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Effect of Teaching Program on AED Knowledge in Critical Care Nurses

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ABSTRACT

Introduction: Defibrillation is an established intervention for life-threatening cardiac arrhythmias such as ventricular fibrillation and pulseless ventricular tachycardia. It delivers an electrical shock to the heart to restore normal rhythm. Automated external defibrillators (AEDs) are designed to analyse cardiac rhythms and guide users, enabling even minimally trained individuals to provide timely intervention during emergencies.

Objectives: The study aimed to assess the baseline knowledge of critical care nurses regarding AED use, evaluate their knowledge following a structured teaching programme, determine the effectiveness of the teaching intervention, and examine the association between pre-test knowledge levels and selected demographic variables.

Materials and Methods: An experimental, single-group pre-test and post-test design was adopted. A total of 130 critical care nurses were selected from selected hospitals using a non-probability purposive sampling technique and assigned to a single experimental group. Knowledge was assessed using a structured questionnaire. A planned teaching programme on AED use was implemented, and post-test data were collected. Data were analysed using descriptive and inferential statistics, including means, standard deviations, and the chi-square test.

Results: Pre-test findings indicated that most participants had inadequate knowledge regarding AED use. Following the teaching programme, there was a marked improvement in knowledge levels among the nurses. A statistically significant association was observed between knowledge scores and selected demographic variables.

Conclusion: The structured teaching programme was effective in enhancing the knowledge of critical care nurses regarding AED use. The findings highlight the importance of educational interventions in improving emergency preparedness among nursing professionals.

Keywords: Automated external defibrillator, planned teaching programme, critical care nurses

I. Introduction:

Heart disease remains the leading cause of mortality worldwide, accounting for approximately 17.9

million deaths annually [1]. In India, cardiovascular disease represents a major public health concern, with a substantial rise in prevalence over the past four decades [2]. It has been estimated by the World Health Organisation that a significant proportion of global cardiovascular disease cases originate from India. [1]. Studies from developed nations indicate that nearly 33–40% of cardiac arrests occur within hospital settings, and more than 60% of these cases are initially identified by nursing staff [3].

Early defibrillation plays a crucial role in improving survival outcomes following cardiac arrest, particularly in cases of ventricular fibrillation and pulseless ventricular tachycardia. The American Heart Association recommends that defibrillation be administered within three minutes of cardiac arrest to increase survival rates [4]. As nurses are frequently the first healthcare professionals to respond to in-hospital cardiac emergencies, expanding their responsibilities to include early defibrillation can significantly reduce delays in treatment and improve survival outcomes [1]. Strengthening nurses' knowledge and competence in using automated external defibrillators (AEDs) can enhance patient outcomes and improve the overall quality of emergency cardiac care [1,2].

Defibrillation involves delivering a controlled electrical shock to the heart using a defibrillator to terminate life-threatening arrhythmias such as ventricular fibrillation and pulseless ventricular tachycardia [2]. The shock depolarises the myocardium, interrupts abnormal electrical activity, and allows the sinoatrial node to re-establish normal sinus rhythm. Defibrillators may be external, transvenous, or implantable, depending on clinical indications [3]. Automated external defibrillators are designed to detect shockable rhythms automatically, enabling trained healthcare providers and even minimally trained individuals to administer lifesaving treatment promptly.[1]

Globally, heart disease remains the leading cause of mortality, accounting for approximately 17.9 million deaths each year [1]. In India, cardiovascular disease has become a major public health concern, with its prevalence rising significantly over the past four decades [2]. According to the World Health Organisation, a substantial share of the global cardiovascular disease burden is concentrated in India [1]. Furthermore, data from developed countries indicate that 33% to 40% of cardiac arrests occur in hospital settings, with over 60% of these cases first identified by nursing staff [3]. Timely defibrillation is critical for improving survival following cardiac arrest, particularly in cases of ventricular fibrillation or pulseless ventricular tachycardia. The American Heart Association recommends that defibrillation be administered within three minutes of cardiac arrest to optimise survival outcomes [4]. As nurses are often the first responders during in-hospital cardiac emergencies, their ability to initiate early defibrillation can significantly reduce delays and enhance patient outcomes [1]. Therefore, strengthening nurses' knowledge and skills related to automated external defibrillators (AEDs) is essential for improving the quality of emergency cardiac care [1,2].

Defibrillation involves delivering a controlled electrical shock to the heart to terminate life-threatening arrhythmias and restore normal cardiac rhythm [2]. Automated external defibrillators are designed to detect shockable rhythms and guide users through the defibrillation process, enabling prompt and effective intervention by healthcare providers [3].

RESEARCH GAP: Despite the critical role of AEDs in emergency cardiac care, several studies indicate that nurses often possess inadequate knowledge and limited practical competence in their use [6,7]. There is a lack of structured educational interventions specifically targeting AED knowledge among critical care nurses in hospital settings, particularly in the local context [8].

NEED FOR THE STUDY: Enhancing the knowledge and competency of critical care nurses through a planned teaching programme is essential to ensure the timely and effective use of AEDs [6]. This study is

therefore undertaken to evaluate the effectiveness of such an intervention in improving nurses' knowledge and ultimately contributing to better patient outcomes during cardiac emergencies.

II. SUBJECTS AND METHODS

The research design used in this study Descriptive research design. A nonprobability purposive sampling technique was used. A study was conducted by selecting 130 critical care nurses who work in the critical care unit in selected hospitals. Self-reported questionnaires were used to assess the effectiveness of AED use among critical care nurses.

ETHICAL CONSIDERATIONS AND SAMPLING TECHNIQUE:

Before the commencement of the study, ethical clearance was obtained from the Institutional Ethics Committee (IEC) of the selected institution (Approval No.: IEC/2023/045; Date: 15 June 2023). Formal administrative permission was also secured from the authorities of the selected hospitals. Written informed consent was obtained from all participating nurses after clearly explaining the purpose, procedures, potential benefits, and voluntary nature of the study. Participants were assured of confidentiality and anonymity, and they were informed of their right to withdraw from the study at any point without any consequences.

A non-probability purposive sampling technique was adopted to select 130 critical care nurses. This method was chosen because it allowed the researcher to deliberately include participants who met specific inclusion criteria, such as working in critical care units and having direct involvement in patient management during cardiac emergencies. Additionally, this technique was practical and efficient in accessing a specialised group within a limited timeframe and ensured that participants possessed relevant experience related to the use of automated external defibrillators (AEDs).

III. RESULTS AND DISCUSSION

The pretest knowledge score regarding automated External Defibrillation (AED) use in the experimental group, the majority, 98.46 (98.46%) of the critical care nurses had a poor level of knowledge score, and 1.54 (1.54%) of them had a fair level of knowledge score. In the posttest knowledge score, the majority, 10.77 (10.77%) of the critical care nurses had a poor level of knowledge score, 8.46 (8.46%) had fair, and 80.77 (80.77%) had a good level of knowledge score. In post-test the 10.77% of the Critical Care Nurses had a poor level of knowledge score, 8.46% had fair, and 80.77% of them had a good level of knowledge score.

SECTION A

This section deals with the percentage-wise distribution of Critical Care Nurses regarding their demographic characteristics. A convenient sample of 130 subjects was drawn from the study population, who were from selected hospitals. The data obtained describes the sample characteristics, including age, gender, professional qualification, work experience, workplace, and previous AED training.

Table 1: Percentage-wise distribution of Critical Care Nurses according to their demographic characteristics.

Demographic Variables	Category	Frequency (n)	Percentage (%)
Age (years)	21–30 years	39	30.0
	31–40 years	31	23.8
	41–50 years	29	22.3

	≥51 years	31	23.8
Gender	Male	63	48.5
	Female	67	51.5
Professional Qualification	GNM	43	33.1
	Basic BSc Nursing	26	20.0
	Post Basic BSc Nursing	43	33.1
	MSc Nursing	18	13.8
Work Experience (years)	<1 year	30	23.1
	1–2 years	35	26.9
	2–3 years	24	18.5
	3–4 years	19	14.6
	≥5 years	22	16.9
Type of ICU Working	MICU	39	30.0
	SICU	35	26.9
	PICU	36	27.7
	CCU	20	15.4
Previous AED Training	Yes	0	0
	No	130	100

SECTION B

ASSESSMENT OF THE LEVEL OF KNOWLEDGE REGARDING AUTOMATED EXTERNAL DEFIBRILLATION (AED) USE AMONG CRITICAL CARE NURSES IN SELECTED HOSPITALS

This section deals with the assessment of the level of knowledge regarding Automated External Defibrillation (AED) use among critical care nurses in a selected hospital. The level of knowledge scores was categorised into three groups: poor, fair, and good.

The knowledge of participants was assessed using a structured questionnaire consisting of multiple-choice questions covering key aspects of AED use, including indications, procedure, safety measures, and post-defibrillation care. Each correct response was awarded one mark, while incorrect responses received zero marks. The total score was calculated and converted into a percentage, based on which the level of knowledge was classified as poor, fair, or good according to predetermined criteria.

The questionnaire was developed based on standard guidelines provided by the American Heart Association and relevant literature on cardiopulmonary resuscitation and AED use. Content validity of the tool was established by a panel of experts in nursing and emergency care, and reliability was ensured through pilot testing using appropriate statistical methods.

Table 2: Assessment with level of pretest knowledge

n=130

Level of pre-test knowledge	**Score Range**	**Level of Pre-test Knowledge Score**	
		No. of Critical Care Nurses	**Percentage**
Poor	<60%	128	98.46

Fair	60-74%	2	1.54
Good	≥75%	0	0
Minimum score		0	
Maximum score		19	
Mean knowledge score		5.75±5.29	
Mean% Knowledge Score		18.56±17.07	

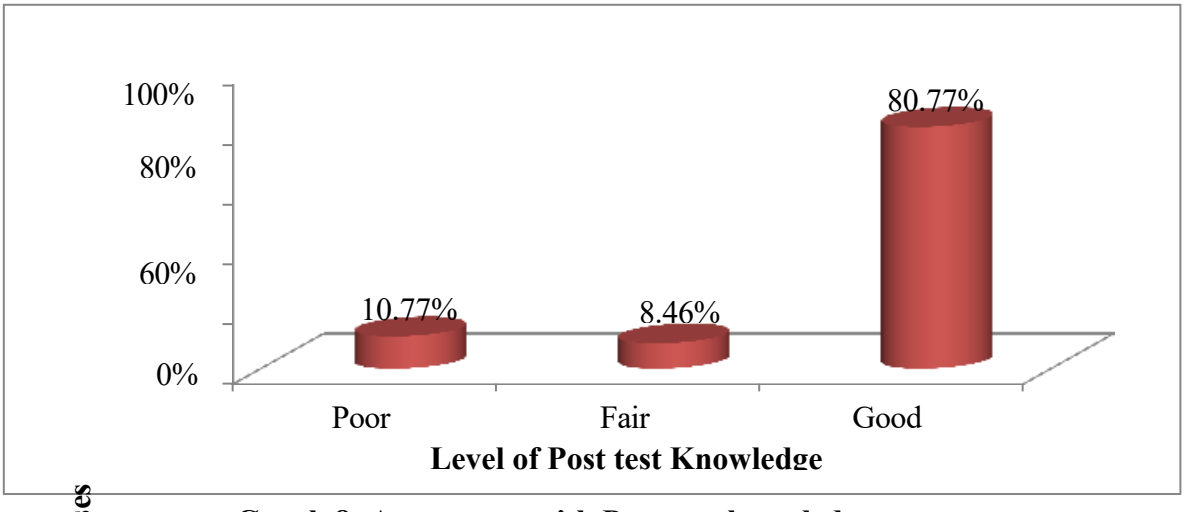
The above table shows that 98.46% of the Critical Care Nurses had a poor level of knowledge score, and1.54% of them had a fair level of knowledge score. Minimum knowledge score in pretest was 0, and maximum knowledge score in pretest was 19. Mean knowledge score in pretest was 5.75±5.29, and mean percentage of knowledge score in pretest was 18.56±17.07.

Table 3: Assessment of the level of post-test knowledge

n=130

Level of Post-test knowledge	Score Range	t-test Knowledge Score	
		No of Critical Care Nurses	Percentage
Poor	<60%	14	10.77
Fair	60-74%	11	8.46
Good	≥75%	105	80.77
Minimum score		10	
Maximum score		31	
Mean knowledge score		27.73±5.29	
Mean % Knowledge Score		89.45±17.07	

The above table shows that 10.77% of the Critical Care Nurses had a poor level of knowledge score, 8.46% had a fair level, and 80.77% of them had a good level of knowledge score. Minimum knowledge score in Posttest was 10, and maximum knowledge score in Posttest was 31. Mean knowledge score in Posttest was 27.73±5.29, and mean percentage of knowledge score in Posttest was 89.45±17.0.



Graph 8: Assessment with Post-test knowledge score

cal Care Nurses

SECTION C

EVALUATION OF THE EFFECTIVENESS OF PLANNED TEACHING PROGRAMME ON KNOWLEDGE REGARDING AUTOMATED EXTERNAL DEFIBRILLATION (AED) USE AMONG CRITICAL CARE NURSES IN SELECTED HOSPITALS

This section deals with the effectiveness of the Planned Teaching Program on knowledge regarding Automated External Defibrillation (AED) use among critical care nurses in a selected hospital. The hypothesis is tested statistically with the distribution of pretest and posttest means and standard deviation, and the mean percentage knowledge score. The levels of knowledge during the posttest and posttest are compared to prove the effectiveness of the Planned Teaching Program. Significance of difference at 5% level of significance is tested with Student's paired t-test, and tabulated t-value is compared with the calculated t-value. Also, the calculated p-values are compared with an acceptable p-value, i.e. 0.05.

Table 4: Significance of difference between knowledge scores in pre and post-test of Critical Care Nurses
n=130

Overall	Mean	SD	Mean Difference	t-value	p-value
Pre-Test	5.75	5.29	21.97±7.50	33.39	0.0001 S,p <0.05
Post test	27.73	5.29			

This table shows the comparison of pretest and post-test knowledge scores of Critical Care Nurses regarding AED in a selected hospital. Mean, standard deviation and mean difference values are compared, and the student's paired t-test is applied at 5% level of significance. The tabulated value for n=130-1, i.e., 129 degrees of freedom, was 1.98. The calculated t-value, i.e. 33.39, is much higher than the tabulated value at 5% level of significance for the overall knowledge score of critical care nurses, which is a statistically acceptable level of significance. Hence, it is statistically interpreted that the Planned Teaching Program on knowledge regarding Automated External Defibrillation (AED) among critical care nurses from selected hospitals was effective. Thus, the H_1 is accepted.

SECTION D

ASSOCIATION OF LEVEL OF POST TEST KNOWLEDGE SCORE REGARDING AUTOMATED EXTERNAL DEFIBRILLATION (AED) USE AMONG CLINICAL CARE NURSES IN SELECTED HOSPITALS IN RELATION TO DEMOGRAPHIC VARIABLES

Table 6: Association of posttest knowledge score regarding Automated External Defibrillation among Critical Care Nurses in relation to their age.

n=130

Age(yrs.)	No. of Critical Care Nurses	Mean posttest knowledge score	F-value	p-value
21-30 yrs.	39	25.87±6.19		
31-40 yrs.	31	28.93±3.79		
41-50 yrs.	29	28.96±3.90		0.044
≥51yrs.	31	27.70±5.97	2.77	S,p <0.05

This table shows the association of knowledge score with age in years of Critical Care Nurses regarding Automated External Defibrillation (AED) from a selected hospital. The tabulated F value was 2.60 (df=3,126), which is less than the calculated F, i.e., 2.77 at 5% level of significance. Also, the calculated p =0.044, which was less than the acceptable level of significance, i.e., p ' = 0.05. Hence, it is interpreted that age in years of Critical Care Nurses is statistically associated with their post-test knowledge score.

Table 7: External Defibrillation among Critical Care Nurses in relation to their gender

Gender	lo. of Critical Care Nurses	Mean Post-test knowledge score	t- value	n=130 p-value
Male	63	27.34±5.43		0.42
Female	67	28.08±5.17	0.79	NS, p >0.05

This table shows the association of knowledge score with the gender of Critical Care Nurses regarding Automated External Defibrillation (AED) from a selected hospital. The tabulated t values were 1.98 (df=128), which is higher than the calculated t, i.e. 0.79 at 5% level of significance. Also, the calculated p =0.42, which was higher than the acceptable level of significance, i.e. p =0.05. Hence, it is interpreted that the gender of Critical Care Nurses is statistically not associated with their posttest knowledge score.

Table 8: Association of post-test knowledge score regarding Automated External Defibrillation among Critical Care Nurses in relation to Educational Qualification

n=130

Educational Qualification	No. of Critical Care Nurses	Mean posttest knowledge score	F-value	p-value
GNM	43	24.41±6.95		
asic BSc Nursing	26	28.26±4.58		0.0001
Post Basic BS	43	29.83±2.43	10.99	S,p <0.05

MSc Nursing	18	29.83±1.79		

This table shows the association of knowledge score with educational qualification of critical care nurses regarding automated external defibrillation (AED) use from a selected hospital. The tabulated F-values were 2.60 (df=3,126), which is less than the calculated F ‘, i.e. 10.99at 5% level of significance. Also, the calculated p‘=0.0001, which was less than the acceptable level of significance, i.e., p'=0.05.Hence, it is interpreted that the educational qualification of Critical Care Nurses is statistically associated with their post-test knowledge score.

Table 9: Association of post-test knowledge score regarding Automated External Defibrillation among Critical Care Nurses in relation to Work Experience(yrs.)

n=130

Work Experience (yrs.)	No. of Critical Care Nurses	Mean posttest knowledge score	F-value	P value
<1year	30	27.76±5.17		
1-2 years	35	28.22±5.52		0.93
2-3 years	24	27.95±5.37		NS, p>0.05
3-4 years	19	27.10±5.50		
≥5years	22	27.18±5.19	0.20	

This table shows the association of knowledge score with work experience(years)of Critical Care Nurses regarding Automated External Defibrillation (AED) from a selected hospital. The tabulated F values were 2.37 (df=4,125), which is higher than the calculated F, i.e. 0.20 at 5% level of significance. Also, the calculated p=0.93, which was higher than the acceptable level of significance, i.e. p=0.05. Hence, it is interpreted that the work experience (yrs) of Critical Care Nurses is statistically not associated with their posttest knowledge score.

Table 10: Association of post-test knowledge score regarding Automated External Defibrillation among Critical Care Nurses in relation to the type of ICU

n=130

Type of ICU working	**No. of Critical Care Nurses**	**Mean post-test knowledge score**	**F-value**	**p-value**
MICU	39	27.92±4.99		
SICU	35	28.37±4.77		
PICU	36	27.02±5.76	0.40	0.74
CCU	20	27.50±6.04		NS,p>0.05

This table shows the association of knowledge score with the type of ICU work of Critical Care Nurses regarding Automated External Defibrillation (AED) from a selected hospital. The tabulated F values were 2.60 (df=3,126), which is higher than the calculated F, i.e. 0.40 at 5% level of significance. Also, the calculated p=0.74, which was higher than the acceptable level of significance, i.e., p=0.05. Hence, it is interpreted that the type of ICU work of Critical Care Nurses is statistically not associated with their

posttest knowledge score.

Table 11: Association of Post Test Knowledge Score among Critical Care Nurses' mothers in relation to Demographic Variables
n=130

)emographic Variable	**F-value**	**df**	**Tabulate d Value**	**p-value**	**ificant**	**t-value**	**df**	**Tabulate d Value**	**p-value**
Age in years	2.77	3.126	2.6	0.044	Significant				
Gender					Not Significant	0.79	128	1.98	0.42
Educational Qualification	10.99	3.126	2.6	0.0001	Significant				
Working Experience (yrs.)	0.2	4.125	2.37	0.93	Not significant				
ype of ICU working	0.4	3.126	2.6	0.74	Not significant				

DISCUSSION

The present study evaluated the effectiveness of a planned teaching programme on knowledge regarding automated external defibrillator (AED) use among critical care nurses. The findings indicated that most nurses had inadequate baseline knowledge, which significantly improved following the educational intervention.

These results are consistent with previous studies by Abella BS et al., which reported insufficient knowledge and skills in resuscitation practices among healthcare providers before training. Similarly, Meaney PA et al. highlighted that structured educational programmes significantly enhance knowledge and performance in resuscitation. Studies by Rajeswaran L et al. also support the effectiveness of targeted training in improving nurses' knowledge of AED use.

A significant association was observed between knowledge levels and selected demographic variables, indicating that factors such as qualification and work experience may influence competency in emergency care.

Overall, the study demonstrates that planned teaching programmes are effective in improving nurses' knowledge regarding AED use and emphasises the need for continuous education to enhance emergency preparedness and patient outcomes.

IMPLICATIONS FOR NURSING PRACTICE

The findings of the present study highlight the importance of enhancing the knowledge and skills of critical care nurses regarding the use of automated external defibrillators (AEDs). As nurses are often the first responders during in-hospital cardiac emergencies, improving their competence in AED use can lead to timely defibrillation and better patient outcomes. The study emphasises the need to incorporate regular in-service education, simulation-based training, and competency-based assessments into nursing practice.

Nursing administrators should ensure the availability of AED training programmes and encourage continuous professional development to maintain high standards of emergency care.

LIMITATIONS OF THE STUDY

The study has certain limitations that should be considered while interpreting the findings. Firstly, the study was conducted using a single-group pre-test and post-test design without a control group, which limits the ability to attribute improvements solely to the intervention. Secondly, the use of a non-probability purposive sampling technique may restrict the generalizability of the findings. Thirdly, the study was limited to selected hospitals and a relatively small sample size, which may not represent all critical care nurses. Additionally, the study assessed only knowledge levels and did not evaluate practical skills or long-term retention of knowledge.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future studies can be conducted using a randomised controlled trial design to provide stronger evidence regarding the effectiveness of teaching programmes. Research with larger sample sizes across multiple healthcare settings would enhance generalizability. Further studies should also assess the impact of training on practical skills and clinical performance related to AED use. Longitudinal studies can be undertaken to evaluate knowledge retention over time. Additionally, comparative studies between different teaching methods, such as simulation-based training and e-learning, may help identify the most effective educational strategies.

CONCLUSION:

The present study aims to assess the effectiveness of a planned teaching program on knowledge regarding Automated external defibrillator uses among critical care nurses of selected hospitals in the city. The findings of the study showed that critical care nurses in experimental of selected hospitals had poor knowledge regarding Automated External Defibrillator use. This study also proved that a planned teaching program was effective in improving the level of knowledge regarding the Automated External Defibrillator of critical care nurses who were included in the experimental group, whereas the level of knowledge regarding the Automated External Defibrillator.

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