

Effectiveness of Educational Intervention on Nurses' Knowledge and Skills Regarding Electrocardiogram



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1.ABSTRACT

Background: An electrocardiogram is a non-invasive test that measures the heart' rhythm and electrical activity. It is regarded as the 1st diagnostic tool for heart problems. It plays a key role in lowering the risk of morbidity and mortality in individuals with heart problems . Nurses are in charge of monitoring and interpreting electrocardiograms. **Aim:** This study aimed to assess the effectiveness of educational intervention on nurses' knowledge and skills regarding electrocardiogram. **Design:** A quasi-experimental design, one group pretest posttest design was used. **Methods:** Two tools were utilized, structured interview questionnaire to evaluate knowledge and demographic data of the nurses and electrocardiogram observational checklist to assess skills in performing ECG procedure. **Results:** This study clarified that the effectiveness of the educational intervention regarding ECG is positive and unequivocal. It also shows that there was good improvement with high significant differences in all phases of the educational intervention in overall main domains related to nurses knowledge and skills if compared with pre the educational intervention and slightly declined post 3 months after the educational intervention. **Conclusion:** Prior to educational intervention, the majority of the nurses lacked adequate ECG knowledge and skills which improved significantly immediately post educational intervention, While this progress slowed slightly after 3 months at follow up. **Recommendations:** Ascertain the importance of ongoing ECG in-service training programs and participation in additional educational sessions to refresh and upgrade nurses' ECG knowledge and skills.

Keywords: Education, Nurses, Knowledge, Skills, Electrocardiogram

2.Introduction:

In 2019, heart disease is the biggest cause of death, accounting for one-third of all deaths globally. According to World Health Organization statistics, cardiovascular disease are Egypt' biggest cause of mortality, accounting for 46 % of all deaths. In Egypt, cardiovascular disease (CVD) accounted for 46.2% of overall mortality in 2017, with 31.8% of deaths due to ischemic heart disease, compared to 18.7% in the United States. The number of people diagnosed with heart disease nearly doubled from 271 million in 1990 to 523 million in 2019, and the number of people dying from heart disease increased from 12.1 million to 18.6 million (Hassanin, Hassanein & Maksoud, 2020).

Interestingly, there was many ways to diagnose CVD one of these ways is electrocardiogram (ECG). It is a non-invasive diagnostic that keeps track of heart rhythm and electrical activity. It is regarded as the first diagnostic tool for chest discomfort, as it

allows physicians to evaluate any hazards or symptoms. (Amini, Hosseini, Zandian, Azizpour & Haghi, 2022).

Many health professionals, including doctors, nurses, physiologists, and paramedics, are involved in electrocardiogram interpretation, which is a challenging undertaking. Given that nurses are among the first to detect cardiac rhythm abnormalities, accurate ECG reading is one of the most critical roles and competencies of nurse. A nurse is in charge of both the technical aspects of monitoring and clinical decision making based on the ECG paper's data. Nurses should have sufficient knowledge to carry out these obligations so that the quality of treatment and patient outcomes are maximized. nurses should be able to recognize and interpret ECG abnormalities quickly and accurately, and intervene as needed (Habibzadeh, et al., 2019).

Additionally due to high burden of cardiovascular disease in Egypt, with lack of

trained cardiac care nurses, There is need to consider continuous in-service education and training programs for the nurses to enable them to stay current with the changes in cardiac care practice. The present study could upgrade knowledge and skills of cardiac care nurse to the standardization level of care regarding ECG interpretation that could have appositive impact on patient life quality , and could help to support the vital role of the cardiac care nurse in the patient care, it is also intended that findings of this study would contribute to the establishment of evidence-based data that can aid nursing practice and nursing research (Sambu, 2018).

2.1 Significance of the study:

Given the rising prevalence of cardiovascular diseases around the world, early detection and simple access to effective treatment are essential for lowering mortality rated and preventing heart disease. So, nursing staff must be able to identify the specific abnormalities of ECG signs and relate them to clinical conditions (Ahmed, 2020). Therefore providing the right nursing care for cardiac patients is not simply a matter and because ECG is the first assessment tool to any abnormalities in heart and most important diagnostic test in cardiothoracic unit, as well as few studies have discussed the impact of a nurse education intervention on ECG knowledge and skills. So, there is an urgent need to conduct this study to provide nurses with required necessary knowledge and abilities to be able have positive impact on the quality of care especially in early identification of arrhythmias that can lead to fasten therapeutic intervention and make nurses to feel of confidence. On the other hand, this study will have a positive impact on the patient because it enables nurse to save patient life in critical cases and decrease mortality rate especially cardiac arrest patients. Interestingly, it helps health institution to lower medical expenditure and cost of treating complications as well as decrease waiting list.

2.2 Aim of the Study

The study goal is to see how successful an educational intervention is at improving nurses' ECG knowledge and skills.

2.3 Research Hypotheses

The following research hypotheses are proposed to achieve the study' goal:

H 1: Nurses who are involved in the educational intervention exhibit a higher knowledge score regarding ECG post implementing the educational intervention than pre educational intervention.

H 2: Nurses who are involved in the educational intervention exhibit a higher score in performing ECG procedure post implementing the educational intervention compared to pre educational intervention.

H 3: There will be a positive relationship between nurses' Knowledge and skills

3. Subjects and methods

3.1 Research Design:

A quasi-experimental research design one group pre/ post- test was utilized to achieve the aim of the study.

3.2 Setting:

The study was carried out at 1-Surgical cardiothoracic ward, at surgical Cardiothoracic and Blood Vessels center affiliated to Mansoura university hospital and in 2-Cardiology inpatient unit at Specialized Medical Hospital. These hospitals introduce medical services to Delta region. Cardiothoracic center have 7 floor, cardiothoracic unit located in the third floor where have 33 beds and the fifth floor where have 34 beds. Specialized medical hospital has four floors, in the second floor there is cardiology unit that contain 50 beds. As nurse to patient ratio is 1 : 10 respectively.

3.3 Study sample:

A convenient sample of 70 nurses who volunteered to participate in this study and worked in the above-mentioned settings.

3.4 Tools of data collection :

Two tools were be used to collect data of this study:-

Tool I: A structured Interview questionnaire:

It was developed and used by the researcher after extensive literature review (Ali, et al.,2012; Clutter,2015; Eckman,2013; Malk, et al.,2013; Pehrson & Sorensen , 2010;

Schultz & Jane, 2010; Sheilini, 2008; Williams, 2015). It consisted of two parts as the following :-

Part I: Demographic data of the studied nurses

It was about the demographics of the nurses who took part in study (age, gender, marital status, level of education, years of experience, etc..)

Part II: Electrocardiogram Knowledge Assessment questionnaire

It was created by the researcher in order to evaluate the nurses' knowledge related anatomy of heart and conduction system, electrocardiogram waves, ECG interpretation, conduction defects, types of arrhythmias and nursing role. This tool was filled three times; once before the program implementation, once immediately after program implementation and once after 3 months later (follow up).

Scoring system:

All of the knowledge variables were closed ended questions. With a total of 50 questions. Total knowledge score was classified as the following:

≥60% satisfactory knowledge level --- score ≥ 30.

<60% unsatisfactory knowledge level--- score < 30.

Tool II: Electrocardiogram Observational Checklist

It was adapted from (Aaronson & Ward, 2012; Dohety & Crawford, 2012; Dougherty & Lister, 2015; Levick, 2009; The Society for Cardiological Science & Technology, 2014; Wagner, 2007) and modified by the researcher. It was used to assess nurses' practice regarding electrocardiography. This tool was filled three times; once before the program implementation, once immediately after program implementation and once after 3 month later (follow up).

Scoring system

Total score of practice was classified into:

Poor < 50.0%

Average (50.0% -75%)

Good >75 %

3.5 Content validity : A jury of 7 experts; 3 professors of medical surgical nursing, one professor of community nursing, one assistant professor of surgical cardiothoracic from faculty of medicine and 2 professor of critical care nursing reviewed The tools for content validity, The expertise reviewed the tool for objectivity, clarity, appropriately and comprehensiveness, minor modification was done.

3.6 Reliability It was tested by using cronbach's alpha test where knowledge part result was 0.89 and 0.72 for skills part.

3.7 Pilot study:

It was applied on 10% of the whole study population. This was done to see if tools were clear, applicable, and efficient. Because no changes were made, the nurses who participated in the pilot study were included in the sample.

3.8 Field work:

From beginning of September 2020 until the end of July 2021, data was collected

procedure:

Once the necessary approval was obtained from the directors of cardiothoracic center and specialized medical hospital by faculty of nursing that issued a letter to them for explaining aim of the study in order to obtain permission for collection of data, the researcher start to collect data.

Intervention

Development phase of education intervention

It includes a review of linked literature and theoretical knowledge of many aspects of the study, as well as the development of an education intervention for nurses using books, papers, the internet, periodicals and magazines. The researcher devised the program' implementation timeline. objectives, learning activities, teaching techniques and media were all planned ahead of time.

After the researcher developed the educational intervention, the researcher was assessed of nurse's knowledge and skills about electro-cardiogram by using questionnaire and observational checklist. The researcher was on setting site 6 days a week, 3 in the morning

and 3 afternoon shift. The researcher filled the observational checklist by observing the nurses during performing the ECG procedure; the time limit was 30 minutes. The knowledge questionnaire were assessed by nurses. Assessment of nurse's knowledge and skills was carried out three times firstly before education program, secondly immediately and thirdly after three months.

Description of the intervention:

The educational intervention consisted of face to face educational session in which pretest was conducted. It was established and revised in coordination with the cardiology department team, it was elaborated according recent intervention in this area. the program was validated by 2 professors from cardiac unit and 3 professors from medical surgical nursing, illustrated colored booklet was prepared and was written in simple Arabic based on the findings of the nurses knowledge and skills evaluation, each nurse was supplemented with booklet and received printed material with guidelines after each session. During educational sessions nurses encouraged to ask questions and provide feedback, communication was kept open between nurses and researcher This content conducted to nurses by using teaching methods as lecture, discussion and Practical exercise, demonstration, re demonstration and also by teaching media as hand out of the program and schedule, Booklet, Picture Laptop, ECG machine, Video and Photos.

Implementation phase

According to universal precaution of Covid -19, the nurses were grouped into 10 groups(7 nurses each group) then each group gathered separately at the available place, the program was implemented through five sessions . The duration of each session is one hour, including intervals of conversation based on the progress and input of the nurses.

The content of educational program sessions was organized as the following: The first session :- introduction of training program, including objective of training program, anatomy of the heart, circulation of the heart and electrical conduction of the heart.

The second session (practical session) :- Electrocardiography (definition of the ECG, purpose of the ECG, ECG machine, leads of the ECG, component of the ECG), (Role of the nurse pre, during, post ECG procedure).

The third session : ECG Interpretation (characteristics of normal ECG, calculate heart rate through ECG strip, interpretation of normal ECG, artifacts and role of the nurse).

The fourth session :- arrhythmia originating in the sinus node and role the of nurse, arrhythmia originating in the atria and role of the nurse, arrhythmia originating in the ventricular and role of the nurse and arrhythmia originating in the AV node and role of the nurse.

The fifth session: carried out for revision and open discussion between researchers and nurses.

The Evaluation phase:

After implementation of an education intervention, the post test was administered to assess nurses' knowledge and practice using tool I part II and tool II. It was done twice, immediately after finishing education program and after three months from first evaluation, this helped to evaluate the effect of the implementing educational intervention.

3.9 Ethical consideration and Human Rights :

The study was carried out after receiving ethical approval from the Research Ethics Committee of Mansoura University's Faculty of Nursing. Participants were told that participation in the study is entirely optional, and they have the freedom to withdraw at any moment for any reason. As well, the results of this study will not have any effect on their job, informed oral consent was obtained from participants after explaining the aim and benefits of the study. Anonymity and confidentiality of data was assured and was used only for research process.

3.10 Statistical analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 26, SPSS Inc. Chicago, IL, USA).

4. Results

Table (1) showed that slightly more than half of the nurses (57.1%) were aged 26-30 years, whereas 30.0 % of them aged 20-25 years and 12.9% of them aged more than 30 years. Also slightly more than half of the studied nurses were female (55.7%), had bachelor degree of nursing education (52.9%) and experience between 1-5 years (57.1%). Overall nurses in the study did not attend training related electrocardiogram, and the majority (70.0%) were working at main Mansoura university hospital and 30.0 % of them were working at specialized medical hospital.

figure (1) illustrate that throughout different phases of educational intervention, there were statistically significant differences in overall nurses' knowledge of electrocardiogram, anatomy and physiology of the heart, conduction system and action

potential of heart, characteristics of ECG waves, types of cardiac arrhythmia, and electrocardiogram interpretation skills.

figure (2) illustrate there were statistically significant differences related overall nurses' performance of electrocardiogram, assessment and preparation for electrocardiogram, implementing electrocardiogram and post care of electrocardiogram throughout different phases of educational intervention

Table (2) show that there was no relationship between nurses' knowledge and performance related electrocardiogram before and immediately after educational intervention. Whereas table (6) and figure (5) show that there was relationship between nurses' knowledge and performance related electrocardiogram after 3 months of educational intervention.

Table (1): Socio-demographic data of the studied nurses (n=70)

Variables	N	%
Age years		
▪ 20-25	21	30.0
▪ 26-30	40	57.1
▪ > 30	9	12.9
Gender		
▪ Male	31	44.3
▪ Female	39	55.7
Level of education		
▪ Bachelor degree	37	52.9
▪ Technical degree	24	34.3
▪ Diploma degree	9	12.9
Experience years:		
▪ < 1	5	7.1
▪ 1-<5	40	57.1
▪ 5-<10	19	27.1
▪ ≥ 10	6	8.6
Attending training related electrocardiogram		
▪ Yes	0	0.0
▪ No	70	100.0
ospital		
▪ Main Mansoura university hospital	49	70.0
▪ Specialized medical hospital	21	30.0

Categorical data expressed as Number and (%)

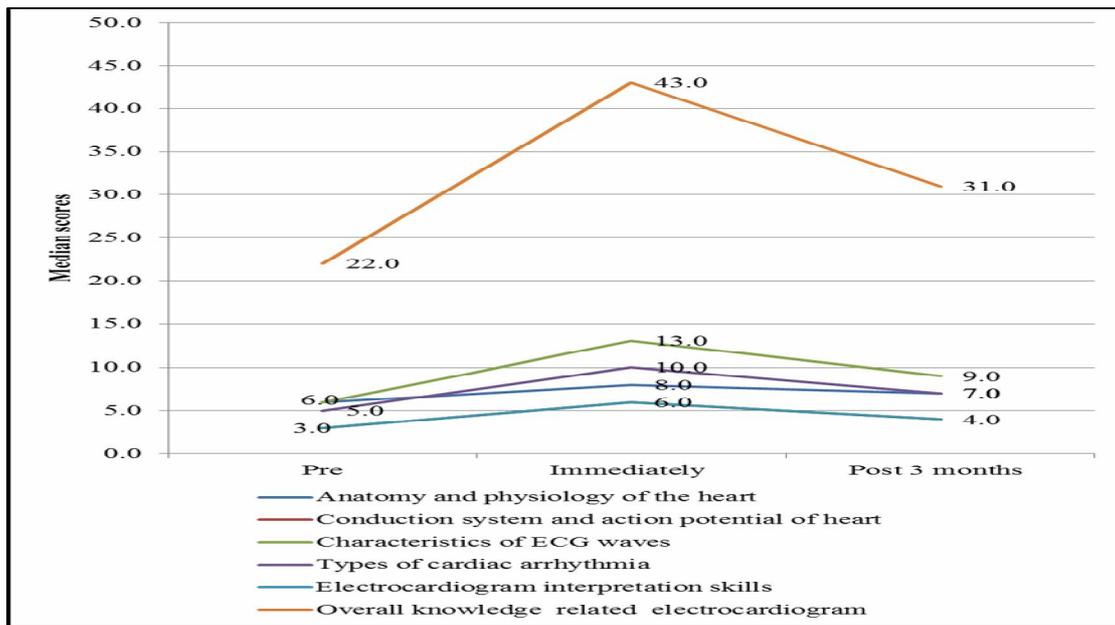


Figure (1): Knowledge of the studied nurses related electrocardiogram throughout phases of educational intervention.

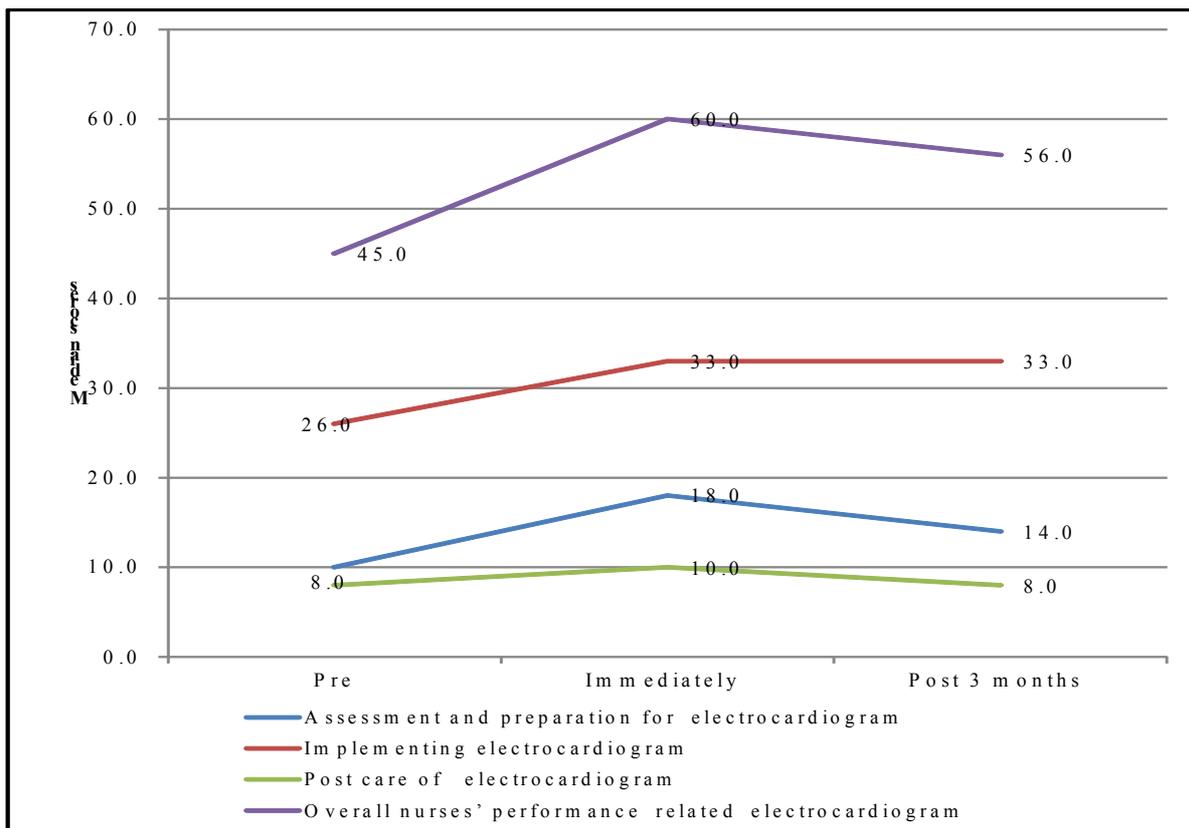


Figure (2): Skills of the studied nurses related electrocardiogram throughout phases of educational intervention

Table (2) Relationship between nurses' knowledge and skills related electrocardiogram throughout phases of educational intervention(n=70)

		Total nurses 'skills related electrocardiogram throughout phases of educational intervention	
		R	P
Total nurses' knowledge related electrocardiogram throughout phases of educational intervention	Pre	0.13	0.27
	Immediately	0.17	0.16
	Post 3 months	0.29	0.02*

*statistically significant $p \leq 0.05$

5. Discussion

Demographic characteristics of the studied nurses

More than half of the nurses in the study were between the ages of 26 and 30 years. This could be related to a recently graduated nurses has been assigned to the surgical cardiothoracic center. This is in accordance with Elsayed , Fekry and Metwaly (2020) who reported that the majority of the studied nurse their age between 20-29 year in their study .

As regard of the gender, this study revealed that slightly more than half of nurses in the study were female .This could be attributable to nursing education for males has only lately begun .This go in the same line with the results of Coll-Badell , Jiménez-Herrera & Llaurodo-Serra (2017) who discovered the majority of the nurses in their study were females) .

In relation to educational level, this study showed that slightly more than half of the studied nurses held a bachelor's degree in nursing education .This finding agrees with Al-Ahdal and Makki (2020) whom study revealed that majority of study sample had bachelor degree .

This study contradicted with Sabry Shehab, Mohamed Helmy and Ramadan Ali (2019) whom study revealed that less than two third of the study group had secondary education ,while minority of them only had a university education .

As regards to years of experience, more than half of the participants in this study had between one and five year. This finding is

consistent with Al.Ahdal and Makki (2020) who found that most of the studied sample had experience less than five years .

Findings of this study clarified that, all of the studied nurses hadn't attend any training courses regarding electrocardiogram. This result contradicted with El –sayed , Fekry and Metwaly (2020) who stated that majority of studied nurses had previously attended training courses regarding dysrhythmia interpretation. On the other hand this result is in accordance with Mohamed Weheida, Mhammed Ahmed and Gaad-Elmoula Sabaan (2016) who revealed that all of the studied sample had no service training courses related to ECG in their study and in accordance with Ahmed (2020) whose findings revealed that the minority of nurses had previous training program in ECG.

Nurses' knowledge regarding electrocardiogram

As related to nurses'knowledge regarding ECG there were statistically significant differences in overall nurses' ECG intervention knowledge. where $P= 0.000$, This result accept the 1st hypothesis that suggest that nurses who are involved in the educational intervention will exhibit a higher knowledge score regarding ECG post implementing the educational intervention

This finding is consistent with Sabry et al., (2019) who reported that majority sector of the study group had satisfactory ECG interpretation knowledge level in most items post test phase compared to pretest phase, but dropped in the follow up phase.

Nurses' skills regarding electrocardiogram

This study illustrate that there were statistically significant differences related

overall nurses' skills of electrocardiogram throughout different phases of educational intervention. This might be reflecting the positive impact of the educational intervention on improving nurses' performance regarding ECG. From the above mentioned result we can accept 2nd hypothesis that proposed that nurses who are involved in the educational intervention will exhibit a higher score in performing ECG procedure post implementing the educational intervention. This result is in the same line with Malk and Hassan (2018) who found that the majority of nurses lacked adequate skills in performing ECG procedure in their study, that evaluate nurses' practice regarding electrocardiogram procedure.

Relation between nurses' knowledge and practice regarding ECG

This study show that that there was no relationship between nurses' knowledge and performance related electrocardiogram before and immediately after educational intervention. Whereas there was relationship between nurses' knowledge and performance related electrocardiogram after 3 months of educational intervention. This findings agree with Ahmed, Muhammad, Ali, Muhammad and Mehany (2019) who found no statistically significance relation between total nurses' knowledge and practice. In contrast at the study of Nabil Malk, Mostafa Rezk, Said Mohammad & Fouad Abd-Allah (2018) revealed that there were a positive correlation between nurses' knowledge and skills at pre, post and follow up educational intervention.

6. Conclusion

Prior to the educational intervention, The nurses were performing poorly in ECG knowledge and skills regarding. Meanwhile, following the educational intervention, the majority of the studied nurses showed statistically significant improvement in their knowledge and skills performance. It demonstrates that the education intervention conducted in study served as reinforcement mechanism for the nurses, while improvement diminished marginally after three months of follow up, confirming the study hypothesis.

7. Recommendations

The following recommendations can be made based on the findings of this study:

- 1- Continuous ECG in-service training programs to keep nurses' ECG knowledge and skills up to date.
- 2-Further researches suggested that the educational training program be implemented on a broader sample of nurses from various geographical locations of Egypt in order to improve the efficiency of nurses knowledge and skills regarding ECG.
- 3-Encourage nurses to attend in sessions both inside and outside the country to further their knowledge.

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9. Conflict of interest

The authors have no conflict of interest to declare.

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Nil

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