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Original Research Article

EVALUATING THE IMPACT OF PRACTICAL EXPERIENCE ON CPR PROFICIENCY: A COMPARATIVE ANALYSIS

RANA MA[1*], IQBAL J[2], CHAUDHARY A[3], ABDELBAKY AM[4], MOSTAFA AMH[4], AWAD AHA[4], ELMASRY WG[4], PERVAIZ R[5], SARWAR T[5]

[1]*Department of Medicine Amna Inayat Medical College Sheikhupura, Consultant Physician and Head of Critical Care Medicine Bahria International Hospital, Lahore.*
[2]*Department of Medicine, Fatima Memorial Hospital College of Medicine and Dentistry Shadman Lahore, Pakistan*
[3]*Department of Pulmonology, Allama Iqbal Medical College/ Jinnah Hospital, Lahore, Pakistan*
[4]*Medical Intensive Care Unit, Rashid Hospital Dubai Health, Dubai*
[5]*Department of Critical Care Medicine, Bahria International Hospital, Lahore, Pakistan*
**Corresponding author's email address:* drasimrana@yahoo.com

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Abstract: *Cardiopulmonary Resuscitation (CPR) is a critical life-saving skill, especially in healthcare settings where timely and proficient intervention can significantly impact patient outcomes. While theoretical CPR training provides foundational knowledge, integrating practical experience is essential for bridging the gap between theoretical understanding and practical real-world application. The primary objectives include evaluating how practical experience influences CPR proficiency between individuals with theoretical training only and those with one year of practical (real-time) experience. The study aims to provide valuable insights into the effectiveness of CPR training programs and the significance of practical exposure in improving outcomes. Seventy healthcare professionals, comprising 35 doctors with CPR training only (Group A) and 35 doctors with one year of practical CPR experience (Group B), were subjected to standardized Basic Life Support (BLS) testing on a manikin. Various CPR performance indicators were meticulously assessed, such as compression depth, rate, hand positioning, effective ventilations, and hands-off time. Statistical analyses were conducted to draw comparisons and highlight the impact of practical experience. With practical experience, Group B demonstrated significantly superior CPR performance compared to Group A. This was evident in shorter start-up time, enhanced compression depth and hand positioning, higher rates of effective ventilations, and reduced hands-off time. While compression rates remained similar between the groups, practical experience emerged as a crucial factor influencing diverse CPR quality indicators. The study concludes that practical experience is pivotal in improving CPR proficiency, emphasizing the need for hands-on components in training programs. These findings contribute to refining CPR training strategies for enhanced real-world application and improved emergency survival rates. Ongoing research in this field is crucial for continuous advancements in CPR protocols.*

Keywords: Cardiopulmonary Resuscitation, Bystander, Basic Life Support, BLS Training, Competence, Chest Compressions

Introduction

Improving the survival rates after out-of-hospital cardiac arrest is a big challenge. However, recognizing cardiac arrest as soon as possible and starting CPR is one of the most critical techniques (Hollenberg et al., 2013). Recent data analyses from different studies have shown that early CPR improves functional mortality and reduces the number of nursing home visits in revived patients (Hasselqvist-Ax et al., 2015; Kragholm et al., 2017).

Several countrywide campaigns have successfully raised bystander CPR rates and at least doubled OHCA survival (Birkun et al., 2021). The quality of CPR is essential, and proper compression depth, pace, and duration of chest compressions can significantly influence the recovery of circulatory function. Therefore, providing CPR training to the general population five is crucial.

Bystanders who have received CPR training are three times more likely to perform CPR than those who have not (Bouland et al., 2017). Today, various courses and options for teaching CPR are available, including concise CPR programs and self-instruction DVDs designed to expand public access to CPR training. Shorter courses have been demonstrated to preserve chest compression quality and defibrillator use, making them appropriate choices for relatively safe bystanders and areas with limited resources. However, it's unknown how shortening CPR training will impact real-world CPR quality or patient outcomes.

A recent study of out-of-hospital cardiac arrest data has shown that bystanders who are specially trained in giving CPR perform better than those who are not specialists (Hollenberg et al., 2013; Riva et al., 2020). This suggests that expanding CPR training programs for ordinary people could improve the outcomes of CPR. By understanding which aspects of training can be enhanced, program creators can tailor courses to the needs of laypeople. However, no controlled studies have explored the link between the amount of practice and real-life performance in the different components of the CPR procedure.

This study aimed to examine the impact of training on the various components of CPR. This was achieved by

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assessing two groups of CPR providers: those who had completed a CRP course only and those with one year of experience with real-time CPR.

Methodology

The study was conducted at Bahria Town International Hospital from January 2022 to December 2023. Seventy participants were recruited from the hospital staff, including doctors from the intensive care unit and emergency department, and were included in the study for analysis. Ethical approval was obtained from the hospital's research ethics committee, and participant confidentiality was ensured.

The study aimed to compare CPR proficiency between two groups: those with only CPR training and those with one year of practical experience. Participants were classified into Group A (Training only) and Group B (Experienced) based on their prior CPR experience.

Data collection involved a CPR performance test, where each participant performed CPR on a standard manikin, simulating a cardiac arrest scenario. Performance was measured using compression depth, rate, hand positioning, and ventilation effectiveness criteria.

CPR manikins equipped with sensors were used to measure performance metrics. Digitally administered questionnaires (Google Forms) were used for ease of data collection and analysis.

Quantitative analysis was conducted using statistical methods to compare the CPR performance metrics between the two groups.

The mean and standard deviation were used to present the continuous variable, while the t-test was utilized to compare the parametric variables between the different groups. The data was analyzed using SPSS version 25, and a p-value of less than 0.05 was considered statistically significant.

Results

Table 1 exhibits the demographic characteristics of the study population, which compares two groups, Group A and Group B, each comprising 35 participants. The table shows four distinct factors: age, gender, real-life CPR provision, and department. The mean age of Group A was 29.5 years (standard deviation [SD] = 2.0), while the mean age of Group B was 31.2 years (SD = 3.5). Regarding gender, 57.1% of Group A were males, compared to 71.4% of Group B, but the difference was not statistically significant (p=0.287). Finally, the table presents the departments where the study was conducted, with 21 participants from Group A, 19 from Group B in the ICU, 14 from Group A, and 16 from Group B in the emergency department. The p-values for these differences were 0.069 and 0.228, respectively. These findings suggest that the groups were similarly distributed across departments and that potential department-based confounding factors were minimized (Table, Figure 1).

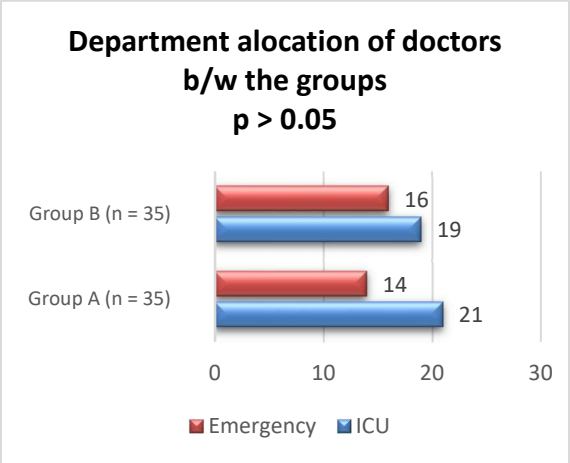

Figure 1: Distribution of doctors according to departments.

Table 1: Demographics of the study population:

Characteristic	Group A (n = 35)	Group B (n = 35)	*p*-value
Age (years)	29.5 ± 2.0	31.2 ± 3.5	0.076
Male gender (%)	20 (57.1)	25 (71.4)	0.287
Provided CPR in real life (%)	0	35	< 0.001
Department			
ICU	21	19	0.069
Emergency	14	16	0.228

Table 2 provides a detailed comparison of CPR quality indicators between the two groups; the characteristics under consideration include Compression Rate (Chest Compressions/Min), performance in different loops of CPR, Effective Ventilations (%), Correct Hand Placement on Chest (%), Correct Compression Depth (%), Total Hands-off Time (s), and Time from Verified Cardiac Arrest to Start CPR (s).

The Compression Rate, which indicates the frequency of chest compressions per minute, shows no significant difference between Group A and Group B (p-value=0.310). This suggests that both groups have similar chest compression rates. However, further analysis reveals differences in specific aspects of CPR execution.

During the First Loop CPR, Group A and Group B showed mean values of 108 ± 28.5 and 108 ± 19.8, respectively. A statistically significant difference was observed between the two groups, indicated by a p-value of 0.040. This suggests a subtle distinction between the two groups' initial stages of CPR performance. On the other hand, during the Second Loop CPR, there was no significant difference between the groups, as the mean values were 103 ± 27.2 and 105 ± 15.5 for Group A and Group B, respectively, with a p-value of 0.355.

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Upon further investigation into the subsequent loops (Third to Fifth), no significant differences were found, indicating consistency in CPR performance beyond the initial stages. However, when analyzing the effectiveness of ventilations, Group B outperformed Group A significantly, with success rates of 69.1% and 15.9%, respectively, and a highly significant p-value of less than 0.001.

Correct Hand Placement on the Chest also demonstrates a significant difference between the two groups (p-value = 0.019), with Group B achieving a higher percentage (91.8%) compared to Group A (69.6%). Similarly, Correct Compression Depth exhibits a substantial variation, with Group B achieving 81.7% correctness compared to Group A's 49.6%, yielding a p-value of < 0.001.

Total Hands-off Time, a critical metric indicating interruptions in chest compressions, is significantly lower in Group B (36.5 ± 12.3s) compared to Group A (48.5 ± 14.5s) (p-value < 0.001). This underscores the potential impact of training levels on minimizing interruptions during CPR.

Lastly, the Time from Verified Cardiac Arrest to Start CPR reveals a substantial difference between the groups. Group B initiates CPR promptly with a mean time of 3.5 ± 2.5s, while Group A exhibits a longer mean time of 15.5 ± 12.2s, resulting in a highly significant p-value of < 0.001.

Table 2: CPR Quality Indicators Between Groups with Different Training Levels

Characteristic	Group A (n = 35)	Group B (n = 35)	*p*-value
Compression Rate (Chest Compressions/Min)			0.310
First Loop CPR	108 ± 28.5	108 ± 19.8	0.040
Second Loop CPR	103 ± 27.2	105 ± 15.5	0.355
- Third Loop CPR	104 ± 26.5	105 ± 16.5	0.598
- Fourth Loop CPR	105 ± 26.8	106 ± 17.6	0.305
- Fifth Loop CPR	98 ± 26.3	112 ± 22.0	< 0.001
Effective Ventilations (%)	15.9	69.1	< 0.001
Correct Hand Placement on Chest (%)	69.6	91.8	0.019
Correct Compression Depth (%)	49.6	81.7	< 0.001
Total Hands-off Time (s)	48.5 ± 14.5	36.5 ± 12.3	< 0.001
Time from Verified Cardiac Arrest to Start CPR (s)	15.5 ± 12.2	3.5 ± 2.5	< 0.001

Discussion

The study findings suggest that practical experience is crucial in enhancing CPR performance. Group B, which consisted of individuals with prior experience, demonstrated better CPR performance than Group A in several key areas. Group B showed a shorter start-up time, improved compression depth, accurate hand positioning, a higher fraction of effective rescue ventilations, and shorter hands-off time. These factors resulted in a higher chest compression fraction, indicating that practical experience can lead to more efficient and effective CPR delivery. Although both groups had similar chest compression rates, the nuances in specific aspects of CPR execution highlighted the added value of practical experience. These findings can help improve CPR training programs and emphasize the importance of hands-on experience.

It is interesting to note that a detailed analysis of CPR loops has provided valuable insights. Upon observation of the initial stages (First Loop CPR), it was found that Group B outperformed Group A marginally. However, no significant differences were observed as CPR progressed to subsequent loops, indicating a consistent performance beyond the initial stages. This observation highlights the significance of practical experience, as it primarily influences the early stages of CPR execution.

Effective ventilations were a crucial aspect where Group B significantly outperformed Group A. The ability to deliver successful ventilation is critical in providing comprehensive CPR, and the results indicate that practical experience plays a substantial role in enhancing this aspect of CPR proficiency.

Different studies were conducted to assess CPR training levels and identify proficiency gaps to improve emergency response and save lives (Bylow, 2021; Hollenberg et al., 2008; Malta Hansen et al., 2017; Nord, 2017).

A study by Lund-Kordahl et al. aimed to analyze the relationship between the level of CPR training, self-reported skills, and actual manikin test performance. The study found that higher levels of BLS training correlated with better CPR quality, and ventilations and hands-on time were the components of CPR most affected by the level of training. Self-assessments of CPR ability correlated well to actual test performance and may have a role in probing CPR skills in students. The results may be necessary for BLS instructors and program developers.

Based on the findings of this study, it is recommended that individuals receive advanced CPR training to improve the quality of CPR performed during an emergency. Additionally, self-assessments of CPR ability may help identify areas for improvement and could be incorporated into CPR training programs (Lund-Kordahl et al., 2019).

Another study by the ST Veettil evaluated the knowledge and ability of physicians and nurses in health centers operated by the Primary Health Care Corporation (PHCC) in Doha, Qatar, to perform CPR. The results showed that nurses and those with more experience in clinical practice had a higher knowledge score in both components. Those who attended more resuscitation courses also had a higher knowledge score. The direct observation of CPR drill performance revealed a satisfactory outcome. The level of CPR knowledge and skills practice among healthcare providers in PHCC is deemed satisfactory, especially among those with more experience. However, to ensure resuscitation knowledge and skills retention, clinical staff should be certified and assessed regularly (Veettil et al., 2023). Our study showed that individuals with practical experience can perform CPR more effectively.

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The outcome of our studies underscores the significance of practical experience in enhancing CPR proficiency. Incorporating real-life scenarios and hands-on practice in training programs can bridge the gap between theoretical knowledge and practical application. Training programs integrating practical experience may lead to more confident and proficient healthcare professionals in emergencies**.**
Despite the valuable insights provided, our study has some limitations. The use of manikins, while standard in CPR research, may not fully replicate real-life scenarios. Additionally, the study focused on a specific group of healthcare professionals, and the findings may not generalize to other populations. Comparative studies across different healthcare settings and professions could provide a broader understanding of the generalizability of our findings.

Conclusion

In conclusion, our study emphasizes the positive impact of practical experience on CPR proficiency. Healthcare professionals with one year of hands-on experience exhibited superior CPR performance to those with training. The findings highlight the need for training programs to incorporate practical components, ensuring healthcare providers are well-prepared and confident in delivering effective CPR in real-life situations.

Recommendation

Based on the study's outcomes, we recommend enhancing CPR training programs for healthcare professionals by integrating practical experiences simulating real-life scenarios, mainly focusing on the initial stages of CPR execution. Continuous and tailored CPR training, emphasizing ventilation techniques, should be implemented to build confidence and align self-assessment with proficiency levels. Technological tools, like CPR manikins with sensors, can provide real-time feedback, fostering continuous improvement. Further research is needed to ensure ongoing effectiveness and proficiency in CPR skills among healthcare professionals.

Declarations

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All data generated or analyzed during the study are included in the manuscript.
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Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

MUHAMMAD ASIM RANA (Assistant Professor)
Coordination of collaborative efforts. Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript, conducted the study.
JAVEID IQBAL (Professor)
Manuscript revisions, critical input.
ANEELA CHAUDHARY (Associate Professor)
Coordination of collaborative efforts, Data acquisition, analysis.
AHMED M. ABDELBAKY (Senior Specialist)
Coordination of collaborative efforts. Data analysis, drafting article, review of manuscript.
AHMED MOHAMMED HASSAN MOSTAFA (Senior Specialist)
Manuscript revisions, critical input. Coordination of collaborative efforts, analysis.
AHMED HOSSAMELDIN AHMED AWAD (Senior Specialist)
Coordination of collaborative efforts. Review of manuscript, analysis.
WAEL GHALY ELMASRY (Senior Specialist)
Manuscript revisions, critical input. Data analysis, drafting article. Review of manuscript
RIZWAN PERVAIZ (Senior Registrar)
Coordination of collaborative efforts. Data entry and Data analysis, drafting article.
TAYYABA SARWAR (Registrar)
Coordination of collaborative efforts. Data acquisition, analysis.

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