescuer 30/2	98 (53.0)	182 (98.4)	<0.001
8. Ability to express chest compression rate correctly 100-120 compressions per minute	70 (37.8)	171 (92.4)	<0.001
9. Being able to remember that if mouth-to-mouth resuscitation is not possible during cardiopulmonary resuscitation, chest compressions alone will help save the victim.	42 (22.7)	79 (42.7)	<0.001
10. Being able to recognize the cardiopulmonary arrest clinic and make necessary intervention decisions Question: As the ambulance physician in charge, you are dispatched to the scene by the 112 command system, and during your initial assessment of a young adult male patient, you determine that the patient is unconscious and not breathing spontaneously. What would be your subsequent action? ** - 30 Applying chest compression	51 (27.6)	157 (84.9)	<0.001

***** Mc Nemar Test, ****** It is the question stem of the related achievement directed to the participants.

Table IV. Comparison of the Changes in Students' BLS Performances Before and After Face-To-Face Training According to the Steps

Variables	Post-test - Pre-test	n	Rank mean	Z	p*
Security	Negative ranks	1	30	-11.775	<0.001
	Positive ranks	170	86.33		
	Equal ranks	14			
Response: Check the state of consciousness	Negative ranks	17	52.12	-8.807	<0.001
	Positive ranks	123	73.04		
	Equal ranks	45			
Check airline	Negative ranks	6	57	-10.575	<0.001
	Positive ranks	150	79.36		
	Equal ranks	29			
Check respiration (Look-Listen-Feel)	Negative ranks	7	39.50	-10.842	<0.001
	Positive ranks	153	82.38		
	Equal ranks	25			
Call 112/Call for help /AED requested	Negative ranks	0	0	-11.870	<0.001
	Positive ranks	175	88.00		
	Equal ranks	10			
Decide on CPR	Negative ranks	8	59.00	-10.110	<0.001
	Positive ranks	134	72.25		
	Equal ranks	43			
Compression (Correct point)	Negative ranks	3	57.00	-11.007	<0.001
	Positive ranks	150	77.40		
	Equal ranks	32			
Correct hand-arm position	Negative ranks	3	53.50	-10.563	<0.001
	Positive ranks	138	71.38		
	Equal ranks	44			
Compression (Correct depth)	Negative ranks	9	57.50	-9.844	<0.001
	Positive ranks	130	70.87		
	Equal ranks	46			
Compression (Correct rate - 100-120/min)	Negative ranks	5	52.50	-10.311	<0.001
	Positive ranks	136	71.68		
	Equal ranks	44			
Compression/ventilation ratio (30/2)	Negative ranks	3	47.50	-10.242	<0.001
	Positive ranks	132	68.47		
	Equal ranks	50			
Correct breathing position-observing the chest	Negative ranks	3	54.00	-11.169	<0.001
	Positive ranks	157	81.01		
	Equal ranks	25			
Sufficient ventilation volume	Negative ranks	4	55.50	-11.190	<0.001
	Positive ranks	159	82.67		
	Equal ranks	22			
Correct AED placement	Negative ranks	1	52.50	-11.996	<0.001
	Positive ranks	180	91.21		
	Equal ranks	4			
Shows the correct recovery position	Negative ranks	2	52.50	-11.887	<0.001
	Positive ranks	178	90.93		
	Equal ranks	5			

***Wilcoxon test. **AED:** Automatic external defibrillator.

Table V. Comparison of the Relationship Between Students' Knowledge and Skill Levels About BLS Before and After Face-To-Face Education

Post-training		BLS knowledge levels	Decision time to CPR (sec)	BLS performances
BLS knowledge levels	r	1.000	0.030	0.067
	CI**	-	(-0.199)-(0.178)	(-0.082)-(0.213)
	p	-	0.682	0.364
Decision time to CPR (sec)	r		1.000	0.122
	CI**		-	(-0.027)-(0.266)
	p		-	0.097
BLS performances	r			1.000
	CI**			-
	p			-
			Post-training	
Pre-training		**BLS knowledge levels**	**Decision time to CPR (sec)**	**BLS performances**
BLS knowledge levels	r	0.343	0.048	-0.047
	CI**	(0.205)-(0.468)	(-0.101)-(0.195)	(-0.194)-(0.102)
	p	<0.001	0.516	0.525
Decision time to CPR (sec)	r	-0.076	0.568	-0.053
	CI**	(-0.222)-(0.073)	(0.458)-(0.660)	(-0.200)-(0.096)
	p	0.302	<0.001	0.470
BLS performances	r	0.223	-0.111	0.072
	CI**	(0.077)-(0.359)	(-0.255)-(0.038)	(-0.078)-(0.218)
	p	0.002	0.133	0.333

*Spearman's rho test **Confidence Intervals of Spearman's rho. **CPR:** Cardiopulmonary resuscitation, **BLS:** Basic life support.

that students' CPR decision-making time, BLS knowledge, and performance levels improved significantly after face-to-face training.

Walker and Peyton's four-step skills teaching method has been implemented in European Resuscitation Council standard courses (17,18). Although the four-step skills training method is widely recognized, some research suggests that this method is no more effective than alternative approaches to resuscitation skills training (20). We applied Walker and Peyton's 4-step format in our face-to-face training. However, we could not carry out an additional application to increase the performance level in step 4 due to our time and team constraints. If we had allocated sufficient individualized time for each student during Step 4, our results could have been more productive. Despite this, students significantly improved their performance in instructor-led CPR.

Today's technological developments are changing the traditional methods of medical education. A transformation that emphasizes the use of digital learning technologies is proposed in the education of future physicians. Digital learning technology includes broad areas such as live lectures, mobile or web-based education, virtual reality, and artificial intelligence applications. However, digital learning may be limited, especially in training that requires a manikin or clinical skills laboratory (21). How adequate is online training in patient treatment practices where only knowledge is insufficient and where performance is much more important? Can online education replace face-to-face education? In current literature, there are studies indicating that online distance education is effective (7,8).

Contrary to these studies, we found that the online training we implemented was insufficient for BLS performances. This situation may be due to the limitations in physical conditions (suitable environment, access to the internet, etc.) caused by the earthquake. On the other hand, some studies have compared the effectiveness of theoretical and practical BLS training. Hansen et al. hypothesized that practical demonstration was superior to the theoretical course for CPR training. Still, they could not detect a statistically significant difference due to their study (22). We believe that BLS training can be best done with a theoretical lecture with visual support followed by practical skills application. Thus, motor skills will be internalized more effectively. From this point of view, we have re-evaluated the training curriculum and renewed and improved it with additional courses with visual support.

Current guidelines report that audiovisual warning and feedback devices can be beneficial in achieving successful resuscitation goals and improving the quality of CPR (2,5,23). In our study, we used manikins with similar technological structures to ensure standardization while developing CPR skills.

Resuscitation training programs have focused on many factors to improve survival outcomes. One of the most important of these factors is the recognition of cardiac arrest (3,24). In addition to evaluating the effectiveness of our BLS training, we also examined the training on a subheading basis to identify shortcomings and steps that needed to be focused. In our study, we found that after the training, students knew "recognizing cardiopulmonary arrest in a victim who does not respond to verbal or tactile stimuli." Still, they did not show sufficient development in "recognizing cardiopulmonary arrest in the event of no breathing or abnormal breathing" (p=0.306). Indeed, the European Resuscitation Council BLS 2021 guideline reports that the rescuer often misjudges the agonal breathing victim as showing normal vital signs (4). While re-planning our training, we considered that this is a distress that needs to be of particular focus.

Resuscitation guidelines mention many reasons that prevent CPR from being performed (2,3,5). These include emotional concerns of the rescuer, fear of harming the victim, fear of doing something wrong, and nervousness and reluctance to have close contact with the victim. One of the most important results of our research is that we identified students with similar concerns. We conducted detailed one-on-one interviews with these students and asked them to empathize with the victim.

Some studies report that senior medical students in many European countries do not have sufficient knowledge about cardiac arrest and CPR (12,25). For example, correct chest compression depth, compression rate, and compression: ventilation ratio were identified by 68%, 53%, and 90% of participants, respectively (25). Similarly, the pre-training knowledge of chest compression depth and rate was also meager in our 2nd year medical students (16.2%, n=30, and 37.8%, n=70, respectively). Chest compression depth knowledge showed a statistically significant increase after training (p<0.001), but this increase was not high enough at 69.7% (n=129). Based on the outcomes we have obtained, we anticipate that the knowledge and skill levels of students will increase until graduation by updating the training curriculum and recurrent training.

Our study has some limitations. The evaluation before the face-to-face training reflects the knowledge and skills students who received online training (with the instructor, on the manikin) could maintain after eight months. As a natural consequence of the earthquake, there may be undesirable poorly restrictions on access to the materials and physical facilities required for distance education. Since there is no evaluation in this process, we do not have enough information about the knowledge and skills of the students immediately after the distance education.

Due to the intensity of the curriculum, an additional theoretical lesson could not planned in the training design before face-to-face training. The instructor-student ratio was 2:8, and the student-manikin ratio was 8:1. Students had the opportunity to perform resuscitation only once to ensure standardization in their performance. Performance evaluation included 10 minutes of practice.

With an adequate number of BLS training at appropriate intervals, it will be possible to reach and maintain the optimal level of performance (2,3,6). Since the training duration in our study was 40 minutes, students had to improve their resuscitation performance in a limited time. We were unable to perform additional practical applications to improve performance. The application of an automated external defibrillator was outside the scope of this study. Students only learned how to place the pads.

CONCLUSIONS

We have determined that the online education method alone is insufficient for BLS training. Students developed their basic knowledge and skills after face-to-face BLS training on a mannequin. Resuscitation success rates may increase when the duration and repetition of BLS skill training are individualized for each student.

AUTHOR CONTRIBUTIONS

Conception or design of the work: FÇ, RD
Data collection: FC, HNL, AA, GA, AYA, SO, EB, İD
Data analysis and interpretation: FC, HNL, AA, GA, AYA, SO, EB, İD
Drafting the article: FC, RD
Critical revision of the article: FC, RD
Other (study supervision, fundings, materials, etc): FC, HNL
The author (FC, RD, HNL, AA, GA, AYA, SO, EB, ID) reviewed the results and approved the final version of the manuscript.

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