Effect of an Educational Program Regarding Cardiac Arrhythmias on Nurses' Knowledge and Practices in Critical Care Units

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ABSTRACT

Context: Cardiac arrhythmia is a serious condition that can lead to fatal forms of rhythm disturbance. Critical care nurse plays a vital role in arrhythmias management, specializing in symptomatic relief, promoting comfort, and taking crisis management activity in fatal dysrhythmias.

Aim: To evaluate the effect of an educational program regarding cardiac arrhythmias on nurses' knowledge and practice in critical care units.

Methods: A quasi-experimental design (pre/test) was applied. This study was carried out at Critical Care Units in Governmental Port-Said general hospitals (Port Said General Hospital, Port-Fouad General Hospital, and Alzhoor Central Hospital) in Port Said Governorate in Egypt. A convenient sample of all available nurses (139) nurses in critical care units was recruited in this study and divided into 116 female and 23 male nurses. The data collection tool encompassed two: A structured interviewing questionnaire with demographic characteristics, a nurses' knowledge questionnaire, and nurses' practice observational checklists.

Results: The results revealed a nurses' mean age of 25.6 ±5.1; 83.5% were females, and 55.4% had technical nursing institute diplomas. A high statistically significant total knowledge and practice score difference between pre and immediate post-program implementation at p<0.001. Also, among pre and follow-up assessments after educational program application at p<0.001. In addition, there was a statistically significant correlation between total nurses' knowledge score and their total practice score immediately after the educational program (r=0.636, p <0.001). and follow up (r=0.426, p<0.001).

Conclusion The nursing educational program significantly improved nurses' knowledge and practice regarding cardiac arrhythmias management among nurses working in the critical care units. The study recommended continuous training and educational program for enhancing and apprising the nurses' knowledge and practice regarding cardiac arrhythmias in the critical care unit.

Keywords: Cardiac arrhythmias, educational program, nurses' knowledge, practice

1. Introduction

Arrhythmias refer to a deviation of the cardiac rhythm or rate from the normal. It results from a disturbance in electrical impulse formation, electrical conduction, or both. Arrhythmia creates in the ventricles or atrial and ranges from asymptomatic rhythm to symptomatic fatal rhythms such as atrial flutter, ventricular fibrillation (VF), atrial fibrillation, ventricular tachycardia (VT), pulseless electrical activity, complete heart block, pulseless ventricular tachycardia, asystole, and torsade de point rhythm resulting in sudden death. When the heart does not pump blood effectively, this affects the perfusion and oxygenation leading to a reduction in cardiac output to vital organs and peripheral tissues, resulting in dysfunction or failure of the organ *(Salem, 2020).*

Globally 16 million deaths were reported due to cardiovascular disorders. Cardiac arrhythmias are some conditions that carry life-threatening risks leading to heart failure or death *(Jacob et al., 2018).* Arrhythmias are grouped into brady dysrhythmias, techy-dysrhythmias, and life-threatening dysrhythmias. Patients with ischemic cardiomyopathy (ICM) and nonischemic cardiomyopathy (NICM) are liable to these types of arrhythmias *(Kripa & Jebastine, 2020).* Life-threatening arrhythmias, including ventricular fibrillation (VF) and ventricular tachycardia (VT), are major causes of sudden cardiac death. Also, it includes pulseless electrical activity (PEA) and asystole, which represent the less common causes of dysrhythmias, 20% to 30% *(Sharabi & Singh, 2020).* Pulseless electrical activity is also considered a life-threatening arrhythmia, a clinical condition characterized by unresponsiveness and an impalpable pulse in the presence of sufficient electrical discharge. A lack of ventricular impulse often points to the absence of ventricular contraction *(Oliver et al., 2020).*

Arrhythmias are a major cause of morbidity, increased hospital length, and higher economic costs. Successful

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treatment of arrhythmias depends on the fast diagnosis and activates management, regularly requiring a multimodality procedure, which may consist of synchronous correction of electrolytes and pH, pharmacological measures for rate control, pressors, exact antiarrhythmic drugs, electrical pacing, or cardioversion. Management must be cautiously custom-made to the affected person's specific arrhythmia, its basic cause, and the patient's coexisting therapeutic and surgical condition *(Salim et al., 2018).*

The interpretation of cardiac rhythm disturbances or dysrhythmias is an essential skill for nurses. The ability to rapidly analyze a rhythm disturbance and initiate appropriate treatment improves patient safety and optimizes successful outcomes. The critical care nurse is often the healthcare professional responsible for continuously monitoring the patient's cardiac rhythm and can provide early intervention to prevent an adverse clinical situation *(Ho et al., 2021).* Nurses should have enough knowledge to carry out these responsibilities to maximize the quality of care and improve patient outcomes. Nurses should be able to quickly and correctly detect and interpret ECG abnormalities and intervene in a timely manner *(Habibzadeh et al., 2019).*

Nurses working in critical care units should be highly qualified and able to provide effective care around -the - clock, with a ratio of one nurse to one patient. This statement intends to ensure high-quality performance to recognize and treat arrhythmias to save patients' lives. Nurse training should be implemented to help nurses recognize potentially fatal arrhythmias, enabling prompt and appropriate patient treatment. Achieving and maintaining ECG interpretation competence by healthcare professionals is recommended by the American Heart Association (AHA) as a patient safety measure *(Rahimpour et al., 2021).* Continuing education in nursing enhances the knowledge, skills, and confidence of professional nurses to provide high-quality, competent, and safe patient care *(Ho et al., 2021).*

Education of critical care nurses plays a vital role in arrhythmias management and should focus on symptomatic relief, promotion of comfort, and taking crisis activity in fatal dysrhythmias which incorporate assessment of disturbed rhythm, getting 12-lead ECG to recognize the type of dysrhythmia and turning in satisfactory oxygen to diminish heart workload as well, while administering medication as prescribed, the possible adverse drug reactions and the nursing care. Besides, quick, secure defibrillation and other cardiac life support procedures in ventricular fibrillation and cardiac arrest *(Ameen et al., 2021).*

2. Significance of the study

Arrhythmias are a worldwide problem. In Egypt, approximately four million people have arrhythmias *(Statistics by Country for Arrhythmias, 2012).* More than 70% of intensive care unit patients experience heart rhythm disturbances, and these patients have correspondingly higher mortality rates, particularly with ventricular arrhythmias *(Uvelin et al., 2017).* Learning and mastering cardiac arrhythmias are difficult, requiring training and practicing all arrhythmias management *(Tavan et al., 2020).* So, enhancing nursing education for managing cardiac arrhythmias is

considered an effective strategy to maintain patients' safety and decrease cardiac-related morbidity and mortality. Hence, this study has been conducted to improve nurses' knowledge and practices regarding caring for patients with cardiac arrhythmias for that wide patient sector.

3. Aim of the study

This study aimed to evaluate the effect of an educational program regarding cardiac arrhythmias on nurses' knowledge and practice in critical care units through the following objectives:
- Assess nurses' knowledge and practice regarding cardiac arrhythmias in critical care units.
- Develop an educational program regarding cardiac arrhythmias in critical care units based on the nurses' educational needs.
- Implement the educational program regarding cardiac arrhythmias in critical care units.
- Evaluate nurses' knowledge and practice regarding cardiac arrhythmias in critical care units immediately and three months after implementing the educational program (follow-up).

3.1. Study hypotheses

- The nurses will improve their knowledge regarding cardiac arrhythmias after the educational program implementation.

- The nurses will improve their practice regarding cardiac arrhythmias after the educational program implementation.

4. Subjects & Methods

4.1. Research Design

A quasi-experimental (one group pre/post-test and follow-up) research design was utilized to achieve the aim of this study. The study's independent variable is the educational program, and the dependent variables are the nurses' knowledge and practice in caring the patients with arrhythmias. The quasi-experimental design is a type of research design that shares similarities with experimental design but lacks some key features, such as the random assignment of participants or the presence of a control group *(Rohlfing, 2012).*

4.2. Study setting

The study was conducted at critical care units in Governmental Port-Said general hospitals (Port Said general hospital, Pour -Fouad general hospital, and Alzhoor central hospital) and, recently, Universal health insurance hospitals in Port Said city. In Port Said general hospital (Elsalam Hospital), the intensive care unit (ICU) contains 20 beds and is divided into two main units: Frist ICU and the third care unit. The Pour -Fouad general hospital contains 32 beds divided into two main units: Adult ICU and median intensive care unit. Alzhoor central hospital contains 16 beds divided into two main units: Adult ICU and median intensive care unit.

4.3. Subjects

A convenient sample of all available nurses (139 nurses in intensive care units divided into 116 females and 23 males) who worked in the aforementioned units at the time of the study.

4.4. Tools of data collection

Data were collected using a structured interview questionnaire and nurses' practice observational checklists.

4.4.1. Structured Interview Questionnaire

The researcher developed a structured interview questionnaire after reviewing the recent related literature of *Hinkle and Cheever (2017)*; *Mclaughlin (2018)* to assess nurses' knowledge regarding cardiac arrhythmias in critical care units. It was designed in the Arabic language to avoid misunderstanding and divided into two parts:

Part 1 included the assessment of demographic characteristics (age, gender, marital status, and qualifications).

Part 2 was concerned with nurses' knowledge assessment. It included nurses' knowledge regarding cardiac arrhythmias, and nurses' role before, during, and after conducting the education program. It is composed of 70 questions. It covered the following areas:

- General knowledge about heart and cardiac dysrhythmias (8 multiple choice questions and ten true and false questions).
- Knowledge related to connecting the patient to the ECG monitor (7 multiple choice questions).
- ECG interpretation (6 true and false questions and 16 multiple choice questions).
- Emergency antiarrhythmic medications (8 multiple choice questions).
- Cardiopulmonary resuscitation (10 multiple choice questions).
- Knowledge related to defibration (5 multiple choice questions).

Scoring system

Regarding nurses' knowledge, the answer was evaluated using a model key answer prepared by the researcher. The true or false questions were mixed in with multiple-choice questions. The "correct answer" scored one, while the "incorrect answer" scored zero. Knowledge was considered satisfactory if the percent score was equal to or above 75% and unsatisfactory if less than 75%.

4.4.2. Nurses' Practice Observational Checklist

The researcher developed a nurses' practice observational checklist based on reviewing recent related literature such as *Lynn (2018), Mclaughlin (2018)*, and *Nettina (2018)* to evaluate nurses' practices regarding cardiac arrhythmias. It included the following checklists:

- Carry out interventions for managing arrhythmias (10 steps like assessing signs and symptoms of cardiac arrhythmia, implementing measures to maintain cardiac output, and preparing the patient for emergency procedures).

- Connecting patients to monitor (22 steps like preparing equipment, hand washing, and applying electrodes).
- Obtain 12-lead ECG and interpretation (23 steps like checking physician order for ECG, explaining the procedure, and placing chest lead).
- Emergency defibration (28 steps like ensuring the patient is unresponsive, beginning CPR/ fetching the crash cart, and commanding all persons to move away from bed areas).
- Perform cardiopulmonary resuscitation (14 steps like assessing the patients, activating the emergency response system, and allowing complete chest recoil between compression).
- Emergency medication for arrhythmias (19 steps like checking the physician's order, giving medication using appropriate specific procedure, and documentation).
- Emergency crash cart (11 steps like preparing equipment commonly used in an emergency, locking drawers when unused, and checking the cart daily).

Scoring system

The items were to be checked as "Done/Not done ." A score of 1 was given to the "done" items and zero to the "not done." For each subsection, these scores were converted to percentiles. The practice was considered satisfactory if the percent score was equal to or above 75% and unsatisfactory if less than 75%.

4.5. Procedures

The operational design included a preparatory phase, validity, reliability, pilot study, and fieldwork.

Preparatory phase: Based on pertinent literature reviews and theoretical understanding of many aspects of the research, the researcher used books, articles, internet journals, and magazines to develop data collection tools.

Validity: It was done by a jury of seven experts (two professors, one assistant professor, and two lecturers from the Medical-Surgical specialty, Faculty of Nursing Port Said University, and two assistant professors from Ain shams University who revised the tools' content validity for clarity, relevance, comprehensiveness, understanding, and ease for implementation, according to their opinion modifications were applied.

Reliability: The reliability of tools used in this study was tested by Cronbach's alpha coefficient test to assess the internal consistency of the tool, and its value was 0.894 for the knowledge tool and 0.901 for the practice tool. The tools reveal good reliability.

Official permission for data collection in the three Port Said hospitals was obtained from the relevant authorities by submission of a formal letter from the dean of the faculty of nursing at Port Said University explaining the purpose of the study to the Directors of the settings mentioned above seeking their approval to conduct the study. A meeting and discussion were held between the researcher and the nursing administrative personnel to make them aware of the aims and objectives of the research, as well as to get better cooperation during the implementation phase of the research. Also, nurses' consent was obtained before starting data collection.

Ethical Consideration: Approval was taken from the Research Ethics Committee of the Faculty of Nursing, Port Said University code no. (NUR 26/11/2018 (1)). The purpose of the study was explained to the participants before obtaining written consent to share in the study. A brief explanation of the study was given to assure the participants that all information obtained would be kept strictly confidential and used only for the study. Participants were informed that; they have the right to participate or withdraw from the study at any time. Code numbers instead of names of the participants were used for identification purposes. This measure ensured that the public reports would not identify the participants.

Pilot Study: Following the development of the tool, a pilot study was conducted, which was carried out on 16 nurses representing 10% of the total study sample. The pilot study aimed to test the clarity, feasibility, and applicability of the study tools and estimate the time needed to complete the tools. It also helped discover any obstacles and problems that might interfere with the data collection. Needed modifications were done based on the findings of the pilot study. The pilot sample was excluded from the main study sample.

The study was carried out through four phases (assessment, planning, implementation, and evaluation).

Phase I: Assessment (Pre-test phase)

The researcher visited the study settings and arranged with the nursing director to implement the study, then evaluated the teaching room in all study places after obtaining permission from the directors of study places. The researcher interviewed the nurses, introduced herself, and then invited them to participate. After they agreed to participate, written consent was obtained to gain their cooperation. The researcher explained the purpose of the study. The research tools were explained and filled in within 20 to 30 minutes. Finally, the researcher assessed nurses' learning needs.

Phase II: Planning

In this step, the researcher designed a plan for educational program implementation. The researcher created an Arabic version of the cardiac arrhythmias educational program booklet and handed it to the study group. It contains the following details: Anatomy and physiology of the heart. Cardiac arrhythmias (definition, signs and symptoms, types of arrhythmias, diagnosis, treatment, and nursing intervention), devices used for monitoring cardiac rhythm as ECG and cardiac monitor (nursing role before, during, and after), cardiac arrhythmias medication (uses, route, contraindications of uses, nursing role, and complications), cardiopulmonary resuscitation (knowledge and procedure), emergency crash cart and health education regarding cardiac arrhythmias. This content is validated by the same panel of expert who validates the study tools.

The booklet was divided into theoretical and practical parts. Also, it was supplemented by photos and colors for more illustration and to help the nurses understand the content. Each participant was given a booklet summarizing the content of cardiac arrhythmia sessions to guide them. Animation videos and slide presentations were used in the sessions. The educational program teaching strategy was determined by selecting the appropriate teaching method: Active lecture, small group discussion, demonstration, and re-demonstration, and selecting the appropriate teaching media, handout, audiovisual material, and real objects.

Phase (III): Health educational program Implementation

In the beginning, the studied nurses were divided into ten groups. Each group consisted of 13 -15 nurses, then each group was gathered in a conference room separately. Because of Covid 19, the four sessions took two weeks for each group as each group was free to choose their optimal time for receiving the educational program. The session was taken at the available time to the gathered group, which was during the working shift in morning and afternoon shifts.

The current study fieldwork lasted eighteen months, from the beginning of March 2020 to the end of August 2021. They were given the structured program education course that lasted about eight hours and was divided into four sessions of about 120 minutes. At the beginning of the training program implementation, an introduction was given regarding its importance. A presentation of the training program plan and learning objectives were explained to each group separately. A copy of the handout was given to each nurse to facilitate remembering the knowledge and steps during explaining the theoretical part and demonstrating the procedure steps of caring for patients with arrhythmia.

The beginning of each session started with a brief revision of what was given before. A statement of the objectives of the present session followed this revision. Each session included a theoretical information presentation, videos, practice, and sharing thoughts and emotions about the class subject. The researcher demonstrated all the procedure steps in front of the nurses while discussing the rationale and the precaution for each step with them.

At the end of each session, nurses were asked about unclear steps that needed repetitions or explanations before the re-demonstration. The researcher emphasized that this session was done for teaching purposes, not for evaluation, so mistakes and forgetting were allowed and were corrected immediately by the researcher.

Finally, the researcher gave her feedback, starting with positive and negative points. Any missing points or mistakes were corrected immediately to prevent other nurses from making the same mistakes. Also, nurses were asked to give their feedback. The program was implemented for nurses in terms of four sessions as the following:

- The first session included an introduction to the anatomy and physiology of the heart and cardiac arrhythmia.
- The second session included reviewing devices used for monitoring cardiac rhythm as electrocardiograms and cardiac monitors.
- The third session included reviewing cardiac arrhythmias medication and cardiopulmonary resuscitation.
- The fourth session included reviewing emergency crash carts and health education regarding cardiac arrhythmias, a discussion followed by immediate post-evaluation.

Phase IV: Evaluation

The program outcome was evaluated using the same version of the study tool immediately after program

implementation (post-test) and a second evaluation after three months (follow-up). The researcher attended with participants during their shifts to evaluate their practice regarding arrhythmias, and the researcher fills an observational checklist.

4.6. Limitation of the Study

- It was difficult and took more time to gather all the nurses from the same department at the same time to attend the program session due to changing the health system in Port Said to the Universal health insurance system, which required a review of the study setting, also, because of Covid pandemic and its precautions. This problem was overcome by dividing the studied nurses in each department shift into two to four groups.
- Access to the intensive care unit was stopped several times for months because of the pandemic of covid 19 as an isolation area for infected patients.
- Intensive care nurses did not participate in all-time training program sessions because of work stress and their busy time, so the researcher asked these nurses to determine a suitable time to take the sessions.

4.7. Data analysis

Data were sorted, organized, coded, and transferred into specially designed formats suitable for the computer entry process. All statistical analyses were performed using SPSS for windows version 25.0 (SPSS, Chicago, IL). Continuous data were normally distributed and were expressed in mean ±standard deviation (SD). Categorical data were expressed in numbers and percentages. The chi-square test was used to compare variables with categorical data (x^2), and the Correlation coefficient test (r) was used to test correlations between two variables. The obtained outcomes were considered significant at p-value ≤0.05 and highly significant at p-value ≤0.001, while p-value >0.05 were considered non-significant.

5. Result

Table 1 shows that 88.5% of the studied nurses were an age group less than 30 years old with a mean ± SD of 25.6±5.1, 83.5% of nurses were females, 55.4% of them had technical health institute diplomas, 100% of studied nurses had no training courses regarding cardiac arrhythmias and 84.2% of the studied nurses had less than six years of experiences.

Table 2 illustrates that 95% of the studied nurses had an unsatisfactory level regarding knowledge related to emergency medications for cardiac arrhythmia pre-educational program implementation compared to 22.3%

and 36% immediately after implementation of the educational program and at follow-up. According to knowledge related to connecting the patient to the monitor, 89.9% of studied nurses had an unsatisfactory level of knowledge pre-educational program implementation versus 23.7% immediately post-educational program implementation and 36.7% at follow-up.

Table 3 reveals a statistically significant difference between the studied nurses' total knowledge pre, post, and at follow-up after implementing the educational program at p <0.001.

Figure 1 clarifies that 77% of nurses had satisfactory total knowledge immediately after post-educational program implementation compared to 13.7% pre and 64.7% at follow-up after educational program implementation.

Table 4 illustrates that 54.7%, 95.7%, and 81.3% of the studied nurses had satisfactory practice regarding cardiopulmonary resuscitation pre, immediate post, and at follow-up, respectively. Also, 34.5%, 95.7%, and 78.4% of them had satisfactory levels of emergency medication administration before and after (post & follow up) implementation of the program regarding management. Besides connecting the patient to the monitor, the table demonstrates that 25.2%, 95.0%, and 72.7% of the studied nurses had satisfactory levels before and after (post & follow-up) program implementation.

Moreover, 69.7% of nurses had unsatisfactory practice levels related to obtaining 12-lead ECG & interpretation procedure pre-educational program implementation compared to 18.7% post-educational program implementation and 39.6% of them at follow-up.

Table 5 demonstrates a statistically significant difference in the nurses' total practice level regarding the pre-, post, and follow-up arrhythmias management procedures after implementing the education program at p <0.001.

Figure 2 clarifies that 92.8% of nurses had a satisfactory total practice level immediately post educational program implementation compared to 37.4% of studied nurses pre-educational program implementation and 69.8% at follow-up after implementing the educational program.

Table 6 shows a high statistically significant relations between total nurses' knowledge score and their total practice score immediately after the educational program and at follow-up (p<0.001). In contrast, no statistically significant difference existed between knowledge and practice before educational program implementation (p= 0.282).

Table 7 illustrates a statistically significant positive correlation between total nurses' knowledge and practice scores post-educational program implementation and follow-up.

Table (1): Frequency distribution of studied nurses' demographic characteristics (n=139).

Variables	No.	%
Age (years)		
<30	123	88.5
30 or More	16	11.5
Mean±SD	25.6 ±5.1	
Gender		
Male	23	16.5
Female	116	83.5
Marital Status		
Single	66	47.5
Married	73	52.5
Educational Level		
Technical Health Institute Diploma	77	55.4
Baccalaureate degree in Nursing	54	38.8
Master's degree in Nursing	8	5.8
Experience Years		
<6	117	84.2
Six or More	22	15.8
Attending any training courses on Cardiac arrhythmia.		
Yes	0	0.0
No	139	100.0

Table (2): Frequency and percentage distribution of nurses' knowledge pre, immediately post, and follow-up after implementing the educational program (n=139).

Knowledge element	Pre-intervention				Post-intervention				Follow-Up			
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Heart and rhythm disorders	118	84.9	21	15.1	37	26.6	102	73.4	49	35.3	90	64.7
Connecting the patient to the monitor	125	89.9	14	10.1	33	23.7	106	76.3	51	36.7	88	63.3
Electrocardiogram knowledge & interpretation	114	82.0	25	18.0	32	23.0	107	77.0	49	35.3	90	64.7
Emergency medications for cardiac arrhythmia	132	95.0	7	5.0	31	22.3	108	77.7	50	36.0	89	64.0
Cardiopulmonary resuscitation	111	79.9	28	20.1	33	23.7	106	76.3	48	34.5	91	65.5
Defibration	118	84.9	21	15.1	34	24.5	105	75.5	45	32.4	94	67.6

Table (3): Comparison of the studied nurses' total knowledge score regarding the arrhythmias pre, post, and follow-up the implementation of the educational program (n=139).

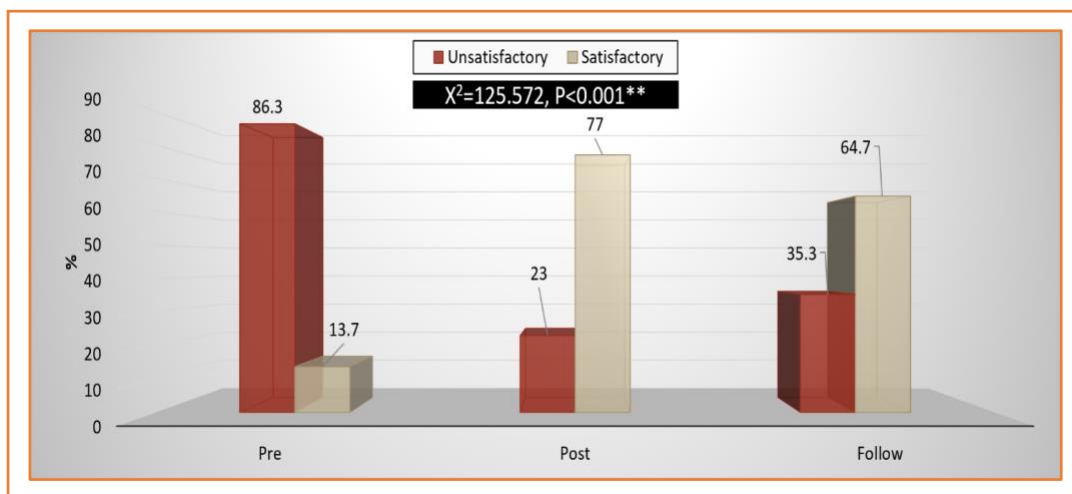| Variable	Pre-intervention				Post-intervention				Follow-Up				X^2	p-value
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Total knowledge score	120	86.3	19	13.7	32	23	107	77	49	35.3	90	64.7	125.57	<0.001

Figure (1): Percentage distribution of total nurses' knowledge pre, immediately post, and follow-up after the educational program (n=139)

Table (4): Frequency and percentage distribution of nurses' practice pre, immediately post, and follow-up after implementing the educational program (n=139).

Practices	Pre-intervention				Post-intervention				Follow-Up			
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Management of arrhythmias	74	53.2	65	46.8	7	5.0	132	95.0	32	23.0	107	77.0
Connecting the patient to monitor	104	74.8	35	25.2	7	5.0	132	95.0	38	27.3	101	72.7
Obtaining 12-LEAD ECG & interpretation	97	69.7	42	30.3	26	18.7	113	81.3	55	39.6	84	60.4
Emergency defibrillation	101	72.7	38	27.3	28	20.1	111	79.9	69	49.6	70	50.4
Cardiopulmonary resuscitation	63	45.3	76	54.7	6	4.3	133	95.7	26	18.7	113	81.3
Emergency medications administration	91	65.5	48	34.5	6	4.3	133	95.7	30	21.6	109	78.4
Emergency crash cart	71	51.1	68	48.9	9	6.5	130	93.5	34	24.5	105	75.5

Table (5): Comparison of the studied nurses' total practice score regarding the arrhythmias pre, post, and follow-up the implementation of the educational program (n=139).

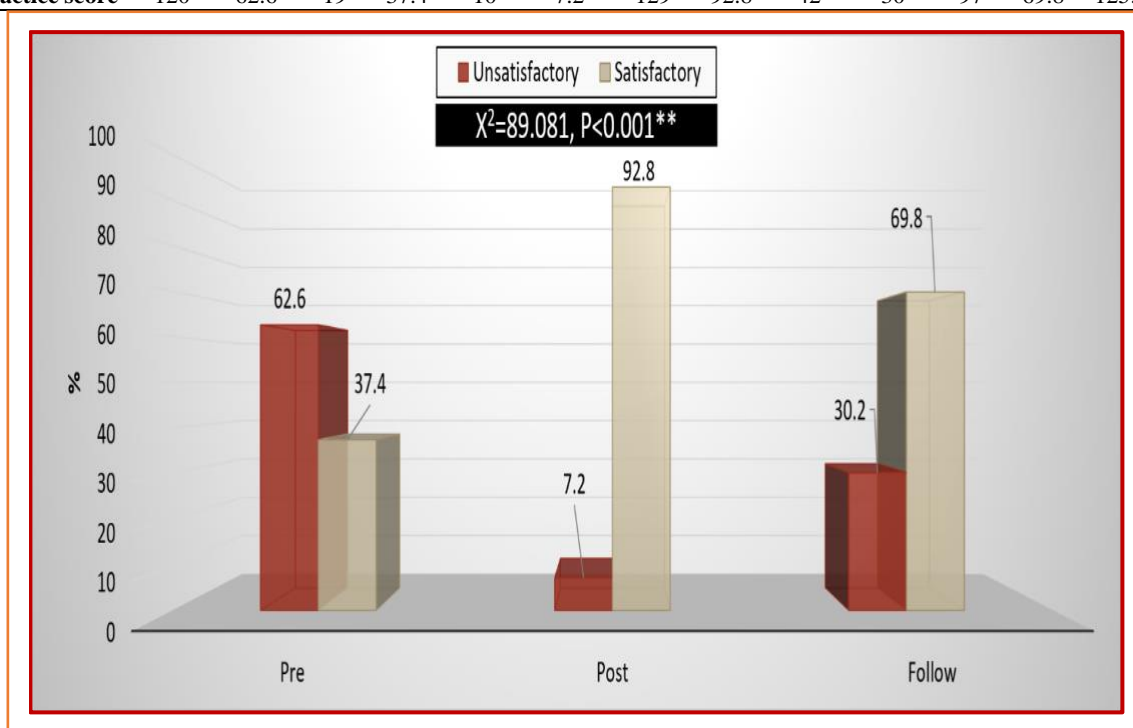| Variable	Pre-intervention				Post-intervention				Follow-Up				X^2	p-value
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
Total practice score	120	62.6	19	37.4	10	7.2	129	92.8	42	30	97	69.8	125.57	<0.001

Figure (2): Percentage distribution of total nurses' practices pre, immediately post, and follow-up after the educational program (n=139).

Table (6): Relation between total nurses' knowledge and total practices score pre, immediately post, and follow-up after the educational program (n=139).

Total knowledge	Total practice				X^2	p-value
	Unsatisfactory practice		Satisfactory practice			
	N	%	N	%		
Pre-Intervention						
Unsatisfactory Knowledge	73	83.9	47	90.4		
Satisfactory Knowledge	14	16.1	5	9.6	1.157	0.282
Post-Intervention						
Unsatisfactory Knowledge	10	76.9	22	17.5		
Satisfactory Knowledge	3	23.1	104	82.5	23.512	<0.001
Follow-Up						
Unsatisfactory Knowledge	37	88.1	12	12.4		
Satisfactory Knowledge	5	11.9	85	87.6	73.632	<0.001

Table (7): Correlation between total nurses' knowledge \ and total practices score pre, immediately post, and follow-up after the educational program (n=139).

Total knowledge score	Total practice score					
	Pre-Intervention		Post Intervention		Follow-Up	
	r	p-value	r	p-value	r	p-value
Pre-intervention	0.185	0.029	0.439	0.119	0.108	0.205
Post-intervention	0.160	0.060	0.636	<0.001	0.240	0.004
Follow-up	0.066	0.438	0.209	0.014	0.426	<0.001

r= person correlation coefficient

6. Discussion

Arrhythmias are abnormal heart rhythms due to disturbances in heart automaticity or abnormal heart conduction, which cause a reduction in cardiac output, and a change in heart rate, thus affecting tissue perfusion. *(Mitchell 2022)*. Critical care nurse plays a vital role in arrhythmias management, specializing in symptomatic relief, promoting comfort, and taking crisis activity in fatal dysrhythmias *(Ameen et al., 2021).* Therefore, the current study aimed to evaluate the effect of an educational program regarding cardiac arrhythmias on nurses' knowledge and practice in critical care units.

Regarding the demographic characteristics of the studied nurses, the study result shows that more than three quadrants were females under thirty years old, and slightly more than half held a technical health institute diploma in nursing. Most had less than six years of experience, with no one having previous training in arrhythmia management. From the researcher's point of view, it might be due to the historical roots of the profession being female nurses. The results also reflect the novelty of nurses with few years of experience and no previous training.

This result was compatible with *Ameen et al. (2021)*, who studied cardiac dysrhythmias Interpretation: Knowledge enhancement nursing protocol and stated that most of the nurses in the study were females, about two third of the studied nurses aged less than thirty, and none of the studied nurses had attended training courses before. This study also agreed with *Yadav and Mehta (2018)*, who studied the effectiveness of educational intervention program on life support measures for the nurses working in the emergency unit of Bpkihs, Nipal: A pre-experimental study and stated that most of the nurses in the study were females and had never attended the life support training courses before.

Conversely, this result was incompatible with *Metwaly et al. (2021),* who studied the effect of a training program on nurses' knowledge and practice regarding patients with cardiac arrhythmias and reported that about two third of the studied nurses aged more than thirty years, half of them had baccalaureate degree in nursing. Also, more than half of them had more than five years of experience in the cardiac intensive care unit, and nearly two-thirds of them received training courses about cardiac arrhythmias.

Regarding nurses' knowledge pre, immediate post, and follow-up phases, the study result illustrates that most of the studied nurses had an unsatisfactory level regarding knowledge related to emergency medications for cardiac arrhythmia in the pre-educational phase versus less than one-quarter of the immediate post-and more than one third at follow up phases. This finding was the case regarding knowledge related to connecting the patient to the monitor; most studied nurses had unsatisfactory levels pre-educational program implementation versus less than one-quarter of them immediately post and more than a third at the follow-up phase of the educational program.

Regarding total nurses' knowledge through educational program phases, the study result clarifies that more than three quadrants of nurses had satisfactory total knowledge immediately after educational program implementation compared to around one-tenth pre and more than two-thirds of them at follow-up after educational program implementation with a statistically significant difference between the three study phases. This improvement indicates the educational program's effectiveness in covering different aspects of arrhythmia management. This result also reflects the motivation of the nurses to learn about arrhythmias as they are novice nurses and have no previous training.

This result was compatible with *Ameen et al. (2021),* who reported statistically significant differences in

knowledge regarding emergency medications and knowledge related to connecting the patient to the monitor at the pre, immediate post, and follow-up program phases. Also, in line with *Fadalla (2018)*, who studied the impact of an educational program on the recognition and management of ventricular arrhythmias guidelines among critical care nurses in Khartoum City, Sudan, and reported statistically significant differences in knowledge regarding emergency medications and knowledge related to connecting the patient to the monitor at pre, immediately post and follow up program phases.

This result was in the same line with *Nagy et al. (2022)*, who studied the effect of a training program on nurses' performance regarding life-threatening cardiac arrhythmias and found a statistically significant improvement in the total level of nurse's knowledge, practice, and attitude post and follow up program phases. Also, this result was compatible with *Tavan et al. (2020),* who studied teaching cardiac arrhythmias using educational videos and simulator software in nurses and reported that after the education intervention program, there was a significant improvement in knowledge and skill for managing cardiac arrhythmias. These findings support the first research hypothesis.

Regarding nurses' practices regarding the management of arrhythmias, the study result clarified that the nurses' practice regarding the management of arrhythmias, most studied nurses related to initiating cardiac monitoring had high statistical significance differences before and after (post & follow-up) implementation of the program. There was a high statistically significant difference in all items of nurses' practice regarding the management of arrhythmias. This result may be due to the comprehensiveness and effectiveness of the educational program.

This result was congruent with *Metwaly et al. (2021)***,** who reported that there were highly statistically significant differences in all items of nurses' practice regarding the management of arrhythmias at pre, post, and follow-up program phases. In line with this study Jacob, et al. (2018) they studied a study to assess the effect of a planned teaching program on knowledge regarding the interpretation of cardiac arrhythmias and its management among staff nurses in Selected Hospitals of Pune City and reported that samples had good knowledge and all items of practice regarding interpretation and management of cardiac arrhythmias after planned teaching program.

As regard nurses' practices pre, immediate post, and follow-up after the educational program, the study result illustrates that more than half of the nurses had satisfactory practice regarding cardiopulmonary resuscitation, more than one-third had satisfactory practice regarding emergency medication administration, a quarter of them had satisfactory practice regarding connecting the patient to monitor, besides more than two-thirds of the nurses had unsatisfactory practice regarding obtaining 12-lead ECG and interpretation before the implementation of the educational program. These findings might be referred to the novelty of the nurses, the absence of any training program, and the moderate qualification in nursing as most of them were technical health institute graduates.

After implementing the educational program, most of the studied nurses had satisfactory levels regarding practices of cardiopulmonary resuscitation and emergency medication administration, and most of them had satisfactory levels regarding the management of arrhythmias and connecting the patient to monitor, with the highest percentage of them can perform the 12-lead ECG and interpret it immediately post educational program implementation. This finding may be due to the effectiveness of the educational program that contains both theory and practice sessions regarding the management of arrhythmia.

These findings are matched with *Derinoz-Guleryuz et al. (2021)*, who studied the skills of defibrillation practice and certified life-support training in the healthcare providers in Turkey and reported that both physicians and non-physician healthcare staff improved their practice of synchronized cardioversion defibrillation after program implementation. Also, this result was compatible with *Ahmed et al. (2019)*. They reported highly statistically significant differences in nurses' practice regarding emergency defibrillation at pre, post, and follow-up program phases.

This result was compatible with *Elsayed et al. (2021)*. They studied the effect of a structured cardiopulmonary resuscitation training program on nursing competence. They reported a statistically significant difference in critical care nurses' knowledge and performance in the pre-and post-structured cardiopulmonary resuscitation training program. In line with this study, *Demirtas et al. (2021)* studied the effectiveness of simulation-based cardiopulmonary resuscitation training programs on fourth-year nursing students. They found that the post-test CPR knowledge increased significantly after the program. In addition, the post-test CPR skills were significantly higher than the pre-test CPR skills. Also, in line with this study, *Elbaih et al. (2019)* studied the assessment of cardiopulmonary resuscitation knowledge and experiences among emergency department nurses pre and post-basic life support training courses in Egypt. They found that most of the studied nurses had satisfactory levels regarding practices related to cardiopulmonary resuscitation and emergency medication administration post-program implementation.

Additionally, in line with this study *Derinoz-Guleryuz et al. (2021*. They reported a statistically significant difference in nurses' practice regarding arrhythmias emergency medications through different program phases. Also, in line with this study *Al-Ahdal and Makki (2020)*. They studied nurses' performance regarding emergency management of arrhythmias post-cardiac surgery at cardiac centers in Khartoum, Sudan. They found that nurses' knowledge and practice regarding emergency drugs were significantly improved after program implementation.

Also, this result was compatible with *Elsayed et al. (2020)*. They studied the nurses' performance regarding life-threatening ventricular dysrhythmias among critically ill patients. They reported statistically significant differences in all items regarding applying electrodes of the monitor at pre, post, and follow-up program phases. This result was congruent with *Yadav and Mehta (2018)*. they reported

statistically significant differences regarding applying electrodes of the monitor at pre, post, and follow-up program phases.

This result was also compatible with *Tahboub and Dal Yilmaz (2019)*. They studied nurses' knowledge and practices of electrocardiogram interpretation and reported that ECG training courses effectively improved the nurses' ECG knowledge and interpretation. This result was matched with *Ahmed et al. (2019)*. They studied the effect of an educational program on nurses' knowledge and practice regarding defibrillation and cardioversion. They reported that nurses' level of knowledge and practice regarding obtaining a 12- Lead ECG and Interpretation was unsatisfactory before the program and significantly improved post-program immediately and at the follow-up phase in all items. In line with this study, *El-Sayed et al. (2020)* reported highly statistically significant differences in all items regarding obtaining A 12- Lead ECG & Interpretation at pre, post, and follow-up program phases.

Regarding the total nurses' practices pre, immediate post, and follow-up after the educational program, the study result clarifies that the majority of nurses had satisfactory total practice levels immediately after post-educational program implementation compared to more than one-third of studied nurses pre-educational program implementation and more than two-thirds follow up educational program with the statistically significant difference between the three study phases. This finding may be due to the effectiveness of the educational program in demonstrating and redemonstrating the procedures related to arrhythmias management.

In line with this study, *Al-Temimi and Atiya (2019)* studied the effectiveness of an educational program on emergency nurses' knowledge. They practiced advanced cardiac life support at the emergency medicine department in Baghdad City, Iraq, and concluded that nurses' knowledge and practice were improved after the educational program. Also, this study was compatible with *AL-Jumaily and Khudur (2019)*. They studied the effectiveness of an education program on nurses' knowledge concerning nursing management for patients with heart block in Kirkuk Teaching Hospitals. They found highly significant differences between pre and post-tests in the study group in overall main domains related to nurses' practice. These findings support the second research hypothesis.

Regarding the relation between total nurses' knowledge and total practice scores pre, immediately post, and follow-up after the educational program, the study result shows high statistical significance between total nurses' knowledge and their total practice score immediately post educational program and follow-up. This finding confirms the relationship between knowledge improvement and its reflection on practice improvement. As regards the correlation between total nurses' knowledge score and total practices score pre, immediately post, and follow-up after the educational program, the study result illustrates a statistically significant correlation between total nurses' knowledge post-educational program implementation and their total practices score immediately post educational program and at follow

up. This finding may be because gaining knowledge affects nurses' practices.

In line with this study, *Nagy et al. (2022)* reported that the nursing training program significantly improved nurses' knowledge and practice regarding life-threatening cardiac arrhythmias. There was a positive correlation between nurses' knowledge and practice through different program phases. Also, this result was compatible with *Ahmed et al. (2019)*, who concluded a positive correlation between nurses' knowledge and practice through pre, post, and follow-up program phases.

This result was incompatible with *El-Sayed et al. (2020)*, who studied nurses' performance regarding life-threatening ventricular dysrhythmias among critically ill patients and found no significant relationship between nurses' total knowledge and practice scores. Also, *KO et al. (2022)* studied the effects of peer learning on nursing students' learning outcomes in electrocardiogram education and found no significant pretest-posttest relation between knowledge and practice.

7. Conclusion

The study findings demonstrated that most of the studied nurses had statistically significant improvement in their knowledge and practice post-program implementation. In contrast, this improvement decreased slightly at follow-up. In addition, there was a statistically significant positive correlation between the total nurses' knowledge score and their total practice score immediately post educational program and follow-up. So, it was concluded that the nursing educational program significantly improved nurses' knowledge and practice regarding cardiac arrhythmias, which supports the current research hypotheses.

8. Recommendations

Based on the findings of the present study, the following recommendations are suggested:
- Continuous training and educational programs to empower and apprise the knowledge and practice of the nurses assigned to work with cardiac arrhythmias patients.
- Episodic evaluation of nurses' knowledge and practice concerning managing arrhythmias patients in any emergency in the critical care units.
- Establishing training programs for critical care nurses on ECG and interpretation of cardiac arrhythmias.
- Make an educational program for newly graduated nurses assigned to work in critical care units to improve their knowledge and practice.
- Educational materials such as booklets and pamphlets should be developed for critical care nurses according to their needs, skills, and educational qualification to update their practice regarding arrhythmia management.
- Replication of similar specific studies using large probability samples and different settings is strongly recommended to enhance and update the nurses' knowledge and practice regarding the care of patients with cardiac arrhythmias.

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