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Research Article

Effectiveness of ACLS Training Programs: A Comparative Study of Pre- and Post-Test Results Across Health Professional Groups

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Objective: The primary aims of our study were to evaluate the fundamental knowledge and skills related to advanced cardiac life support (ACLS) and basic life support (BLS) across different professional groups through a survey-based assessment and to compare pre-test and post-test surveys following theoretical and simulation-based training to assess improvements in knowledge.

Materials and methods: This study was conducted retrospectively between April 1, 2024, and May 15, 2024. The study group consisted entirely of healthcare professionals. The pre-and post-course results of ACLS training provided by 12 emergency medicine specialists with at least five years of experience in ACLS instruction were evaluated. The statistical analyses of the data were performed using the IBM SPSS 25.0 software package.

Results: The study included a total of 456 participants, of whom 48.5% (n=221) were male. Among the participants, 35.5% (n=162) were emergency medicine residents. Analysis based on the participants' roles revealed a statistically significant difference between the pre-test and post-test results (p=0.010). Post-hoc analysis indicated statistically significant differences between general practitioners and nurses, as well as between general practitioners and paramedics (p=0.012 and p=0.029, respectively).

Conclusion: The study found that a guided ACLS training program, which included standard didactic, practical, and simulation methods, resulted in improved ACLS and increased ACLS knowledge levels among all healthcare professionals. However, no single professional group exhibited a more pronounced increase in post-course success levels compared to others.

Keywords: Advanced cardiovascular life support, Cardiopulmonary resuscitation, Education, Interprofessional education

1. INTRODUCTION

Sudden cardiac death affects 350,000 individuals annually in the USA alone. The provision of early and effective basic life support (BLS) and advanced cardiac life support (ACLS) following sudden cardiac arrest, which has a high mortality rate, is closely linked with the return of spontaneous circulation and favorable neurological recovery in patients.[1] Consequently, BLS and ACLS training programs are widely conducted worldwide, not only for emergency and critical care personnel but also for all healthcare professionals.

Several studies have revealed deficiencies in the resuscitation knowledge of healthcare professionals.[2,3] Highlighting the need for BLS and ACLS training. Globally, BLS and ACLS training continues rapidly through both face-to-face and digital platforms. However, it is known that BLS and ACLS training that includes face-to-face practice and simulations is more effective compared to training without simulations.[4] Courses involving simulations or practical applications enhance participants' skills in performing appropriate chest compressions, using defibrillators, recognizing

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lethal rhythms, and intervening accordingly. The quality and effectiveness of the trainers are as crucial as the format of the training itself. In addition, the effect of the training is related to the participants' roles within the healthcare system. A previous study demonstrated that physicians increased their ACLS knowledge and skills more than nurses following an ACLS course,[5] a finding that is associated with social roles.[6] Nevertheless, all healthcare professionals must be able to provide adequate and effective BLS and ACLS during sudden cardiac arrest. A study involving medical students and resident physicians showed significant improvements in success rates for both groups following appropriately conducted ACLS training.[7] Therefore, training programs should be tailored to the knowledge and experience levels of all healthcare professionals .

In Turkey, many associations and organizations conduct ACLS courses, most of which integrate both theoretical and practical training. The primary aims of the current study were to evaluate the fundamental knowledge and skills related to BLS and ACLS among different professional groups through a survey-based assessment and to compare pre-test and post-test surveys following theoretical and simulation-based training to assess improvements in knowledge.

2. MATERIALS AND METHOD

Study design and population:

This study was conducted retrospectively from April 1, 2024, to May 15, 2024. This study was approved by the Atatürk University Clinical Research Ethics Committee with decision number 3/63 and dated May 3, 2024. The study was performed in accordance with the tenets of the Declaration of Helsinki.

The results of ACLS theoretical and simulation training courses, conducted by 12 emergency medicine specialists with at least five years of experience in ACLS instruction, were evaluated. Participants in these courses were healthcare professionals from various occupational groups (specialist doctors, general practitioners, nurses, and paramedics). The ACLS training provided included a total of 12 hours of theoretical lessons. The theoretical lesson topics were as follows:

1. BLS,
2. ACLS and innovations,
3. Airway management,
4. Cardiovascular pharmacology,
5. Myocardial infarction,
6. Dysrhythmias,
7. Lethal dysrhythmias and electrical therapies,
8. Special considerations in resuscitation (pregnancy, trauma, cardiac arrest in asthma)
9. Special considerations in resuscitation 2 (cardiac arrest in toxicological emergencies)
10. Special considerations in resuscitation 3 (environmental emergencies: anaphylaxis, drowning, hypothermia, and cardiac arrest in electric shock and lightning strikes),
11. Special considerations in resuscitation 4 (thrombolytic use in the emergency department and cardiac arrest in stroke and pulmonary embolism),
12. Ethical and legal aspects of resuscitation.

In addition, the participants received eight hours of practical training with appropriate simulation models, allowing them to practice the following:

1. BLS procedures and the use of automatic external defibrillators,

2. Airway management,
3. Rhythm recognition,
4. Electrical therapy for lethal rhythms and defibrillator use,
5. Management of special cardiac arrest scenarios.

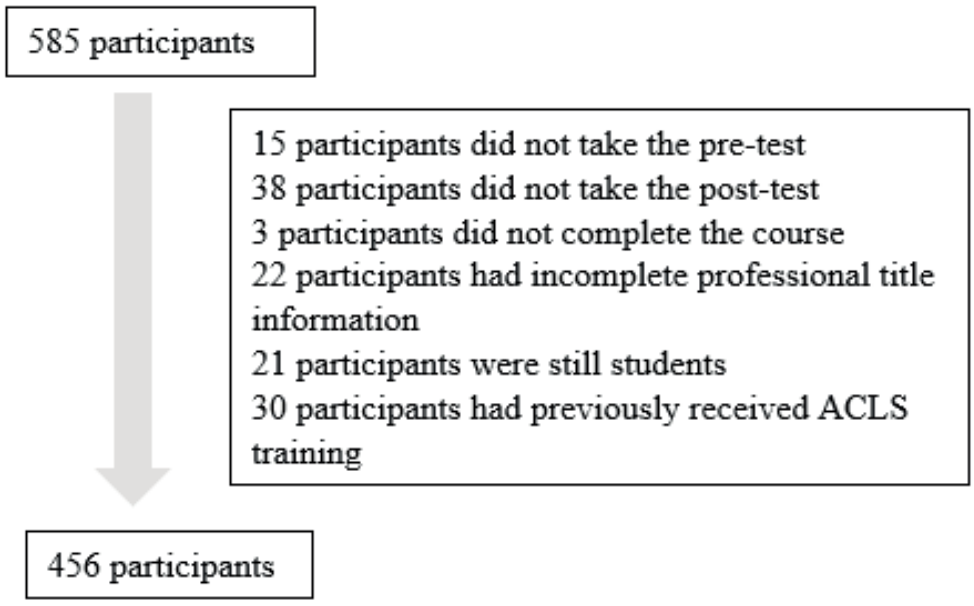
A pre-test was administered to all participants before the lessons began. Following the completion of the theoretical and simulation-based training, a post-test was undertaken. Both the pre-test and post-test consisted of 40 multiple-choice questions, prepared and reviewed by the 12 emergency medicine specialists who provided the ACLS training. The study included all participants from 14 ACLS courses conducted over one year. Excluded from the study were individuals who did not attend the entire course, did not take the pre-test or post-test, were still students, had previously taken an ACLS course, or whose professional titles were not available. A total of 585 participants were initially considered, but only 456 who met the inclusion criteria completed the study. Figure 1 presents the flow chart for the participants.

Statistical analysis:

In this study, statistical analyses were conducted using the IBM SPSS 25.0 software package. The Kolmogorov-Smirnov test was employed to assess the normality of the data distribution. Categorical data were presented as frequencies and percentages, while numerical data were provided as means and standard deviations. For dependent groups, the Wilcoxon test was used to compare two groups. When comparing three or more dependent groups, the Friedman test was utilized. The Dunnett T3 test was employed for the post-hoc analysis of the data. Throughout the study, a p-value of less than 0.05 was considered statistically significant.

Figure 1.

Flow chart for the participants.



3. RESULTS

The study included a total of 456 participants, of whom 48.5% (n = 221) were male. Among the participants, 35.5% (n = 162) were working as emergency medicine residents, and 6.4% (n = 29) were actively working as emergency medicine specialists. The sociodemographic characteristics of the participants are summarized in Table 1.

Examining the pre-test results of the participants included in the study, it was determined that the group of emergency medicine specialists had higher pre-test scores compared to the remaining groups. All groups improved their success levels in the post-test following the course. This increase was also found to be statistically significant (p≤0.001, Table 1).

In the study, when evaluating the differences between the pre-test and post-test scores of the participants, statistical significance was found in terms of gender (p = 0.01 0). Additionally, a statistically significant difference was observed between the pre-test and post-test scores based on the participants' roles (p = 0.010). The post-hoc analysis revealed statistically significant differences between general practitioners and nurses, as well as between general practitioners and paramedics (p = 0.012 and p = 0.029, respectively). No statistical significance was found in the comparison of the remaining groups (p > 0.05) (Table 2).

Table 1.

Pre-test and post-test results according to the participants' sociodemographic characteristics, gender, and professional role.

Variable	n(%)	Pre-test	Post-test	P value
Gender				
Male	221 (48.5%)	54.3 ± 14.9 (12-100)	70.2 ± 14.3 (22.5-97.5)	≤0.001
Female	235 (51.5%)	51.2 ± 13.9 (12-84)	65.5 ± 14.0 (20.2-97.5)	≤0.001
Professional role				
EMS	29 (6.4%)	63.4 ± 11.5 (40-84)	79.3 ± 10.6 (55-97.5)	≤0.001
SD	66 (14.5%)	54.7 ± 12.7 (24-84)	71.1 ± 10 (47.5-92.5)	≤0.001
General practitioner	69 (15.1%)	48.7 ± 12.6 (20-76)	66.1 ± 11.2 (40-95)	≤0.001
Nurse	77 (16.9%)	41.4 ± 13.4 (12-72)	53.2 ± 13 (20-87.5)	≤0.001
Paramedic	53 (11.6%)	45.9 ± 13.1 (24-84)	57.7 ± 15.8 (22.5-92.5)	≤0.001
EMR	162 (35.5%)	59.3 ± 12.2 (24-100)	67.8 ± 9.4 (47.5-97.5)	≤0.001

EMS: Emergency medicine specialist, SD: Specialist doctor in other branches of medicine, EMR: Emergency medicine resident

Table 2.

Comparison of the participants' delta values according to gender and professional role

Variable	Delta test	P value	Post-hoc
Gender			
Male	16.1 ± 13.0 (-27.0-50.5)	0.123	-
Female	14.5 ± 12.8 (-20.0-62.5)		
Professional role			
Emergency medicine specialist[a]	15.9 ± 8.1 (-5.0-30.0)		
Specialist doctor in other branches of medicine[a]	16.4 ± 12.2 (-8.5-41.0)		
General practitioner[a,b]	19.0 ± 122.8 (-12-62.5)	0.010	b > c, d
Nurse[a,c]	11.9 ± 15.5 (-20-51.5)		
Paramedic[a,d]	11.8 ± 14.1 (-27.0-40.5)		
Emergency medicine resident[a]	15.9 ± 11.8 (-19.5-51.0)		

4. DISCUSSION

This study revealed that post-test scores evaluated after the course increased across all groups compared to pre-test scores. However, the increased success rates showed no significant difference among these groups, with almost all healthcare professionals exhibiting a similar level of improvement. Participants should benefit equally from a training program that includes all medical professional groups. For efficient training, it is important to use guided training, as the guide possesses expertise in the subject matter, imparts knowledge, demonstrates its application, and instructs on how to implement it.[8] In addition, standard didactics, face-to-face skill stations, and high-quality simulation training methods should all be implemented during adult education. It has previously been reported in the literature that training with this method increases success rates.[9] The ACLS course provided utilized a full range of guided, standardized didactics, hands-on skills stations, and high-quality simulation training formats and was conducted in small groups, ensuring that all participants were able to equally benefit from them.

The theoretical knowledge provided during school years may be recalled during ACLS courses. However, some participants, such as specialist doctors working in non-emergency medical fields, may not have the opportunity to refresh or practice resuscitation skills sufficiently in their daily work. Therefore, simulations conducted during ACLS training can be instructive for such participants.[10] Simulation is considered the most effective method among educational approaches used to retain knowledge and enhance resuscitation skills.[11] The abundance of professional experience (continuous exposure to resuscitation) may explain why the emergency medicine specialists in the current study scored higher than the remaining professional groups in both pre-tests and post-tests. Emergency medicine specialists are often required to perform resuscitation numerous times

due to the nature of their specialization. Repeated practices ensure the retention of resuscitation knowledge and skills. Thus, although they scored higher than all remaining groups in pre-tests and post-tests due to actively performing resuscitation in their routine work lives, their post-course development did not differ significantly from the other groups. A previous study on determining the frequency of resuscitation training for emergency medicine specialists also reported that the time elapsed after their last training and even the presence of a previous training history did not affect their resuscitation skills.[12] This can also be attributed to the continuous experience these professionals gain in their daily work lives.

Nurses participating in this study had the lowest scores in both pre-tests and post-tests. A study by Botes et al. reported that nurses working in emergency departments and intensive care units had insufficient ACLS knowledge both before and after training.[13] Similarly, Rajeswaran et al. observed that nurses had significantly low levels of resuscitation knowledge before the course. While their post-course knowledge levels increased, a considerable decline was noted when the participants were reassessed after six months.[14] The inadequacy of resuscitation knowledge among nurses in Turkey may be related to their roles in administering medication, preparing materials, etc., during resuscitation. This situation can also be associated with legally binding rules in Turkey's nursing practice, such as the clause requiring nurses to collaborate with physicians in emergency situations and initiate resuscitation in the absence of a physician or a certified practitioner with an unexpired certificate.[15] However, despite these factors, a study conducted with nurse participants in Turkey found that 53.9% of the participants initiated resuscitation without a physician, and nurses with longer work experience were likely more successful in resuscitation, possibly due to their increased experience.[15] In addition, the authors determined that nurses working in emergency departments scored higher on average compared to other nurses. Based on these results, it can be stated that nurses who work in units with constant exposure to resuscitation, such as emergency rooms and intensive care units, have higher success rates compared to their colleagues, most likely due to their greater experience.

The participants working as paramedics in the healthcare system had an increase in their ACLS knowledge levels following the course. This increase could be related to the inclusion of simulations in the training. A previous study found that paramedic students achieved a higher success rate with simulation-based training compared to traditional methods.[16] Furthermore, paramedic participants were observed to perform better than nurses in both pre-tests and post-tests. A study conducted with paramedics in Turkey determined that performing defibrillation or cardioversion during resuscitation significantly increased their knowledge level about resuscitation.[17] The higher scores of paramedics compared to nurses in Turkey may be attributed to their increased exposure to pre-hospital resuscitation protocols due to the frequent solitary nature of their work in ambulances, necessitating the execution of all resuscitation steps prior to hospital admission, thereby facilitating greater experiential gains.

In Turkey, the term "general practitioner" refers to physicians who have graduated from medical school without receiving specialized training in any medical field. Therefore, general practitioners acquire their ACLS-related knowledge during medical school and post-graduation work experience. Consequently, their experience and theoretical knowledge are limited compared to doctors who have undergone specialized training.

In the current study, both groups had increased post-test scores, with similar increases in success rates following training. When comparing general practitioners to doctors working in non-emergency medical fields, specialist doctors scored higher in both pre-tests and post-tests. Similarly, a study undertaken by Stirparo et al. reported that more experienced doctors had higher ACLS knowledge levels compared to new graduates.[18] Our study also indicated that general practitioners scored higher on average in both pre-tests and post-tests compared to nurses and paramedics, which, we believe, is due to the abundance of theoretical education received during school years rather than professional experience.

Our study focused on the benefits gained from the course rather than evaluating participants as successful or unsuccessful. However, we only included participants from the last 14 courses in our study; therefore, our data only reflects the evaluation of the last 14 trainings. We also did not consider the participants' ages or the length of their professional experience. Furthermore, the nursing group was not divided into subgroups based on their encounters with resuscitation processes, such as emergency nurses or intensive care nurses. Lastly, the educational levels of the participants in the nursing group were overlooked, which can be considered another limitation of our study.

5. CONCLUSION

This study revealed that guided ACLS training, involving the utilization of standard didactic, practical, and simulation methods, increased ACLS knowledge levels among all healthcare professional groups. However, the post-course success levels did not significantly differ according to the professional role. The increase in ACLS knowledge levels will also affect the outcomes of resuscitation. To increase survival rates after cardiac arrest, such training should be provided at frequent intervals, especially to healthcare professionals not regularly involved in resuscitation procedures, including emergency medicine specialists and residents.

Ethics Committee Approval

This study was approved by the Atatürk University Clinical Research Ethics Committee with decision number 3/63 and dated May 3, 2024.

Conflict of Interest

The authors declare no conflict of interest in this study.

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No financial support was received from any institution or organization for this study.

REFERENCES

1. Panchal AR, Bartos JA, Cabañas JG, Donnino MW, Drennan IR, Hirsch KG,et al. Adult Basic and Advanced Life Support Writing Group. Part 3: Adult Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2020 Oct 20;142(16_suppl_2): S366-S468. doi: 10.1161/CIR.0000000000000916. PMID: 33081529.
2. Ghauri SK, Javaeed A, Shah F, Ghani MUH. Dismal situation of cardiopulmonary resuscitation knowledge and skills among junior doctors in twin cities of Pakistan. Pak J Med Sci. 2019 Sep-Oct;35(5):1295-1300. doi: 10.12669/pjms.35.5.785. PMID: 31488995; PMCID: PMC6717444.
3. Silverplats J, Södersved Källestedt ML, Wagner P, Ravn-Fischer A, Äng B, Strömsöe A. Theoretical knowledge and self-assessed ability to perform cardiopulmonary resuscitation: A survey among 3044 healthcare professionals in Sweden. Eur J Emerg Med. 2020 Oct;27(5):368-372. doi: 10.1097/MEJ.0000000000000692. PMID: 32852925; PMCID: PMC7448834.
4. Cheng A, Lockey A, Bhanji F, Lin Y, Hunt EA, Lang E. The use of high-fidelity manikins for advanced life support training--A systematic review and meta-analysis. Resuscitation. 2015 Aug;93:142-9. doi: 10.1016/j.resuscitation.2015.04.004. PMID: 25888241.
5. Agarwal A, Baitha U, Ranjan P, Swarnkar NK, Singh GP, Baidya DK, et al. Knowledge and Skills in Cardiopulmonary Resuscitation and Effect of Simulation Training on it among Healthcare Workers in a Tertiary Care Center in India. Indian J Crit Care Med. 2024 Apr;28(4):336-342. doi: 10.5005/jp-journals-10071-24670. PMID: 38585308; PMCID: PMC10998517.

6. Passali C, Pantazopoulos I, Dontas I, Patsaki A, Barouxis D, Troupis G, et al. Evaluation of nurses' and doctors' knowledge of basic & advanced life support resuscitation guidelines. Nurse Educ Pract. 2011 Nov;11(6):365-9. doi: 10.1016/j.nepr.2011.03.010. PMID: 21474382.
7. Mohammed Z, Arafa A, Saleh Y, Dardir M, Taha A, Shaban H et al. Knowledge of and attitudes towards cardiopulmonary resuscitation among junior doctors and medical students in Upper Egypt: Cross-sectional study. Int J Emerg Med 2020;13(19). https://doi.org/10.1186/s12245-020-00277-x
8. Madavan Kakkoprath T. Effectiveness and perception of demonstration-observation- assistance-performance (DOAP) versus video-assisted learning (VAL) in training advanced cardiac life support (ACLS) among medical interns – A comparative study. Journal of Education and Health Promotion 2022;11(1):412. | DOI: 10.4103/jehp.jehp_1663_21
9. Young AK, Maniaci MJ, Simon LV, Lowman PE, McKenna RT, Thomas CS et al. Use of a simulation-based advanced resuscitation training curriculum: Impact on cardiopulmonary resuscitation quality and patient outcomes. Journal of the Intensive Care Society. 2020;21(1):57-63. doi:10.1177/1751143719838209
10. Kim SH, Issenberg B, Roh YS. The Effects of Simulation-Based Advanced Life Support Education for Nursing Students. Comput Inform Nurs. 2020 May;38(5):240-245. doi: 10.1097/CIN.0000000000000560.
11. Jeong HW, Ju D, Lee AK, Lee JA, Kang NR, Choi EJ, et al. Effect of a hybrid team-based advanced cardiopulmonary life support simulation program for clinical nurses. PLoS One. 2022 Dec 16;17(12):e0278512. doi: 10.1371/journal.pone.0278512.
12. Schmitz GR, McNeilly C, Hoebee S, Blutinger E, Fernandez J, Kang C, et al. Cardiopulmonary resuscitation and skill retention in emergency physicians. Am J Emerg Med. 2021 Mar;41:179-183. doi: 10.1016/j.ajem.2020.01.056.
13. Botes ML, Moepeng M. An investigation into specialist practice nurses' knowledge of cardiopulmonary resuscitation guidelines in a tertiary hospital in Gauteng Province, South Africa. South Afr J Crit Care. 2020 Dec 1;36(2):10.7196/SAJCC.2020.v36i2.397. doi: 10.7196/SAJCC.2020.v36i2.397.
14. Rajeswaran L, Cox M, Moeng S, Tsima BM. Assessment of nurses' cardiopulmonary resuscitation knowledge and skills within three district hospitals in Botswana. Afr J Prim Health Care Fam Med. 2018 Apr 12;10(1):e1-e6. doi: 10.4102/phcfm.v10i1.1633.
15. Hemşirelik Yönetmeliğinde Değişiklik Yapılmasına Dair Yönetmelik, https://www.hemed.org.tr/dosyalar/pdf/yasa-ve yonetmelikler/Hemsirelik_Yonetmeligi_19_Nisan_2011.pdf. Erişim tarihi 22.05.2024.
16. Kartal H. Acil ve Yoğun Bakım Kliniğindeki Hemşirelerin Kardiyopulmoner Resüsitasyon Uygulamaya Yönelik Mevcut Durumlarının Değerlendirilmesi. Journal of Academic Research in Nursing (JAREN). 2021;7(1):1-9. doi:10.55646/jaren.2021.92905
17. Lee CC, Im M, Kim TM, Stapleton ER, Kim K, Suh GJ, et al. Comparison of traditional advanced cardiac life support (ACLS) course instruction vs. a scenario-based, performance oriented team instruction (SPOTI) method for Korean paramedic students. J Emerg Med. 2010 Jan;38(1):89-92. doi: 10.1016/j.jemermed.2007.11.078.
18. Kayadelen CL, Kayadelen AN & Durukan P. Factors influencing paramedics' and emergency medical technicians' level of knowledge about the 2015 basic life support guidelines. BMC Emerg Med. 2021;21(82). https://doi.org/10.1186/s12873-021-00474-8