A Descriptive Study To Assess Knowledge Regarding The Use Of Defibrillators Among Staff Nurses Working In Selected Hospitals Of The Metropolitan City

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Research Abstract

Introduction - *Cardiovascular diseases are the leading cause of death globally. In 2019, about 17.9 million people died from cardiovascular diseases, accounting for 32% of global deaths. In 2021, approximately 20.5 million deaths were attributed to CVDs, resulting in an average of 56000 deaths per day and one death every 1.5 seconds. In India, cardiovascular diseases also top the list of causes of death. The CVD death rate in India is 272 per 100,000 population, which is higher than the global rate of 235 deaths per 100,000 population.*

Of the total deaths due to CVDs (17 million as per WHO), approximately 25% (4.25 million) are attributed to sudden cardiac death (SCD). Ventricular fibrillation and pulseless ventricular tachycardia are the most common causes of sudden cardiac arrest/death. The American Heart Association recommends immediate defibrillation as the treatment of choice for ventricular fibrillation (VF). This study aims to assess the knowledge of staff nurses working in selected hospitals of a metropolitan city regarding the use of a defibrillator.

Problem Statement - *A Descriptive Study to Assess Knowledge Regarding the Use of Defibrillators Among Staff Nurses Working in Selected Hospitals of the Metropolitan City*

Methodology - *Quantitative research design with descriptive research approach was used to conduct this study. A non-probability convenience sampling technique was used. A sample size of 50 staff nurses was selected. Data was collected using a Structured Questionnaire after confirmation of the reliability and validity of the tool. Collected data was compiled, edited, coded, classified, tabulated and then analysed using descriptive statistics.*

Results - *50 staff nurses participated in the research study, all of whom were females. Majority 36% participants were of age group 35 - 40 years, 60 % participants had completed the graduation in nursing, 56 % of the participants were practicing in general wards, 82 % of participants has not completed ACLS / BLS course, 72 % of seen the defibrillation procedure, 50 % have assisted the defibrillation procedure and only 8% have performed the defibrillation procedure. of all the participants, 44 % of participants had average knowledge, 32 % of participants had good knowledge, 14 % had below average knowledge, 8% had poor knowledge, and only 2 % participants had very good knowledge regarding the use of defibrillators*

Conclusion - *A comprehensive analysis of this study indicates that the majority of staff nurses exhibit average to suboptimal knowledge regarding defibrillator utilisation. This research further demonstrates an absence of association between demographic variables and nurses' knowledge levels. Given the escalating incidence of sudden cardiac arrest, the preparedness of staff nurses as initial responders is pivotal for improving patient outcomes in these critical cardiac emergencies. Consequently, the study strongly recommends the consistent integration of defibrillator training into staff development programs within hospitals and nursing institutes to ensure nurses are adequately equipped for effective emergency response.*

Keywords – *Staff nurses, Defibrillator, Sudden Cardiac Arrest, Ventricular Tachycardia, Ventricular Fibrillation, Cardiovascular Diseases, ECG analysis and Interpretation.*

I.   Introduction

The heart is a vital hollow, muscular organ situated in the mediastinum of the thorax and is encased within a protective structure called the pericardium. Its primary function is to serve as a pump that circulates blood throughout the body, facilitating the delivery of oxygen and nutrients to tissues while removing waste products.

The heart operates through two primary phases: contraction, known as systole, and relaxation, called diastole. During the relaxation phase (diastole), deoxygenated blood returns to the heart via the superior and inferior vena cava, filling the right atrium before flowing into the right ventricle. Simultaneously, oxygenated blood from the lungs arrives through the pulmonary veins, filling the left atrium and subsequently the left

ventricle. This phase prepares the heart for the next contraction. In the contraction phase (systole), the heart pumps blood out of the ventricles; the right ventricle sends blood into the pulmonary artery for oxygenation in the lungs, while the left ventricle pumps blood into the aorta to supply the rest of the body.

The heart's ability to contract and relax in a coordinated manner is regulated by its conducting system, comprised of specialised myocardial cells that generate and transmit electrical impulses. The key components of this system include the Sinoatrial (SA) node, which acts as the heart's natural pacemaker, the Atrioventricular (AV) node, the Bundle of His, right and left bundle branches, and Purkinje fibres. This intricate network ensures that impulses are transmitted efficiently, allowing for the synchronised contraction of the heart chambers.

Monitoring the heart's electrical activity is performed using an Electrocardiograph (ECG). The ECG traces the heart's electrical impulses through electrodes placed on the body's surface. A normal ECG waveform includes distinct components such as the P wave, QRS complexes, T wave, and the QRST complex, which provide valuable information about heart rhythm and electrical conduction. However, disturbances in the heart's normal rhythm can occur, leading to conditions known as cardiac dysrhythmias, arrhythmias, or abnormal cardiac rhythms. These can manifest in various forms, including Sinus Tachycardia, Sinus Bradycardia, Sinus Arrhythmia, Heart block, Extrasystole, Paroxysmal tachycardia, Atrial flutter, Atrial fibrillation, and the more critical forms of Ventricular Tachycardia (VT) and Ventricular fibrillation (VF).

Among these, Pulseless Ventricular Tachycardia and Ventricular Fibrillation are the most dangerous, requiring immediate medical intervention to prevent life-threatening complications. Pulseless Ventricular Tachycardia is characterised by rapid, disorganised contractions of the ventricles that are ineffective in pumping blood, leading to insufficient perfusion of vital organs. If not treated immediately, it can result in cardiac arrest and death. Ventricular Fibrillation is similarly critical; it involves rapid and chaotic twitching of the ventricles, disrupting the heart's ability to pump blood effectively, leading to a high risk of sudden cardiac arrest (SCA) and death if not promptly addressed.

Sudden cardiac arrest is defined as an unexpected natural death due to cardiac causes, occurring within one hour of symptom onset. The immediate response to SCA includes the administration of defibrillation combined with Cardiopulmonary Resuscitation (CPR) to restore the heart's natural rhythm. The American Heart Association (AHA) emphasises the importance of early defibrillation as the treatment of choice for both Ventricular Fibrillation and Pulseless Ventricular Tachycardia. For hospitalised patients experiencing these conditions, the AHA recommends that defibrillation be administered within three minutes of a collapse, highlighting the urgency of a rapid response in life-threatening situations. Defibrillation involves using electrical energy to depolarise the heart muscle cells temporarily. This process allows for a higher likelihood of the heart returning to a normal electrical rhythm upon repolarisation.

A defibrillator is the device used to deliver this electrical shock, aiming to restore a regular heart rhythm by overwhelming the chaotic electrical activity occurring during VT or VF. Experts stress that for defibrillation to be effective; the shock must be sufficiently strong to depolarise a significant portion of the cardiac tissue. If enough cardiac cells are affected by the shock, the uncoordinated electrical waveforms responsible for VF or VT may be extinguished, enabling the heart to restore normal contraction patterns.

Furthermore, the International Liaison Committee on Resuscitation (ILCOR) advocates for the establishment of early defibrillation programs for non-physicians in hospital settings. Regular training for all hospital staff to respond to sudden cardiovascular emergencies is encouraged to enhance preparedness and increase survival chances for patients experiencing SCA. Despite these recommendations, the implementation of nurse-led defibrillation programs has not gained widespread acceptance in many hospitals. Barriers such as insufficient knowledge, the challenge of skill retention, lack of organisational support, and a passive culture among nurses hinder progress towards more rapid deployment of defibrillation by capable hospital staff.

In summary, understanding the heart's anatomy, physiology, and the knowledge regarding the critical response to cardiac arrhythmias is essential in improving outcomes for patients experiencing life-threatening conditions like Pulseless Ventricular Tachycardia and Ventricular Fibrillation. Timely intervention through defibrillation

II. Background Of The Study

The historical development of defibrillators spans over a century, characterised by crucial discoveries and technological progress that have significantly impacted cardiac care.

Early Discoveries: In 1849, German physician Carl Ludwig and his student M. Hoffa first observed that electrical stimulation could induce ventricular fibrillation in frog hearts. This foundational work was expanded upon in 1899 by physiologists Jean-Louis Prévost and Frédéric Battelli, who demonstrated that a stronger electrical shock could reverse ventricular fibrillation in dogs, marking the initial demonstration of defibrillation.

Pioneering Use in Humans: A landmark event occurred in 1947 when American surgeon Claude Beck successfully employed a defibrillator on a human patient, restoring the heartbeat of a 14-year-old boy who had

experienced cardiac arrest. This breakthrough was instrumental in facilitating the subsequent clinical adoption of defibrillation.

Technological Advancements: The invention of the external defibrillator by electrical engineer William Kouwenhoven in 1930 revolutionised cardiac resuscitation by enabling electric shocks to be delivered through the chest wall. The 1960s witnessed the emergence of portable defibrillators, thus enabling their use in pre-hospital settings. By the 1980s, automated external defibrillators (AEDs) were introduced, allowing laypersons to administer defibrillation, which significantly improved survival rates for cardiac arrest victims.

Modern Defibrillators: Today, defibrillators are indispensable in managing sudden cardiac arrest, available in various forms, including implantable cardioverter-defibrillators (ICDs) geared towards high-risk individuals and wearable defibrillators suitable for athletes.

In summary, the evolution of defibrillators reflects a blend of scientific inquiry, clinical innovation, and technological advancement, establishing them as vital tools in emergency medicine and cardiovascular care.

Need for Study

Cardiovascular diseases are the leading cause of death worldwide. It is estimated that approximately 17.9 million people died from cardiovascular diseases in 2019, accounting for 32% of global deaths.

One in every 3 deaths occurring globally is estimated due to CVDs. In 2021, around 20.5 million deaths occurred due to CVD, which is around 56000 deaths per day and one death every 1.5 sec. Thus, CVDs emerged as the biggest killer in the year 2021.

In India, Cardiovascular Diseases are the leading cause of death. According to the Global Burden of Diseases study, the CVD death rate in India is 272 per 100,000 population, much higher than the global rate of 235 deaths per 100,000 population.

Of the total deaths occurring due to CVDs (i.e. 17 million, as per WHO), approximately 25% (i.e. 4.25 million) are said to be due to Sudden cardiac death (SCD). [3,4] VT and VF are the prime life-threatening arrhythmias that can precipitate sudden cardiac arrest (SCA).

Ahmed Ali Abdullah Ghared, Samia Gaballaha, et. al (2023) conducted a descriptive cross-sectional study to assess the performance of critical care nurses regarding the management of Ventricular Arrhythmias. 85 staff nurses were selected as a sample for the study using a non-probability convenience sampling method. Data was collected through a self-administered questionnaire, observational checklist, and attitude scale. Data collected was analysed by using SPSS statistical packages. The result of the analysis showed that about 69.4 % of nurses had unsatisfactory knowledge regarding the management of patients with VA, while only 30.6 % of nurses had satisfactory knowledge. 36.5 % of nurses had satisfactory practice regarding the management of VA., while 63.5 % of nurses had unsatisfactory practice scores. 87.1 % of nurses had a negative attitude regarding the management of the VA, while only 12.9 % of nurses had a positive attitude. The researcher from this study concluded that more than three-quarters of the nurses had unsatisfactory knowledge, attitude, and skills regarding the management of VA. The researcher at the end of this study recommended periodic evaluation of the performance of nurses regarding the management of VA, and in-service training programs for updating nurses' knowledge, performance, and attitude regarding VA.

It has been observed during the years of clinical practice that most of the staff nurses working in the Intensive Care Unit, Cardiac Care Unit, Trauma Care Unit, or Emergency Department have inadequate knowledge regarding the analysis and interpretation of the ECG, identification of life-threatening arrhythmias and appropriate use of a defibrillator in terminating those life-threatening ventricular arrhythmias. This hampers the overall patient's outcome, as delaying the defibrillation for termination of Life-threatening ventricular arrhythmias can result in to death of the patient within a fraction of a second.

Therefore, researchers find it essential to assess the knowledge regarding the use of defibrillators among the staff nurses.

Objectives
- To assess the knowledge regarding the use of defibrillators among the staff nurses
- To identify the association between the knowledge regarding the use of defibrillators and selected demographic variables.

Scope Of The Study: -
   Geographic Scope
- **Metropolitan City:** The study will be conducted within the boundaries of a specific metropolitan city, ensuring a focus on urban healthcare settings.

Population Scope
- **Staff Nurses:** The primary focus will be on staff nurses working in selected hospitals within the metropolitan city. This includes nurses with varying levels of experience and specialisation.

Conceptual Scope
- Defibrillator use – This study particularly explores the knowledge regarding the use of defibrillators among the staff nurses. This includes knowledge regarding the ability to read an ECG and to recognise cardiac arrest, and knowledge regarding the correct use of a defibrillator.

Outcome measures
- Knowledge assessment – This study will assess the participants' knowledge regarding indication, contraindications and proper techniques to use a defibrillator.

Limitations and Challenges
- **Generalizability:** The findings of the study may not be fully generalizable to other healthcare settings or populations, as this study was conducted in selected hospitals of a metropolitan city
- **Sample Size:** The sample size may limit the generalizability of the results, as the sample size is limited to 50.

By focusing on these specific areas, the study will provide valuable insights into the knowledge of the staff nurses regarding the use of defibrillators.

Hypothesis –
- (H_{01}) – Nurses do not have adequate knowledge regarding the defibrillation procedure.
- (H_1) – Nurses have adequate knowledge regarding the defibrillation procedure.
- (H_{02}) – There is no significant association between knowledge of the staff nurses and the selected demographic data.
- (H_2) – There is a significant association between knowledge of the staff nurses and the selected demographic data.

Assumptions: -
1. Staff nurses may have basic knowledge regarding ECG analysis and interpretation.
2. Staff nurses may have basic knowledge regarding the identification of life-threatening ventricular arrhythmias.
3. Staff nurses may have some basic knowledge regarding the use of a defibrillator

III. Research Methodology

Quantitative research design with descriptive research approach was used to conduct this study. A non-probability convenience sampling technique was used. A sample size of 50 staff nurses was selected. Data was collected using a Structured Questionnaire after confirmation of the reliability and validity of the tool. The structured questionnaire was divided into two parts – Section A and Section B. Section A consisted of demographic data, while Section B consisted of the questions regarding the use of a defibrillator. Section B was further divided into subparts that specifically focused on assessing the knowledge related to the Anatomy of Physiology of the Heart, Basic of ECG analysis and interpretation, Identification of life-threatening ventricular arrhythmias, Importance of early defibrillation, Steps of the defibrillation procedure, and the post-defibrillation care.
Collected data was compiled, edited, coded, classified, tabulated and then analysed using descriptive statistics.

Major Findings of the Study

Out of the total 50 staff nurses who participated in this study, all were females. A maximum of 36 % participants belonged to the age group 35 – 40 years, 26 % of participants were of the age group 41 – 45 years, 20 % were of the age group 25 – 20 yrs, while the remaining 18 % were of the age group 31 – 35 yrs.

AGE OF PARTICIPANTS

- 25 -30 Yrs
- 31 - 35 Yrs
- 36 - 40 Yrs
- 41 - 45 Yrs

20%

18%

36%

26%
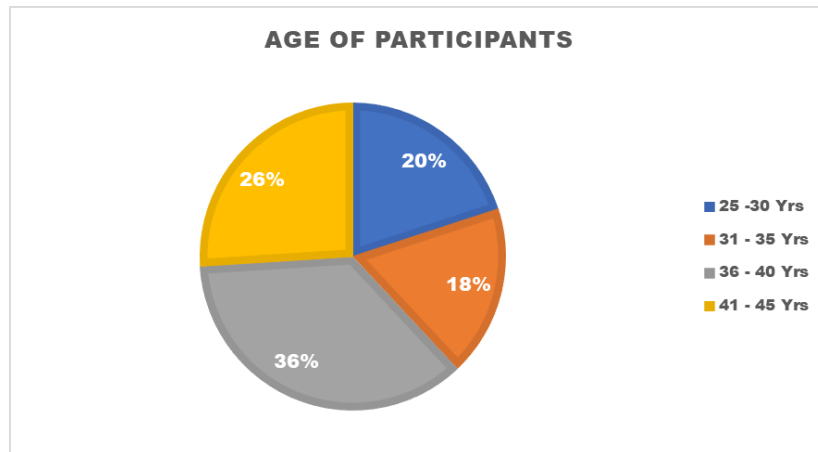
60 % of the participants had passed graduation (B.Sc / P.B.B.Sc nursing), 34 % of participants had a diploma (GNM) as their basic education, while only 6 % of the participants had completed their post-graduation (M.Sc Nursing).

Education of the participants

6%

34%

60%

- GNM
- BSC / PBBSC
- MSC
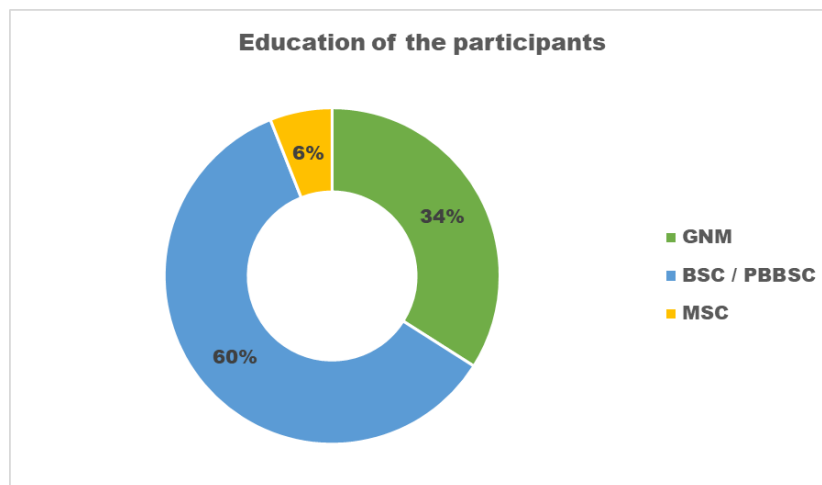
The majority of participants (56%) were practising in wards, 12 % were practising in intensive and critical care units, 10 % in emergency departments, 10 % in other wards like dialysis units, 6 % in OPD's and 6 % in OT's. Yet 64 % of participants said that they have experience working in critical care or emergency units.

Clinical Experince

	Gward	ED	ICCU	OT	OPD	Other
Clinical Experince	28	5	6	3	3	5
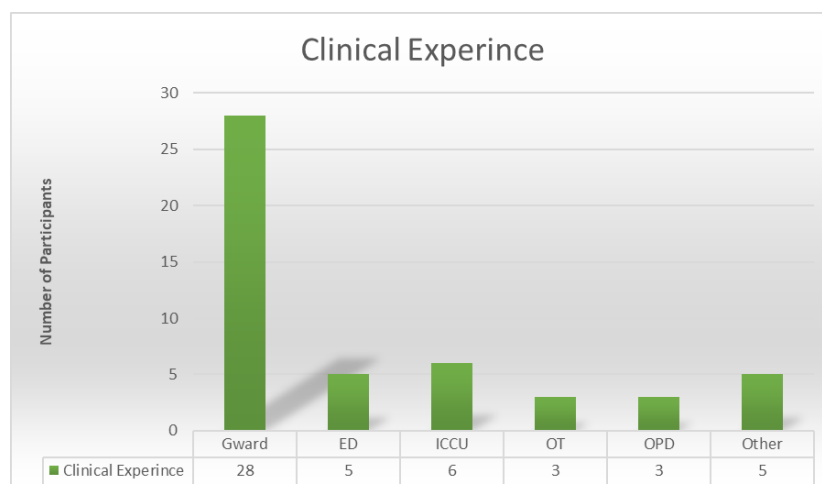
18 % of participants said that they had undergone basic life support and advanced cardiac life support courses, while the remaining 82 % of participants said that they had not undergone any such courses, here before.

BLS and ACLS Training
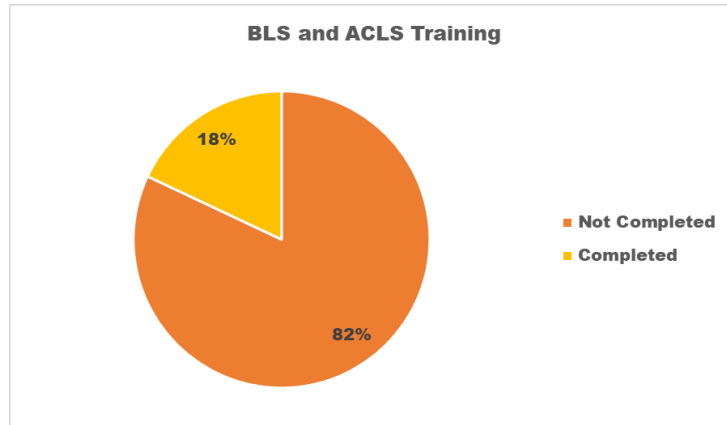
72 % participants said that they had seen the defibrillator procedure, while 28 % participants denied seeing the defibrillator procedure before. Of those who have seen the defibrillator procedure, 50 % have assisted with the defibrillation procedure, while the remaining 50 % have not. And only 8% of total participants have performed the defibrillation procedure on their own, while the remaining 92% have never performed it before.
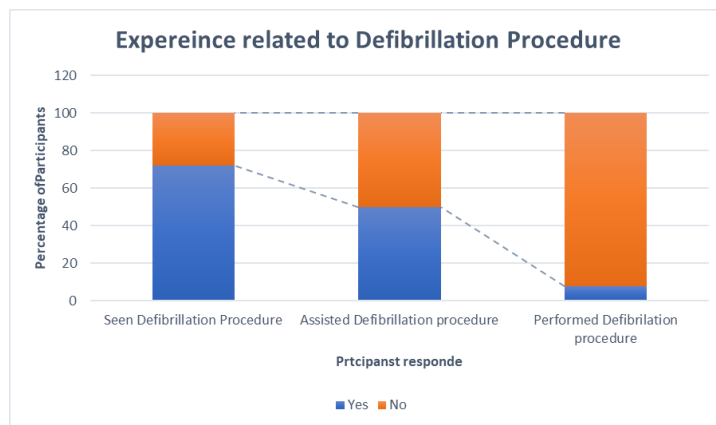
Analysis of the data related to knowledge of the participants related to the defibrillation procedure shows that, majority (44%) of the participants had average knowledge regarding the defibrillation procedure, followed by 32 % of participants having good knowledge, 14 % participants having below average knowledge, 8 % participants having poor knowledge and only 2 % of participants were having very good level of knowledge regarding defibrillation.

Knowledge regarding the defibrillation procedure	Grade	Frequency	Percentage
Very Good	26 – 30	1	2
Good	21 – 25	16	32
Average	16 – 20	22	44
Below Average	11 – 15	7	14
Poor	Less than 10	4	8
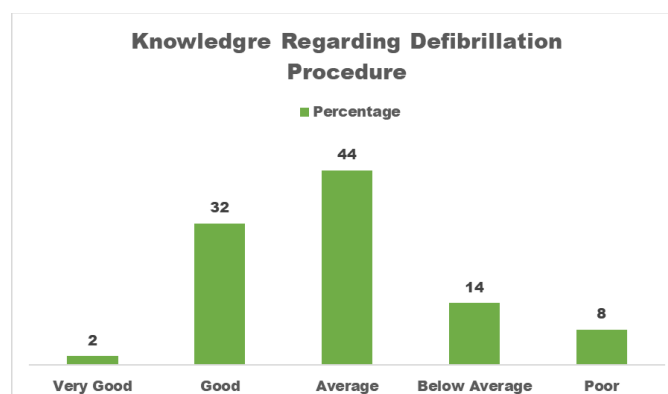
The findings of the study also showed that there is no significant association between the knowledge of the participants and the selected demographic data.

Implications of the study

This study has several implications for the nursing profession. These implications are categorised as implications in nursing services, in nursing education, in nursing research and in nursing administration.

Implications for Nursing Research

This study serves as a foundational piece of nursing research by systematically identifying critical knowledge and confidence gaps among staff nurses concerning defibrillator use. The primary purpose of nursing research is to generate scientific knowledge that directly informs nursing practice, enabling nurses to provide optimal patient care. By highlighting these deficiencies, the study provides empirical evidence that can be translated into actionable strategies to improve patient safety and outcomes. Nurse scientists play a crucial role in adapting and integrating such findings into everyday patient care, influencing clinical practice guidelines and standards.

The findings also illuminate several crucial avenues for future nursing research:

- **Longitudinal Studies on Competency Maintenance:** While the study acknowledges skill decay, future research should rigorously assess how defibrillator competencies evolve over time following initial training. This would help identify optimal intervals for refresher training to combat skill deterioration and maintain proficiency.
- **Effectiveness of Various Training Models:** There is a clear need to systematically evaluate the comparative effectiveness of different training models, particularly focusing on simulation-based learning, hands-on drills, and blended learning approaches. Research should investigate which specific components of training programs are most effective in improving both knowledge and confidence, especially in resource-limited settings like county hospitals.
- **Systemic and Psychological Barriers:** Building on the observation that nurses hesitate due to fear and anxiety , future research should delve deeper into the systemic and psychological factors that impede nurses' willingness to use defibrillators. This could involve qualitative studies to explore perceptions, attitudes, and organizational influences in greater detail, informing targeted interventions that address emotional and attitudinal challenges alongside skill deficits.
- **Impact of Organizational Culture and Leadership:** Given the identified deficiencies in team performance, leadership behavior, and communication during resuscitation events , future research should investigate how supportive leadership, clear role definitions, and a culture that promotes autonomy and psychological safety influence nurses' confidence and performance during cardiac emergencies.
- **Resource Allocation and Disparities:** The observed disparities in AED equipment and training access between municipal and county hospitals warrant further investigation. Research could analyze the impact of resource allocation policies on nurse competency and patient outcomes across various hospital types, informing policies that promote equitable AED deployment and financial support to reduce regional disparities.

Implications for Nursing Education

The study's findings reveal significant deficiencies in current nursing education strategies, necessitating a comprehensive overhaul to ensure both competency and confidence in defibrillator use:

- **Inadequacy of Current Training Models:** Despite mandatory Advanced Cardiovascular Life Support (ACLS) training every two years, this biannual approach is insufficient to maintain competence, as skills tend to diminish over time if not regularly applied. The low mean knowledge and performance scores observed indicate that many existing programs are predominantly theoretical, lacking the crucial hands-on components necessary for practical proficiency.
- **Need for Enhanced Hands-on and Simulation-Based Training:** The research consistently demonstrates that additional training and hands-on drills significantly improve knowledge and confidence in AED use. Mock code simulations have proven highly effective in increasing self-reported nurse confidence and improving response times for critical interventions like time to first defibrillation. Education must emphasise practical drills and scenario-based simulations to bridge the gap between theoretical knowledge and practical application.
- **Increased Training Frequency:** To combat skill deterioration, resuscitation training should be repeated with greater frequency, ideally every 3 to 6 months, rather than adhering to the current biannual cycle.
- **Addressing Psychological Barriers:** A substantial percentage of nurses hesitate due to fear of injuring patients (27%) and general anxiety (64%). Traditional training often fails to adequately prepare nurses for the intense emotional and psychological demands of a cardiac emergency. Therefore, education must incorporate stress

inoculation, confidence-building exercises, and open discussions around managing fear to ensure theoretical knowledge translates into decisive action.

- **Curriculum Enhancement for Foundational Knowledge and Team Performance:** Targeted curriculum enhancements are needed to foster a deeper understanding of cardiac rhythms, appropriate defibrillator settings, and procedural steps. Additionally, future resuscitation education should focus on improving the quality of cardiopulmonary resuscitation, including team performance, leadership behavior, and communication among team members, as these were frequently absent in emergency responses.
- **Continuing Professional Development:** Hospitals and nursing organizations must develop structured continuing professional development (CPD) programs that emphasize ongoing competency assessment and maintenance. Leveraging external certification bodies like the Red Cross can supplement internal training efforts and provide accredited Continuing Education Units (CEUs).

Implications for Nursing Administration

The research findings present significant implications for nursing administration, demanding strategic policy development, judicious resource allocation, and a proactive approach to fostering a supportive organizational culture:

- **Policy Revision for Continuous Competency:** Current policies, such as the biannual ACLS certification, are insufficient for maintaining sustained competency. Administration must revise competency standards to move beyond periodic certification towards continuous assessment and maintenance of skills, mandating more frequent, hands-on training and simulation drills. Policies should also clarify nurses' scope of practice regarding defibrillation, empowering them to act promptly.
- **Equitable Resource Allocation:** Pronounced disparities exist in AED availability and training quality, with county hospitals often lacking equipment and offering only theoretical training. Nursing administration must prioritize significant investment in AED equipment, ensuring an adequate number of devices are readily available, properly maintained, and strategically located across all hospital units. Substantial funding must also be allocated for comprehensive training programs, including high-fidelity simulation labs and necessary training equipment. Government agencies are encouraged to implement policies promoting AED deployment and provide financial support to reduce regional disparities.
- **Fostering an Empowering Organizational Culture:** Psychological barriers, such as fear of injuring patients (27%) and general anxiety (64%), significantly hinder nurses' willingness to perform defibrillation. Perceptions of defibrillation as solely a "doctor's assistant job" and a lack of job autonomy also impede decisive action. Nursing administration has a crucial role in addressing these barriers by creating an environment where nurses feel empowered and supported to utilize their skills. This involves promoting nurse autonomy and leadership in emergency response, clearly defining nurses' roles, and fostering a culture of safety and continuous improvement that supports nurses in maintaining their careers in critical care units.

IV.   Discussion

The result of this study indicates that the majority, 44 % of the staff nurses, had average knowledge regarding the defibrillator procedure, 32 % of the staff nurses had good knowledge, 14 % of the staff nurses had below average knowledge, and 8 % of staff nurses had poor knowledge. Only 2 % of staff nurses had very good knowledge regarding the defibrillator procedure. The findings of the above study were supported by similar research conducted by Mr. L. B. Ghule (2014). During the study, Mr. Ghule found that the majority, 54 % of staff nurses, had average knowledge related to defibrillation procedures, 24 % of staff nurses had good knowledge, and 22 % of staff nurses had poor knowledge regarding the defibrillator procedure. [71]

Another similar study conducted by **Ahmed Ali Abdulla et al (2023)** reveals that 69.4 % of the nurses had unsatisfactory total scores of knowledge regarding the use of defibrillators in the management of patients with VA, while only 30.6 % of staff nurses had a satisfactory total score of knowledge. [10]

V.   Conclusion

A detailed analysis of this study concludes that the majority of the staff nurses have average to below-average knowledge regarding the use of a defibrillator. This study underlines that there is no association between the demographic variables and the knowledge of the staff nurses. Based on the study, it is strongly recommended that, in light of the increasing occurrences of sudden cardiac arrest, the preparedness of staff nurses as first responders plays a pivotal role in improving the outcome of this cardiac emergency. Consequently, training regarding the use of defibrillators must be consistently integrated into staff development programs in hospitals and nursing institutes to ensure that nurses are fully equipped to respond effectively to such emergencies.

VI.   Recommendation

- A similar study can be conducted on a larger scale, with a large sample and in different settings.
- A similar study can be conducted to assess the skills or the practice of the staff nurses regarding the defibrillation procedure.
- A comparative study can be conducted on the staff nurses from private and public settings or in rural and urban settings.
- A similar study can be conducted among the other healthcare members or the students of medicine, paramedical or nursing professions.
- A study can be conducted by providing the training regarding the defibrillation procedure and then assessing its effectiveness.

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