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Original Article

Impact of Basic Life Support Training on Knowledge and Performance Among Rural Intermediate Students: A Quasi-Experimental Study

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Abstract

Objectives: This study aimed to evaluate the effectiveness of Basic Life Support (BLS) training on the knowledge and performance of intermediate students from a rural area.

Methodology: A quasi-experimental study with pretest, posttest, and follow-up phases was conducted at a private sector high school. Non-probability purposive sampling was used to select participants, consisting of 11th and 12th-grade students with low to moderate levels of BLS knowledge, as assessed by a structured questionnaire. The BLS training, lasting three hours, included a PowerPoint presentation and hands-on practice. Data were collected from 80 participants at three stages: pre-test, post-test, and a follow-up test three months after the intervention. Participant performance was evaluated using the American Heart Association checklist. Data analysis was performed using SPSS version 25, with Friedman's ANOVA applied for inferential statistics.

Results: Initially, 95% of participants had a low level of BLS knowledge, with a median score of 3. Post-intervention, knowledge significantly improved, with a median score of 6.5 and 37.5% of participants achieving a high level of knowledge, while 30% reached a moderate level (p-value <0.0001). However, knowledge retention declined after three months, with a median score of 4.0 (p-value <0.0001). Previous knowledge of CPR was significantly associated with improved post-intervention knowledge scores (p-value = 0.03).

Conclusion: The BLS training significantly enhanced participants' knowledge and performance. Nonetheless, there was a notable decline in knowledge retention over time.

Keywords: Effectiveness, Knowledge, Performance, Basic Life Support, Cardiopulmonary Resuscitation, American Heart Association

INTRODUCTION

Basic Life Support (BLS) encompasses essential techniques for maintaining airway, breathing, and circulation in individuals experiencing cardiac arrest, without the use of advanced medical equipment [1]. Cardiopulmonary resuscitation (CPR), a key component of BLS, is crucial in emergencies, particularly in rural areas where access to healthcare facilities is limited [2]. In such regions, the ability of residents to perform BLS can significantly impact survival rates and reduce fatalities from cardiac arrest.

Cardiac arrest remains a major global health challenge. In the United States alone, it results in approximately 395,000 deaths annually outside of medical settings [3]. Cardiovascular diseases (CVDs) have seen a global increase in mortality, with deaths rising from 12.1 million in 1990 to 18.6 million in 2019. In Europe, cardiac arrest accounts for about 700,000 deaths each year, and outside of hospitals, sudden deaths due to cardiac arrest occur at rates of 20-140 per 100,000 people [4]. These out-of-hospital cardiac arrests constitute 50-70% of all cardiac arrest cases [5,6].

In Pakistan, coronary heart diseases were responsible for 240,720 deaths in 2020, with cardiac arrest being a leading cause, representing 16.49% of all fatalities. Pakistan ranks 30th globally in terms of mortality rate from cardiac events, with a rate of 193.56 per 100,000 people. Non-communicable diseases (NCDs) are the leading cause of death, contributing to 70% of deaths, with circulatory disorders accounting for 45% of NCD-related fatalities [7].

In developed countries, the incidence of out-of-hospital cardiac arrests exceeds 200 per 100,000 people annually. BLS is critical for victims of cardiac or respiratory arrest caused by various emergencies such as heart attacks, heat strokes, electric shocks, drowning, or choking [8]. Prompt BLS, ideally within 4-6 minutes of arrest, is vital for preventing physiological death and ensuring adequate oxygen supply to vital organs like the heart and brain [9]. Effective BLS performed by bystanders has been shown to improve survival rates significantly [10].

In Asia, survival rates for out-of-hospital cardiac arrests range from 0.5% to 8.5%, often due to delays in treatment [11]. Every minute of delay increases the risk of morbidity and mortality [12]. Immediate CPR by bystanders can double the chances of survival, highlighting the importance of prompt action [13]. Community-based initiatives, such as mass media campaigns and training programs, are essential to increase BLS awareness and skills among the general population [14].

Given these considerations, this study aims to evaluate the effectiveness of BLS training on the knowledge of rural intermediate school students in Muzaffargarh District, Punjab, Pakistan. By equipping these students with life-saving skills, the study seeks to enhance emergency response capabilities in areas where immediate medical assistance may not be readily available.

METHODOLOGY

Participants: The study targeted intermediate-level students at Dawn Girls Higher Secondary School in Sanawan, a town in Tehsil Kot Adu, District Muzaffargarh, Punjab, Pakistan, with an estimated population of 40,000. Participants were selected based on their baseline knowledge of Basic Life Support (BLS). Students with low (below 60%) and moderate (60-80%) levels of BLS knowledge were included. Exclusion criteria included students with a fear of emergency situations, those with prior BLS training within the last two years, and those unwilling to participate.

Interventions: The intervention aimed to enhance the BLS knowledge of the participants. Students were divided into four groups (Group I, II, III, IV), each comprising 20 members. Over a period of two weeks, each group received a comprehensive educational intervention, including PowerPoint presentations, lectures, videos, and interactive discussions focused on BLS principles. The intervention was structured to cover the critical components of BLS, with the effectiveness evaluated through pre- and post-intervention knowledge assessments.

Outcomes: The primary outcome was the improvement in BLS knowledge among the participants, measured by a validated and structured questionnaire comprising 10 specific questions on BLS. The knowledge scores were categorized into three levels: low (below 60%), moderate (60-80%), and high (above 80%). Post-intervention knowledge was assessed immediately after the intervention and

again after three months to evaluate knowledge retention.

Sample Size: The sample size was calculated using the online software "Sample-size.net," referencing a prior study conducted in Iran. The mean paired difference was 7.42 with an assumed standard deviation of 23. With a 95% confidence level and 5% absolute precision, the calculated sample size was 76 participants. To ensure robustness, the final sample size was rounded to 80 participants.

Assignment Method: Participants were assigned to one of four groups using a quasi-random assignment method, ensuring that each group had an equal number of participants. The intervention was delivered sequentially, with each group receiving the educational program on a designated day within the two-week intervention period.

Blinding: Blinding was not feasible due to the nature of the educational intervention. However, the data analysis was conducted by a researcher who was not involved in the intervention delivery to minimize potential biases.

Unit of Analysis: The unit of analysis was the individual participant. Knowledge scores from pre- and post-intervention assessments were analyzed at the participant level, allowing for a detailed evaluation of the intervention's effectiveness.

Statistical Methods: Data analysis was performed using SPSS software version 26.0. Descriptive statistics, including frequencies and percentages for categorical variables and mean ± standard deviation for continuous data, were computed. For skewed data, median and interquartile range (IQR) were reported. To assess differences in knowledge scores over time, Friedman's ANOVA was used for repeated measures. For pairwise comparisons, the Wilcoxon Signed Rank test was applied. A p-value of ≤ 0.05 was considered statistically significant.

Ethical Considerations: Approval for this study was obtained from the Ethical Review Committee (ERC) and the Board of Advanced Studies and Research (BASR) at Ziauddin University, Karachi. Additionally, permission was secured from the Principal of Dawn Girls Higher Secondary School, Sanawan. Informed consent was obtained from all participants prior to their involvement in the study. All measures were taken to ensure the confidentiality of participants' records and data throughout the research process.

RESULTS

Participant Flow: A total of 80 participants were initially recruited for the study, achieving a 100% response rate. All participants completed the pre-intervention assessment, the immediate post-intervention assessment, and the three-month follow-up assessment. No participants were lost to follow-up, and data from all participants were included in the final analysis.

Recruitment: Participants were recruited from Dawn Girls Higher Secondary School, Sanawan, with the recruitment process concluding once the sample size of 80 was reached. Recruitment efforts ensured that students met the inclusion criteria of having low to moderate BLS knowledge, with no prior BLS training in the past two years and a willingness to participate.

Baseline Data: At baseline, the majority of participants (77.5%) were aged between 15 to 17 years, with all participants being female and enrolled at the intermediate college level. Approximately half of the participants' fathers were farmers (48.8%), followed by those employed in government jobs (31.3%). A minority of participants (13.7%) had encountered a fainting incident, with half of these individuals having called a rescue team. Furthermore, 37.5% of participants had prior information about basic CPR, primarily acquired through the internet. Almost all participants (96.3%) expressed a strong interest in learning CPR.

Baseline Equivalence: The baseline equivalence in BLS knowledge was evident as 95% of participants demonstrated low levels of BLS knowledge (<60%), while only 5% exhibited moderate knowledge (60-80%). No participants had high levels of BLS knowledge (>80%) at the outset of the study.

Numbers Analyzed: All 80 participants were analyzed at each assessment point—pre-intervention, post-intervention, and post-three months. The comprehensive analysis included data from all participants, ensuring robust statistical power for the study's conclusions.

Outcomes and Estimation: The intervention led to a significant improvement in BLS knowledge. Post-intervention, 37.5% of participants achieved high

knowledge levels, while 30% reached moderate levels. However, a notable decline in knowledge retention was observed at the three-month follow-up, with only 10% of participants maintaining high knowledge levels, and 71.3% reverting to low knowledge levels.

Friedman's ANOVA revealed a statistically significant difference in knowledge scores across the three time points (p < 0.001). Pairwise comparisons using the Wilcoxon Signed Ranks test indicated significant improvements in knowledge scores from pre-intervention to post-intervention (p < 0.001) and

from pre-intervention to post-three months (p < 0.001). However, there was a significant decrease in knowledge scores from post-intervention to post-three months (p < 0.001), suggesting some decline in knowledge retention over time.

Ancillary Analyses: Additional analyses examined the potential influence of demographic variables on BLS knowledge retention. No significant correlations were found between participants' age, parental occupation, or prior CPR information and their ability to retain BLS knowledge at the three-month follow-up.

Table 1: Level of Knowledge of Participants about BLS

Level of Knowledge	Pre-Intervention		Post-Intervention		Post-3 months	
	n (%)	Median (IQR)	n (%)	Median (IQR)	n (%)	Median (IQR)
Low	76 (95.0)	2.5 (2.0)	26 (32.5)	4.5 (1.0)	57 (71.3)	4.0 (1.5)
Moderate	4 (5.0)	6.0 (0.0)	24 (30.0)	6.0 (1.0)	15 (18.8)	6.0 (1.0)
High	0	0 (0.0)	30 (37.5)	10.0 (1.0)	8 (10.0)	10.0 (0.0)

Table 2: Comparing the Difference in Score of Knowledge before, after and Post- three months of Intervention using Friedman's ANOVA

N (80)	Median (IQR)	P-value
Knowledge		
Pre-Intervention	3.0 (3.0)	
Post-Intervention	6.5 (5.0)	<0. 001
Post-3 months	4.0 (3.0)	

Table 3: Pair wise comparison of Knowledge Score using Wilcoxon Signed Ranks Test

Group		Median (IQR)	Mean Rank	P-value
Pair-1	**Pre-Intervention**	3.0 (3.0)	1.23	<0.001*
	Post-Intervention	6.5 (5.0)	2.71	
Pair-2	**Pre-Intervention**	3.0 (3.0)	1.23	<0.001*
	Post-3 months	4.0 (3.0)	2.06	
Pair-3	**Post-Intervention**	6.5 (5.0)	2.71	<0.001*
	Post-3 months	4.0 (3.0)	2.06	

Significant at p-value < 0.017 (Bonferroni adjustment)

DISCUSSION

This study aimed to evaluate the impact of Basic Life Support (BLS) training on the knowledge of intermediate school students from a rural area. The hypothesis was that BLS training would significantly enhance participants' knowledge. The study focused exclusively on female students, revealing that only a few had witnessed fainting incidents. Despite this, a majority lacked CPR knowledge, although nearly all were keen to learn this vital skill.

The study's findings align with those from a similar study conducted in Riyadh, Saudi Arabia, where over

half of the female participants lacked CPR knowledge, and many considered BLS training essential. This similarity underscores the widespread need for basic life-saving education [15].

Our results demonstrated a marked improvement in BLS knowledge post-intervention. The immediate post-test scores were significantly higher than the pre-intervention scores, with nearly all participants showing enhanced performance. This improvement reflects a similar trend observed in studies globally. For example, a study in Pakistan showed an increase in scores from less than 50% to over 50% after training, while research in India and Iran reported significant score improvements post-training [16-19].

Despite the positive immediate impact, the three-month follow-up revealed a considerable decline in knowledge retention. At this point, 71.3% of participants were back to a low knowledge level. This decline was statistically significant across all assessment time points, highlighting the challenge of long-term knowledge retention. The drop in scores between the immediate post-test and the three-month follow-up underscores the need for regular reinforcement of BLS training.

Comparative studies provide additional context. For instance, a study in Rawalpindi, Pakistan, showed improved CPR knowledge with comparable retention rates after three months, though the difference was not statistically significant [20]. Conversely, research

in Malaysia showed a similar decline in knowledge over time despite initial improvements, echoing our findings [21]. These studies suggest that while initial training is effective, sustained knowledge requires ongoing reinforcement [22-23].

The importance of BLS training in high schools is evident from this study. To maintain and further enhance BLS knowledge, it is recommended that such training be incorporated into the educational curriculum. Additionally, public awareness campaigns through electronic and social media should be conducted to promote BLS education and ensure that training programs are regularly offered.

Limitations

Limitations of this study include its single-center design and the focus on only female participants, which may limit the generalizability of the findings. Future research should aim to include a more diverse sample and multiple centers to provide a broader understanding of BLS training effectiveness.

CONCLUSION

The study concluded that high school students displayed a positive attitude toward learning CPR, and Basic Life Support (BLS) training significantly improved their knowledge and performance. However, while immediate gains were notable, there was a decline in both knowledge and performance over time. Notably, no correlation was found between pre-test knowledge and demographic variables of the respondents. Nevertheless, prior exposure to basic CPR was significantly associated with higher post-test scores.

AUTHORS' CONTRIBUTION

UJ, R, and AUK: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. UJ, RR, and AUK: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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