Effect of Implementing Educational Program about Electrocardiography Interpretation on Internship Nursing Students' Performance at Intensive Care Units

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Abstract: **The role transition from student to newly professional nurse can be stressful. Nursing internship students may find themselves in situations that are prepared inadequately. As a rapidly advancing profession, nursing demands higher cognitive skills from nurses to provide direct and complex care more rapidly in life threatening situation such as ECG interpretation. In hospital, at critical care units, the nurse is the person most involved with ECG monitoring. Nurses should have sufficient knowledge in ECG interpretation to maximize the quality of care and patient outcomes. Aim: To evaluate the effect of implementing educational program about electrocardiogram interpretation on internship nursing students' performance at intensive care units. Method: A quasi-experimental research study with one-group pretest and posttest assessments was used in conducting the present study. The study involved all internship nursing students (N= 200). The nursing interns were trained in the various areas of Anesthesia Intensive Care Units, cardiology, neurology, medical and oncology, hemodialysis, burn and operating room. Data were collected using the Socio-demographic Data of Nurses' internship, Internship Nursing Students' Knowledge Assessment Sheet and Internship Nursing Students' Observational Checklist. Results: It was observed that the total knowledge score was 25.92±13.92 pre implementation and it was 43.15±2.70 immediately after educational program and was decreased to 35.31±5.34 after three months with a significant difference ,while P=0.000. About one quarter (24.5%) of the sample had high knowledge score pre educational program compared to the vast majority (99.0%) of them immediately after program and the percentage was decreased to (41.5%) post three months of program. Also, most (75.0%) of the sample had unsatisfactory level of practice score pre educational program. On the other hand, the majority (99.0%) of them had satisfactory level immediately after program and the percentage was (77.5%) after three months from implementation of the program. P= 0.000. Conclusion: It can be concluded that educational program was beneficial in improving nurses' internship students' knowledge and practice toward electrocardiogram interpretation. Recommendation: There should be a continuous in–service training program for updating the knowledge and skills of nurses 'internship students**

Keywords: **'internship students, ECG interpretation.**

I. INTRODUCTION

Nursing internship students start the role of professional nurse though an internship training program. Internship is defined as a form of empirical learning that integrates knowledge and theory learned in the classroom with practical application and skills development in the professional setting. The role transition from student to newly professional nurse

can be stressful. Nursing internship students may find themselves in situations that are inadequately prepared. As a rapidly advancing profession, nursing demands higher cognitive skills from nurses to provide direct and complex care more rapidly in life threatening situation such as ECG interpretation[1].

The electrocardiogram (ECG) is one of the most widely and useful investigations tool used in many specialties, including cardiology, internal medicine, emergency & Intensive Care Units. In addition, the electrocardiogram is essential for the identification of disorders of the cardiac rhythm, in various general conditions like cardiac disorders, injury, poisoning, accidents, drowning, surgical complications and electrolyte disturbance. However, it is specifically useful for the diagnosis of abnormalities of the heart such as myocardial infarction (M.I) and coronary artery disease. Recording & interpreted of (ECG) done by skilled nurses in many specialties, its interpretation vary among staff nurses working in Intensive Care Units [2]. Therefore, an adequate nurses' knowledge & practice should include improvement their ability to define and recognize the basic pathophysiology of certain electrocardiographic abnormalities [3].

In addition, changes in practice have made knowledge of the basic ECG interpretation is very important because Intensive Care Unit (ICU) nurses are required to manage an increasing number of patients undergoing cardiac disorders and intravenous (I.V) conscious sedation who require ECG monitoring. Rapid ECG interpretation can reveal arrhythmias before a patient becomes symptomatic. Also it can reveal underlying cardiac problems and uncover electrolyte imbalance that, if left untreated could cost the life of patient [4, 5].

Nurses'internship performance of ECG identification from classroom lecture & faculty lab gradually decreases when they leave the classroom. Although nursing internship may be comfortable in learning theoretical knowledge from classroom lectures, however, they can become apprehensive when applying this knowledge during the clinical experience [6]. The gap between nurses'internship knowledge and applying knowledge at the bedside is reflective of the disconnect between the skills and knowledge learned under supervision in an academic faculties and those skills needed for safe, independent function at the patient's bedside [7, 8].

Electrocardiogram (ECG) interpretation is a complex subject that requires considerable experience. The nurse should understand the principles underlying generation of the ECG that make this learning process easier [9]. In order to interpret the ECG, nurses'internship should understand the events that reinforce the cardiac cycle of contraction and relaxation. The Sino atrial node (SA) is the dominant pacemaker in the heart. It fires spontaneously at a rate of 60-100 beats per minute, and a wave of depolarization begins to spread outward into the atrium myocardial cells. The depolarization of these cells results in atrial contraction and is reflected as the P wave on the ECG strip. Then, the ventricular myocardial cells depolarize, causing a ventricular contraction that is reflected as the QRS complex on the ECG strip. Ventricular repolarization is the final step and is reflected by a T wave on the ECG strip [10]. The other key component that the researchers believe is important for ECG interpretation is to determine the rhythm. Rhythms can originate from within the atria, junctional or ventricular areas and may occur because of a problem with the electrical conduction of the heart, a mechanical problem with the heart, or some imbalance with homeostasis [11]. Nurse' internship must participate in ongoing educational activities to acquire knowledge and skills needed, such as ECG strip interpretation. These experiences should reflect current clinical practice in order to maintain current clinical skills and competencies to care for acutely and critically ill patients [12-13]. Therefore, the aim of this study is to evaluate the effect of implementing educational program about electrocardiography interpretation on internship-nursing students' performance at Intensive Care Units.

Significant of the study: In order to provide safe, competent care, nurses' internship has difficulty interpreting (ECG) rhythms. They have minimal clinical practice opportunity for applying this knowledge [5]. Hospitals environment often lacks application and practice opportunities. This lack of clinical experience may result in difficulty in identifying ECG rhythms, which directly affects patient care [14]. There are minority of researches assess nurse's internship performance toward (ECG) interpretation and In Tanta; there is a lack of studies to improve nursing performance about recording & interpreting of (ECG). To refresh (ECG) reading knowledge, prevent knowledge decay, and maintain improved knowledge, with the goal of better quality of care and patient outcomes. Thus, the objective of this study was to evaluate the effect of implementing educational program about electrocardiography interpretation on internship-nursing students' performance at intensive care units.

II.   MATERIAL AND METHODS

Aim of the study:

The aim of the study is to evaluate the effect of implementing educational program about electrocardiography interpretation on internship-nursing students' performance at intensive care units.

Research hypothesis:

1-The post mean knowledge scores of internship nursing students who are exposed to educational program about electrocardiogram interpretation will be higher than their pre knowledge mean scores.

2- The post-mean practice scores of internship nursing students who are exposed to educational program about electrocardiogram interpretation will be higher than their pre practice scores.

III.   SUBJECTS AND METHODS

Research design: A quasi-experimental research study with one-group pretest and posttest assessments was used in conducting the present study.

Setting: The study was carried out at Intensive Care Units at Tanta university hospital .

Subjects: All internship nursing students (N= 200) was included in the study. An internship year begins at the fifth year of the bachelor of nursing program under supervision of the Nursing Administration Department. The nursing interns were trained in the various areas of anesthesia intensive care units, cardiology, neurology, medical and oncology, hemodialysis, burn and operating room.

Tools for data collection

Two tools will be used in this study:

Tool I: Internship Nursing Students' Structured Interview Questionnaire [15-16], it was developed by the researchers after reviewing relevant literature to collect data pertinent to the current study. It consisted of two parts

Part (1): Socio-demographic characteristics of nurses' internship . It was used to assess data related to age, sex, marital status, interesting in ECG reading and previous in-service program about ECG interpretation.

Part (2): Internship Nursing Students' Knowledge Assessment Sheet. This part was used to assess nurses' knowledge related to definitions and indication of ECG, conduction system of heart, basic normal ECG waveform morphology, identified the characteristics of a normal ECG, normal durations and amplitudes of the ECG, anatomical relations of leads in a standard 12 lead electrocardiogram, determine heart rate on the ECG, cardiac axis determination. The characteristics of normal sinus rhythm , identified common abnormalities in ECG recording, which included specific ECG change in cardiac ischemia, myocardial infarction, prolonged, short PR-interval and P wave not followed by a QRS on ECG, atrial flutter, fibrillation, ventricular premature beats, ventricular tachycardia and fibrillation.

Scoring system

Three level of scoring for questions was utilized as follows:

- Correct and complete answer scored (2)

- Correct and incomplete answer scored (1)

- Incorrect answer scored (0)

The total scoring system of nurses' knowledge was calculated and classified as the following:-

-More than 75% was considered high level of knowledge.

-More than or equal $\geq$ 60% - 75% was considered moderate level of knowledge.

- Less than   60% was considered low level of knowledge.

Tools(II):**Internship Nursing Students' Observational Checklist about ECG Interpretation** [9,15,16]: It was developed by the researchers after reviewing of related literature to assess the actual nursing practice pre, immediate and 3months later post implementation of educational program about ECG interpretations as the following; preparation of patient and

ECG machine, identify location of limb electrode- limb and chest leads, obtain a rhythm strip in the patient record, identify immediate life-threatening abnormalities as sinus arrhythmia, atrial dysrhythmia, heart block and ventricular dysrhythmias.

Scoring system:

Each item was scored as follows:

- Done correctly was assigned a score of (2)

- Done correctly and incompletely was assigned a score of (1)

- Not done was assigned a score of (0)

Total practice score was classified into:

-The total score of practice more than 70% will be considered satisfactory practice level.

-The total score of practice less than 70% will be considered unsatisfactory practice level.

Method

- Ethical consideration:

-Written consent was obtained from every internship nurse students was included in this study after explanation of the aim of the study and assuring them of confidentiality of collected data.

-Confidentiality and anonymity was maintained and the right of withdrawal was reserved. Privacy of the studied internship nurses students was maintained.

Tools validity and reliability:

-The developed knowledge questionnaire and observational checklist tools were reviewed by five panel of experts in critical care and medical surgical nursing to ensure its validity.

-The reliability of the knowledge was confirmed by alpha Crobach and the performance checklist was tested and retested and its items were significantly correlated with Pearson correlation (r=0.891, p 0.00).

Pilot Study:

A pilot study was conducted on (10%) of nurses' internship to test the clarity, applicability, feasibility & relevance of the tools used. Modifications on tools were done.

Administrative Design

To carry out the study, permission for data collection was obtained from the director of Tanta university hospital.

Fieldwork

Data were collected from the beginning July 2019 to the end of December 2019. Each nurse' internship was observed by the researcher while they were doing the ECG procedure; the time allowed was 15 minutes. The researcher was attended to the setting 3 days per week in the morning and afternoon shift. Data collection was conducted throughout the following phases:

Assessment phase: throughout this phase, data will be collected by the previously mentioned tool through meeting nurses' internship at ICU to collect the baseline data as a pre intervention assessment. Assessment of nurse's knowledge and practice will be used three times; before, immediately after and 3 months after the educational program.

Planning phase:

-According to the results of the pretest and extensive review of literature, the educational program on ECG interpretation was designed.

-Illustrated color booklet was prepared and written in simple Arabic language.

-The booklet was revised by experts in medical surgical and critical care nursing field.   -Different teaching methods were used as booklet, video, group discussion and power point, demonstration and re-demonstration.

- The educational program was conducted in eight sessions for nurses who are divided into (10) subgroups, 20 nurses in each group, four days per week and time of each session will be about 30 minutes.

Implementation phase.

The researchers will implement the educational program for all study subjects as the following:

For theoretical part: Four sessions will be used for four consecutive days 30 minutes for each session. *Session one* of the program consists of explaining aim of the study, definitions and indications of ECG , conduction system of the heart and basic normal ECG waveform morphology; *Session two* consists of identified the characteristics of a normal ECG, normal durations and amplitudes of The ECG, anatomical relations of leads in a standard 12 lead electrocardiogram and determine heart rate on the ECG; *Session three* consisted of cardiac axis determination and the characteristics of normal sinus rhythm and common abnormalities in ECG recording; *Session four* was carried out for revision and open discussion between researchers and subjects. Each nurse was supplemented with the knowledge booklet and received printed materials with guidelines after each session. During the classes, nurses were encouraged to ask questions and provide feedback. Communication was kept open between the researchers and the nurses. Teaching methods utilized were lectures, booklets, lab top and power point was prepared by the researcher based on literature review.

For the practical part: four sessions will be used for four consecutive days 30 minutes for each session. Subjects were divided into small groups (20 nurses) in each group. *Session one* included, preparation of patient and ECG machine, identify location of limb electrode- limb and chest leads; *Session two* covered obtain a rhythm strip in the patient record ; *Session three* included identify immediate life-threatening abnormalities as sinus arrhythmia, atrial dysrhythmia, heart block and ventricular dysrhythmias. *Session four* was carried out for revision and open discussion between researchers and subjects. Each nurse was supplemented with booklet and received printed materials with guidelines after each session. During the classes, nurses were encouraged to ask questions and provide feedback. Communication was kept open between the researchers and the nurses. Teaching methods utilized were demonstration and re-demonstration where used as Educational methods and aids.

Evaluation phase

Evaluate the effect of implementing educational program about ECG interpretation on nurses' internship performance at Intensive Care Unit by using Tool I, II for nurses' internship three times pretest, immediate and follow up three months after program implementation.

Statistical analysis:

The analysis was performed using statistical software SPSS version 25. For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, a comparison between one group before and after intervention was done by using Chi-square test ($\chi 2$). For a comparison between more than two means, the F-value of ANOVA was calculated. A significance was adopted at $P<0.05$ for interpretation of results of tests of significance [17].

IV. RESULTS

Figure (1): Distribution of the studied Internship Nursing Students according to their sociodemographic characteristics.
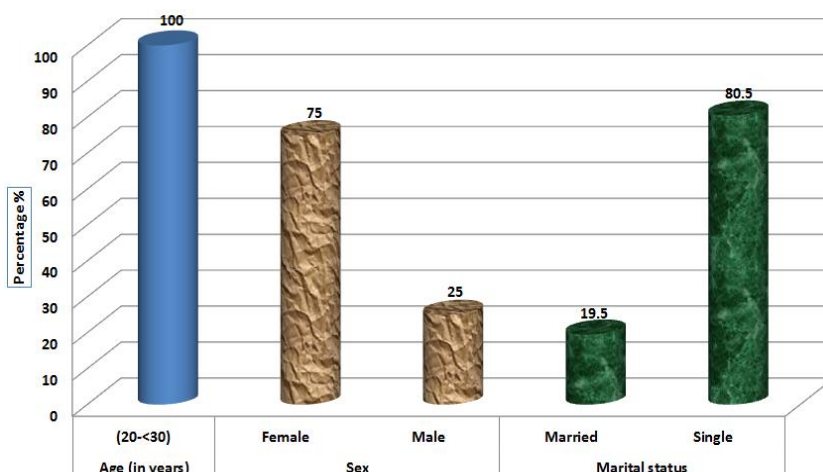
Figure (2): Distribution of the studied Internship Nursing Students according to their previous training program and their interest in ECG interpretation
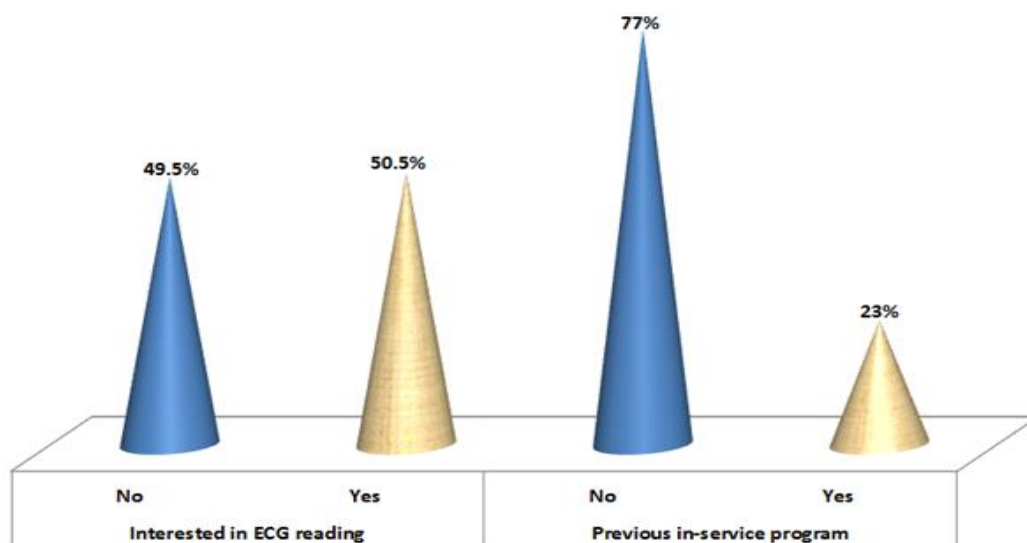

Figure (1, 2) shows distribution of the studied Internship Nursing Students according to their sociodemographic characteristics. In this table, it was observed that all sample was between 20 to less than 30 years old. Also, most (75%) and (80.5%) of the sample were female and single. In addition, about half (50.5%) of the sample are interested in ECG reading and the majority (77.0%) of them didn't had previous training program about ECG interpretation.

Table (1): Mean scores of total knowledge domains of the studied Internship nursing students about ECG interpretation throughout periods of study

Knowledge domains	The studied nurses Range Mean ± SD			F P
	Pre	**Immediately**	**Post three months**	
1. Definitions and indication of ECG	(0-3) 1.99±0.77	(2-3) 2.79±0.41	(1-3) 2.44±0.53	**93.75 0.000***
2. Cardiac electrophysiology	(0-6) 3.38±2.04	(1-6) 5.74±0.66	(2-6) 4.70±1.14	**142.01 0.000***
3. Basic normal ECG wave form morphology	(0-5) 3.79±1.79	(4-5) 5.00±0.07	(3-5) 4.78±0.43	**73.49 0.000***
4. Normal durations and Amplitudes of ECG	(0-7) 3.22±2.20	(2-7) 6.63±0.77	(1-7) 4.76±1.26	**248.01 0.000***
5. Anatomical relations of leads in a standard 12 lead electrocardiogram	(0-8) 4.09±2.73	(4-8) 6.38±1.33	(2-8) 5.58±1.70	**67.30 0.000***
6. Determine heart rate on ECG	(0-2) 1.29±0.79	(1-2) 1.85±0.36	(0-2) 1.77±0.44	**57.98 0.000***
7. Cardiac axis determination	(0-6) 2.32±1.74	(3-6) 4.46±0.79	(1-6) 3.45±1.00	**147.01 0.000***
8. characteristics of normal sinus rhythm	(0-2) 1.07±0.73	(1-2) 1.81±0.39	(0-2) 1.39±0.56	**83.52 0.000***
9. Identified common abnormalities in ECG recording	(0-9) 4.80±2.92	(2-9) 8.52±0.90	(2-9) 6.46±1.87	**162.44 0.000***
Total knowledge score	**(0-44) 25.92±13.92**	**(26-48)**	**(24-44) 35.31±5.34**	**194.48 0.000***

* Significant at level P<0.05.

Table (1) represents the mean scores of total knowledge domains of the studied Internship nursing students about ECG interpretation throughout periods of study. In this table, significant differences were observed regarding knowledge domains which include definitions and indication of ECG, cardiac electrophysiology, basic normal ECG wave form morphology, normal durations and amplitudes of ECG, anatomical relations of leads in a standard 12 lead electrocardiogram, determine heart rate on ECG, cardiac axis determination, characteristics of normal sinus rhythm and identified common abnormalities in ECG recording where P= 0.000. Moreover, the mean of total knowledge score was 25.92±13.92 pre implementation and it was 43.15±2.70 immediately after educational program and was decreased to 35.31±5.34 after three months with a significant difference, while P=0.000.

Table (2): Distribution of the studied Internship nursing students regarding their total knowledge level about ECG interpretation throughout periods of study

Total Knowledge Level	The studied nurses (n=200)						χ^2 P
	Pre		Immediately		Post three months		
	N	%	N	%	N	%	
▪ Low ▪ Moderate ▪ High	78 73 49	39.0 36.5 24.5	1 1 198	0.5 0.5 99.0	22 95 83	11.0 47.5 41.5	290.79 0.000*

<60% Poor   (60-75) % Fair   >75% Good

* Significant at level P<0.05.

Table (2) shows distribution of the studied Internship nursing students regarding their total knowledge level about ECG interpretation throughout periods of study. In this table, about one quarter (24.5%) of the sample had high knowledge score pre educational program compared to the vast majority (99.0%) of them immediately after program and the percentage was decreased to (41.5%) post three months of program with a significant difference was observed while P= 0.000.

Table (3): Mean scores of total practice domains of the studied Internship nursing students about ECG interpretation throughout periods of study

Practice domains	The studied nurses(n=200) Range Mean ± SD			χ^2 P
	Pre	Immediately	Post three months	
1. preparation of patient and ECG machine	(2-9) 5.43±1.31	(6-10) 9.26±1.52	(2-10) 7.82±1.90	295.79 0.000*
2. Identify Location of limb electrode	(2-4) 2.93±0.71	(4-4) 4.00±0.00	(0-4) 3.29±1.18	93.09 0.000*
3. Identify Location of chest electrode	(1-12) 7.14±2.35	(11-12) 11.97±0.18	(6-12) 11.75±0.85	712.56 0.000*
4. Obtain a rhythm strip in the patient record	(0-3) 1.13±0.94	(2-6) 3.45±0.75	(1-5) 2.93±0.82	416.99 0.000*
5. identify immediate life-threatening abnormalities	(0-4) 1.58±1.48	(2-8) 4.75±1.29	(0-8) 4.05±1.54	268.41 0.000*
Total practice score	**(11-33)** **20.14±6.23**	**(26-38)** **33.42±2.23**	**(20-39)** **29.84±3.12**	530.42 0.000*

* Significant at level P<0.05.

Table (3) represents the mean scores of total practice domains of the studied Internship nursing students about ECG interpretation throughout periods of study

In this table, significant differences were observed among the sample regarding practice domains which include preparation of patient and ECG machine, identify location of limb electrode, identify location of chest electrode, obtain a

rhythm strip in the patient record, and identify immediate life-threatening abnormalities where P= 0.000. Also, the total mean score of practice was (20.14±6.23) pre educational program and was (33.42±2.23) immediately after implementation and decreased to (29.84±3.12) post three months of implementation with p value was 0.000.

Table (4): Distribution of the studied Internship nursing students regarding their total practice level about ECG interpretation throughout periods of study

Total practice level	The studied nurses (n=200)						χ^2 P
	Pre		Immediately		Post 3 months		
	N	%	N	%	N	%	
▪ Unsatisfactory	150	75.0	2	1.0	45	22.5	**262.83**
▪ Satisfactory	50	25.0	198	99.0	155	77.5	**0.000***

<70% Unsatisfactory   ≥70% Satisfactory

* Significant at level P<0.05.

Table (4) shows distribution of the studied Internship nursing students regarding their total practice level about ECG interpretation throughout periods of study

In this table, it was observed that most (75.0%) of the sample had unsatisfactory level of practice score pre educational program. On the other hand, the majority (99.0%) of them had satisfactory level immediately after program and the percentage was (77.5%) after three months from implementation of the program. P= 0.000.

Table (5): Percent comparison and correlation between total knowledge level and total practice level of the studied Internship nursing students about ECG interpretation throughout periods of study

Total knowledge level	The studied nurses (n=200) Total practice level				χ^2 P
	Unsatisfactory		Satisfactory		
	N	%	N	%	
Pre					
▪ Low	55	27.5	23	11.5	4.061
▪ Moderate	53	26.5	20	10.0	0.131
▪ High	42	21.0	7	3.4	
r , P	0.055 , 0.438				
Immediately					
▪ Low	1	0.5	0	0.0	**200.00**
▪ Moderate	1	0.5	0	0.0	**0.000***
▪ High	0	0.0	198	99.0	
r , P	**0.352 , 0.000****				
Post three months					
▪ Low	8	4.0	14	7.0	**19.118**
▪ Moderate	31	15.5	64	32.0	**0.000***
▪ High	6	3.0	77	38.5	
r , P	**0.420 , 0.000****				

* Significant at level P<0.05.

** Highly significant at level P<0.01.

Table (5) represents percent comparison and correlation between total knowledge level and total practice level of the studied Internship nursing students about ECG interpretation throughout periods of study. It was observed that no significant correlation was observed regarding total knowledge and practices scores before implementation of educational program where r= 0.055 and P= 0.438. On the other hand, a highly and positive correlations were observed among the sample in relation to total knowledge and practice scores with r =0.000 immediately and after three months of the program.

Table (6): Percent comparison between Socio-demographic characteristics of the studied Internship nursing students and their total knowledge level about ECG interpretation throughout periods of study

Characteristics	Studied sample (n=200) Total knowledge score											
	Pre						Post three months					
	low		moderate		high		low		moderate		high	
	N	%	N	%	N	%	N	%	N	%	N	%
Sex												
▪ Female	62	31.0	53	26.5	35	17.5	11	5.5	87	43.5	52	26.0
▪ Male	16	8.0	20	10.0	14	7.0	11	5.5	8	4.0	31	15.5
χ^2 , P	1.395 , 0.498						**28.011 , 0.000***					
Marital status												
▪ Married	11	5.5	16	8.0	12	6.0	3	1.5	31	15.5	5	2.5
▪ Single	67	33.5	57	28.5	37	18.5	19	9.5	64	32.0	78	39.0
χ^2 , P	2.497 , 0.287						**20.52 , 0.000***					
Interested in ECG reading												
▪ No	43	21.5	32	16.0	24	12.0	15	7.5	59	29.5	25	12.5
▪ Yes	35	17.5	41	20.5	25	12.5	7	3.5	36	18.0	58	29.0
χ^2 , P	1.931 , 0.381						**21.58 , 0.000***					
Previous in-service program about ECG interpretation												
▪ No	63	31.5	55	27.5	36	18.0	22	11.0	91	45.5	41	20.5
▪ Yes	15	7.5	18	9.0	13	6.5	0	0.0	4	2.0	42	21.0
χ^2 , P	1.084 , 0.582						**61.216 , 0.000***					

* Significant at level $P<0.05$.

Table (6) represents percent comparison between Socio-demographic characteristics of the studied Internship nursing students and their total knowledge level about ECG interpretation throughout periods of study. In this table, no statistical significant difference was observed among the sample in relation to sex and total knowledge score before educational program. On the other hand, near to half (43.5%) of the female internship nurses had moderate level of knowledge compared to only (4.0%) of male one after three months with a significant difference where p= 0.000. Moreover, More than one third (39.0%) of the sample was single and had high level of knowledge compared to only (2.5%) of married one with p= 0.000. Also, a significant difference was found regarding previous training program after three months from implementation of the program with p= 0.000. More than one quarter (29.0%) of the sample that were interested in ECG interpretation had good level of knowledge compared with only (12.5%) of sample that not interested with p= 0.000

Table (7): Percent comparison between Socio-demographic of the studied Internship nursing students and their total practice level about ECG interpretation throughout periods of study

Characteristics	Studied sample (n=200) Total practice score							
	Pre				Post three months			
	Unsatisfactory		Satisfactory		Unsatisfactory		Satisfactory	
	N	%	N	%	N	%	N	%
Sex								
▪ Female (150)	114	57.0	36	18.0	37	18.5	113	56.5
▪ Male (50)	36	18.0	14	7.0	8	4.0	42	21.0
χ^2 , P	FE , 0.576				FE , 0.244			
Marital status								
▪ Married (39)	30	15.0	9	4.5	12	6.0	27	13.5
▪ Single (161)	120	60.0	41	20.0	33	16.5	128	64.0
χ^2 , P	FE , 0.839				FE , 0.200			

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Interested in ECG reading								
▪ No (99)	76	38.0	23	11.5	23	11.5	76	38.0
▪ Yes (101)	74	37.0	27	13.5	22	11.0	79	39.5
χ^2 , P	FE , 0.626				FE , 0.866			
Previous in-service program about ECG interpretation								
▪ No (154)	120	60.0	34	17.0	41	20.5	113	56.5
▪ Yes (46)	30	15.0	16	8.0	4	2.0	42	21.0
χ^2 , P	FE , 0.085				**FE , 0.009***			

* Significant at level P<0.05.

Table (7) shows percent comparison between Socio-demographic characteristics of the studied Internship nursing students and their total practice level about ECG interpretation throughout periods of study. In this table, it was observed that no significant differences were observed among the sample in relation to sex, marital status, and interesting in ECG interpretation before and after implementation of educational program. On the other hand, more than half (56.5%) of the sample that hadn't training program about ECG had satisfactory practice level compared to (21.0%) of them that had training program with a significant different where p= 0.009.

V. DISCUSSION

All nursing internship students take their training in Intensive Care Units in different areas of hospital. As a rapidly advancing profession, nursing demands higher cognitive skills from nurses to provide direct and complex care more rapidly in life threatening situation such as ECG interpretation. In hospital critical care units, the nurse is the person most involved with ECG monitoring. Nurses should have sufficient knowledge in ECG interpretation to maximize the quality of care and patient outcomes [1, 18, 19].Therefore, the aim of this study is to evaluate the effect of implementation of educational program about electrocardiogram interpretation on internship nursing students' performance at intensive care units.

The current study showed that all internship students' nurse age was in between 20 to less than 30 years old, most of them were female and single. This result was supported by **Keshk et al (2018)** [20] who stated that majority of internship student's nurse were female and their age range in between 23-25 years.

In addition, the present finding revealed that minority of students' nurses had previous training program in ECG and about half of the sample was interested in electrocardiogram (ECG) reading. This emphasized the importance of educational program about ECG interpretation for internship nurses' students. Similarly, **Eslava et al (2009)** [21] emphasized on the importance of included the structured curricula and educational program about ECG interpretation for medical students and nurses working in hospital of different specialties, including emergency department and cardiology,

As regard the mean scores of total knowledge domains of the ECG interpretation**,** the present finding revealed a significant improvement of knowledge scores among studied internship nurses students regarding definitions and indication of ECG, cardiac electrophysiology, basic normal ECG wave morphology, determination of heart rate, characteristics of normal sinus rhythm and common abnormalities in ECG recording immediately after educational program compared with preprogram implementation. This may be due to the complexity of ECG interpretation, and the interpretation of ECG wasn't included in undergraduate curriculum. However, following educational program, nurses' knowledge was improved significantly. This indicated to the effectiveness of educational program and the researcher had suitable learning media and material for teaching. In the same way **Sasikala (2019)** [22] mentioned that structured educational program was effective on improving critical care nurses' knowledge, regarding interpretation of Electrocardiogram.

However, after three months, the mean scores of these items were decreased. This is interpreted that the majority of nurses have no time to refresh their knowledge about ECG interpretation. In the same line, **Funk et al (2010)**[23] reported that the mean scores of nurses ' knowledge was decreased after 2 months of educational program in comparison with immediate mean scores and emphasized the importance of developing timely re-education programs and in-service training to refresh ECG interpretation knowledge.

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Concerning internship students' nurse total knowledge level , the current study showed that more than one third of the sample had low knowledge score pre educational program compared to the vast majority of them had high knowledge score immediately after program and this percentage was decreased post three months of educational program. This might be attributed that ECG interpretation wasn't incorporated in details in nursing curriculum and the educational program makes refreshment in nurses' knowledge.

This finding goes in the same line with **Antiperovitch et al (2018)** [24] they reported that the comprehensive ECG interpretation not included in medical and nursing education curriculum. They emphasized the importance of development of organized curricula that including ECG interpretation in undergraduate and postgraduate medical educational programs. In addition, **Celikkan et al (2013)** [5] mentioned that nursing students' knowledge retention of ECG identification from classroom lecture gradually decreases when students leave the classroom.

As regard mean scores of total practice domains of the studied internship students, the current results showed a significant improvement of practice mean scores of studied internship nurses regarding preparation of patient and ECG machine, identify Location of limb electrode and chest electrode, obtain a rhythm strip in the patient record, and identify immediate life-threatening abnormalities after educational program compared with preprogram implementation. This may be attributed to the educational program makes refreshment in nurses' knowledge, which in turn leads to improvement in their practice. This result was agreed with **Richley (2016)** [25] **and Cvach et al (2012)** [26] who reported that improvement of nurses practice regarding preparation of patient and ECG machine and stated that preparation of patients 'skin prior to electrode application enhances conductivity by promoting adhesion and skin-electrode contact. Similarly, **Hassan et al (2013)** [27] found that significant improvement of study group post implementing educational program compared with pre-test in main domains related to observational check of items of nurses' practice in preparation the ECG machine and patients ,correct placement of limb and chest electrodes.

In relation to total practice level of the studied nurses 'internship**,** the present finding showed that most of the studied nurses 'internship had unsatisfactory level of practice score pre educational program. One explanation for this result that the overlapping of work and nurses have no time to refresh their knowledge and practice and the majority of the sample had not received in-service training program about ECG reading. This finding agreed with **Sheilini and Devi (2014)** [28] they stated that the majority of the studied nurse had an unsatisfactory level of practice about ECG procedure before program implementation.

On the other hand, the majority of the sample had satisfactory level immediately after educational program implementation and the percentage was decreased in little percentage after three months from implementation of the program. One explanation for the low level of proficiency that the majority of the sample had not received formal instruction regarding clinical procedure of ECG and ECG interpretation before this study and implementation of educational program improved their practice.

This finding was supported by **Pickham et al (2014)** [29] who found that nurses' ability to read ECG was improved after educational program. In the same line, **Winkler et al (2009)** [30] reported that conducting a structured educational programme on ECG interpretation enhance nurses' knowledge and practice about ECG reading and help them to identify and manage the cardiac arrhythmia.

Concerning correlation between total knowledge and practice level among the studied nurses about ECG interpretation, No significant correlation was observed before implementing educational program. This result was supported by **Jablonover et al (2014)** [31] who concluded that graduating interns had a low level of competency in ECG reading in pretest phase.

On the other hand, high and positive correlations were observed among the sample in relation to total knowledge and practice scores immediately and after three months of the program where there's improvement in their practice and knowledge scores immediately and after three months of the program. This result may be attributed to the educational program refreshing knowledge and practice of nurses' students. The same finding was indicated by **Mohamed (2011)** [32] in Ain Shams University". They concluded that the majority of nurses had unsatisfactory knowledge and practice about ECG reading before implementation of program and after applying the standards there was improvement in practice and knowledge score. Also **Ayed** et **al (2015)** [33] mentioned that providing educational training programs for newly nurses improve nurses' knowledge and practice.

Regarding comparison between socio characteristics of the studied nurses and their total knowledge level about ECG interpretation, the present result revealed that nearly half of the female internship nurses had moderate level of knowledge compared to low percentage of male nurses after three months and more than one third of single nurses had high level of knowledge compared to low percentage of married one this because that single nurses may have time and effort to develop and increase their knowledge than married one. Moreover, most of studied nurses' internship that had previous training program and interested in ECG interpretation had high level of knowledge after three months from implementation of the program. This result was similar with **Alghamdi et al(2018)[34]** who concluded that previous in-service training program in ECG courses and interest in ECG reading were associated with higher scores knowledge compared to pre program education.

Concerning comparison between socio characteristics of the studied nurses and their total practice level. The current result showed that no significant differences were observed among the sample in relation to sex, marital status, and interesting in ECG interpretation before and after implementation of educational program. In contrast, **Störmann et al (2016)** [35] reported that gender had influence on ECG interpretation.

According to comparison between studied nurses' total practice level and previous training program, the present result showed that the studied nurses' internship that hadn't previous training program about ECG had satisfactory practice level this may be due to small number of nurses that had previous training program about ECG. In this regard Alghamdi **et al (2018)** [34] stated that self-learning, in-service training program in ECG interpretation were associated with better performance**.** Finally, Electrocardiographic reading are important required clinical skills n all intensive care units (ICUs). Therefore, there should be continuous refreshment program for internship nurses about ECG interpretation [36].

VI. CONCLUSION AND RECOMMENDATIONS

Conclusion:

It can be concluded that educational program was beneficial in improving nurses' internship students' knowledge and practice toward electrocardiogram interpretation. As well as no significant differences were observed among the sample in relation to sex, marital status, and interesting in ECG interpretation before and after implementation of educational program.

Recommendations:

- There should be a continuous in–service training program for updating the knowledge and skills of nurses 'internship students.

- During academic studies, the students should have course outline about ECG interpretation

- Routinely refreshment program on regarding ECG should be offered on simple media to internship nursing students

- Establishing booklet guideline for nurses about regarding ECG.

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