12-Leads Electrocardiogram Interpretation Competency among Nurses working in Critical Care Areas at Dow University Hospital, Karachi

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ABSTRACT

OBJECTIVE: To assess the 12-Lead Electrocardiograph (ECG) interpretation competency level of nurses working in the critical care units of Dow University Hospital, Karachi.

METHODOLOGY: The descriptive cross-sectional design study was conducted from October to December 2019. The purposive sampling technique was used to include the participants. The study sample constitutes 120 registered nurses from the critical care units of Dow University Hospital (DUH), including the intensive care unit (ICU), coronary care unit (CCU), and emergency department(ED). Full-time Registered nurses with more than one year of professional experience and currently working in critical care units of Dow University Hospital were included, and those with post-basic-cardiology specialization were excluded. Data were collected through a 12-item validated study questionnaire and analyzed through descriptive statistics using SPSS version 21.0.

RESULTS: Most of the participants, 84 (70.0%) in this study, were male, and 46(38.3%) of the nurses have completed Post RN-BS Nursing (post-diploma two years undergraduate nursing degree program) as the highest professional qualification. This study determined ECG interpretation competence as a score of ≥ 9 out of 12. The findings of this study revealed that 38(31.66%) nurses scored ≥ 9, whereas 82 (69.34%) nurses scored eight or less.

CONCLUSION: The study found that most nurses performing their duties in critical hospital areas have suboptimal ECG interpretation competency levels. A relatively higher level of competency was found among nurses working in CCU.

Key Words: Nurse, Interpretation, competency level, Electrocardiogram, Tertiary care hospital

INTRODUCTION

Cardiovascular diseases (CVDs) are key health concerns worldwide. CVDs are one of the main reasons for death globally, with persistent increasing numbers[1] and a fast augmentation rate in low socioeconomic countries[2]. Pre-mature death ratio is about 4% in first-world countries, while in underdeveloped countries, it is around 42%, of which 80% are due to a CVD[3]. Pakistan is under developing country with a suboptimal literacy standard. Here, the public generally lacks awareness of preventive health measures, which puts them at a greater risk of acquiring certain chronic diseases, including CVD. Consistent with the global scenario, CVDs constitute a significant fraction of deaths in the country. A report by WHO revealed that 62% of the crude fatalities and 77% of the age-standardized in Pakistan occur due to NCDs, mainly include CVDs and injuries[4].

To recognize and monitor cardiac abnormalities such as Myocardial infarction, ischemia, arrhythmias, and cardiac electrical conduction abnormalities, an electrocardiogram (ECG) is used as a gold standard diagnostic evaluation tool in all healthcare facilities[1]. In the causality department and other intensive care units, Registered Nurses (RNs) are significant in performing and understanding ECG and communicating its findings to concerned health team members[5]. The training in ECG interpretation of nurses is therefore critical in the early detection of certain cardiac conditions improving the outcomes for resuscitation measures in CVDs and decreasing mortality due to delayed management of CVDs complications[6]. It has been reported that the decision-making capability of nurses is of critical importance in reducing cardiac problems, and it can be achieved mainly through the training of nurses so they can make a decision even in the absence of a cardiologist[7]. It is also reported that the availability of on-field cardiac doctors, nurses, and ECG technicians in hospitals is questionable for quick ECG interpretations. Hospitals are significantly facing a lack of expertise in interpreting ECG findings[7]. The literature revealed that most of the research is conducted on physicians to evaluate their competency in electrocardiographic interpretation. Very few studies are conducted on hospital nurses[2]. A recent study involving 100 nurses in cardiopulmonary hospitals appraised double educational approaches to understanding cardiac arrhythmias, besides it exhibits students' trouble in identifying the tachyarrhythmia presented (ventricular tachycardia, atrial fibrillation, and supraventricular R tachycardia)[8]. This research is intended to assess 12-Lead Electrocardiograph (ECG) interpretation capability of nurses employed at the critical care units of Dow University Hospital, Karachi.

METHODOLOGY

The descriptive cross-sectional design study was conducted from October to December 2019. The study was conducted from October to December 2019. Institutional Review Committee approval was sought from Dow University of Health Sciences. Permission for data collection was also obtained from the Medical Superintendent of the study setting. It was made sure to collect consent from each participant before data collection. The study was conducted in critical care units (Surgical Intensive Care Unit, Liver Transplant Intensive Care Unit, Renal Transplant Intensive Care Unit, High Dependency Unit, Coronary Care Unit & Emergency Department) of Dow University Hospital (DUH) Karachi.

Using a 95% confidence interval and 5% margins of error to the mean score of 8.6 (SD=1.1)[1], the computed sample size was 120 nurses. Around 145 nurses served the hospital in selected units during the study period.

Data were collected through a self-administered study instrument which included two sections. Section I contains socio-demographic aspects of the study candidates, including age, gender, working experience, electrocardiographic training, and type of training. Section II was a questionnaire to assess nurses' 12 leads electrocardiography (ECG) interpretation competency. It comprises 12 multiple-choice questions, two abstract questions and ten questions about different ECG patterns indicating several cardiac conditions. The participants were asked to choose correct answers from the choices of each question. A score of 1 point was given for each correct response, while incorrect responses were given a 0 score. The cut-off value for ECG interpretation competence was a minimum score of 9 out of 12. This questionnaire is developed by Coll-Badell M 2017[9]. The tool has already established reliability (Intraclass Correlation Coefficient, 0.869) and validity (Content Validity Index 0.87), tested in Spain in 2017. Permission was also obtained to use the study tool from the author.

Full-time Registered nursing staff with more than one year of professional background in cardiology and currently working in critical care units of Dow University Hospital were included. Those with post-essential cardiology specialization were excluded because they have a better prior understanding of ECG interpretation and can serve as an outlier in the statistical analysis.

Statistical analysis was performed on the Statistical Package for Social Sciences (SPSS) software version 21.0.0. The threshold for statistical significance was set at a P-value ≤ 0.05. The Results for categorical variables are presented in percentages, and for continuous variables, results are presented using means and standard deviation.

RESULTS

A total of 120 registered nursing staff (n=120) employed in critical care units of Dow University Hospital (DUH), Karachi, was included in this research project. Participants' mean ($\pm$ SD) age was 29.38+4.76 years, and 84(70.0%) were male. Of most nurses, 46 have Post RN BSN qualifications, while 30 have generic BSN and 42 have diplomas in nursing. Only 2(1.70%) nurses have completed the MSN program. Regarding clinical placement, most of the nurses, 64(53.3%), were working in Intensive Care Units, 41(34.2%) were working in the Emergency Room, and 15(12.5%) were working in C.C.U. Most of the nurses, 86(71.7%), have 1-5 years of working experience, 26(21.7%) have 6-10 years of working experience, 6(5.0%) have 10-15 years, and 2(1.70%) have more than 15 years working experience. Out of 120 nurses, 48 (40.0%) have completed training in Electrocardiography, out of whom 26(54.2%) completed their training last year. A brief detail of participants' characteristics is given in **Table I**.

Table I: Characteristics of the Study Participants

Variables		
Age	29.38± 4.76	
Mean± SD		
Range	Min: 20 Max: 41	
	Frequency	**Percentages**
Gender		
Male	84	70
Female	36	30
Level of Education		
Diploma in Nursing	42	35
Post RN BSc. Nursing	46	38.3
Generic BSN	30	25
Master of Nursing	2	1.7
Area of practice		
Intensive Care Units	64	53.3
Emergency Room	41	34.2
C.C.U	15	12.5
Working experience in emergency care		
1-5 years	86	71.7
6-10 years	26	21.7
10-15 years	6	5.0
>15 years	2	1.7
Did you do any training courses in Electrocardiography?		
Yes	48	40
No	72	60
If yes, then: When was the last course?		
< 1 year	26	54.2
Between 2-5 years	14	29.2
> 5 years	8	16.7
How was the course taken?		
Online	0	0.0
Face-to-face	42	87.5
Partial face-to-face	6	12.5
How many hours was the course?		
< 10 hours	44	91.7
10-20 hours	4	8.3
>20 hours	0	0.0

Out of 120 nurses, 74(61.7%) could recognize the order of ECG waves and intervals appropriately. In contrast, 86(71.7%) nurses identified a conduction issue in the atriums if the p wave did not develop in ECG. Of most nurses, 87(72.5%) correctly identified an atrial flutter on the ECG strip. A substantial number of 71(60.0%) nurses could trace ventricular fibrillation on ECG CG and replied that, in this case, they asked for help without leaving the patient alone.

Sixty-four (53.33%) could trace atrial fibrillation. The pathological pause was identified by 63(52.5%) nurses. 64 (53.3%) nurses correctly diagnosed a third-degree block. 10 (8.3%) nurses correctly identified supraventricular tachycardia. An acute myocardial infarction was traced by 74(61.7%) nurses. 60 (50.0%) nurses correctly answered ventricular extra-systole, and 46(38.3%) nurses could accurately identify atrial tachycardia. **Table II** shows details of the assessment of 12 Lead ECG interpretations competency of nurses.

Table II: Assessment of 12 Lead ECG Interpretations Competency of Nurses

Assessment Questions with ECG	Correct n (%)	Incorrect n (%)
Correct order of ECG waves and intervals?	74(61.7)	46(38.3)
A conduction problem between the atriums	86(71.7)	34(28.3)
An atrial flutter	87(72.5)	33(27.5)
Ventricular fibrillation	72(60.0)	48(40.0)
An atrial fibrillation	64(53.3)	56(46.7)
Pathological Q waves	63(52.5)	57(47.5)
A third-degree heart block	64(53.3)	56(46.7)
A ventricular tachycardia	62(51.7)	58(48.3)
An acute myocardial infarction	74(61.7)	46(38.3)
A normal ECG	72(60.0)	48(40.0)
A ventricular extra-systole	60(50.0)	60(50.0)
An atrial tachycardia	46(38.3)	74(61.7)

This study determined ECG interpretation competence as a score of ≥ 9 out of 12. The mean (SD) of the participants' score was 6.89±2.61. Whereas 21 (17.5%) participants scored ≥ 9.0 and 99 (82.5%) scored < 9.0. Details of the participants' scores are given in **Table III**.

Table III: 12-Leads Electrocardiogram Interpretation Competency among Nurses

Participants' Score	Mean ± SD 6.89 ± 2.61	
	Frequency	**Percentages**
Score ≥ 9	21	17.5
Score < 9	99	82.5
Total	120	100

The overall results showed that most nurses working in the critical care units of DUH have poor knowledge about interpreting ECG, while a few participants have adequate knowledge. The findings also revealed that nurses working in CCU and the Emergency room have almost similar scores of ECG competence, 20.0 % and 19.5%, respectively. In comparison, the ICU nurses have a relatively lower score of 15.6% on ECG interpretation competence (**Table IV**).

Table IV:
Specialty wise 12-Leads Electrocardiogram Interpretation Competency among Nurses

Area of Practice	N (%)	Correct (score ≥ 9)	Incorrect (score< 9)
Intensive Care Unit	64 (53.3)	10 (15.6)	54 (84.4)
Emergency	41 (34.2)	8 (19.51)	33 (80.49)
CCU	15 (15.5)	3 (20)	12 (80)
Total	120 (100)		

DISCUSSION

This study assessed the 12-lead electrocardiogram interpretation competency among nurses working in critical care units of DUH, Karachi, particularly identifying abnormal electrocardiographic patterns that require immediate interventions.

The results of this research study revealed that most of the participants (84%) were male. This finding was supported by a survey conducted by Sibley A et al.[10]; however, it opposed to the studies conducted in Egypt by Ismail AL 2020[11], Panduragan MH 2020[12] in India, and by Tavan H 2020[13] in Iran With a female predominance. Our research highlighted approximately fifty percent (50%) of the studied population had Post RN BSN qualification. This finding was opposed by the study conducted in Agashe N 2021[14] in India and another study conducted in Tanzania by Ruhwanya DI[15] in 2018.

This study revealed that most participants had less than five years of working experience. A similar level of knowledge was noted in the study conducted by Giannetta N et al.[16] and Agashe N 2021[14]. At the same time, these findings contradicted the survey conducted by Tavan H 2020[13].

Most nurses, 61.7%, have correctly interpreted the acute myocardial infarction (MI) on the ECG strip. This finding resembled a study conducted by Coll-Badell M 2017[9], where most of the study participants correctly interpreted MI. While the study conducted in Australia showed only 20% of participants could interpret MI on ECG paper correctly[17].

This study finding revealed that more than half of the nurses could recognize the normal sinus rhythm properly. This result was similar to a study conducted by Chen Y et al[18].

This study's result highlighted that only 1/5 of the study participants could score at competency level for interpretation of ECG. This finding contradicted a survey conducted Rahimpour M 2021[19], where most participants scored higher in competence level. Our study evidenced approximately half of the participants had correctly interpreted the atrial fibrillation rhythm. The finding was opposed by the survey conducted in the U.S. in 2020 by Turner JL et al.[20] and another study conducted by Qaddumi JA 2020[21], where registered nurses' correct interpretation of the atrial fibrillation rhythm was higher.

This research study accomplishes that more than half of the studied nurses (60%) correctly interpreted the Ventricular fibrillation rhythm on ECG. This finding contradicted the study conducted by Ruhwanya DI 2018[15].

Our study also revealed the maximum proportion of ECG interpretation knowledge found with staff nurses deputed in Cardiac Care Unit (CCU). These findings parallel the results of the study conducted by Tahboub OY 2019[22].

CONCLUSION

The study found that most nurses working in the critical care units of DUH have extensive knowledge of ECG interpretation, mainly due to their training and past experiences regarding Electrocardiography. Moreover, the study revealed that most nurses could also appropriately recognize critical cardiac events such as acute myocardial infarction on a 12-leads ECG Strip.

The findings of this study have implications for clinical nursing practice, nursing education, and nursing leadership. As nurses are the forefront caregiver of patients, competency in ECG interpretation enables them to save a precious life by prompt response to a critical cardiac event. Such practices also enhance the profession's image among other healthcare team members. Nursing program curricula also need to focus on basic-to-advance ECG interpretation skills, specifically the courses that include content on critical care nursing. For graduated nurses, continuing nursing education (CNE) sessions may be arranged to enhance/refresh their ECG interpretation competencies.

The study also has certain limitations. The findings cannot be generalized to other healthcare facilities as it was limited to a single public sector setting. Also, the study included only critical care units, limiting its generalizability to nurses working in other sub-specialties and intensive care units. Further studies can also be conducted, encompassing other medical, surgical, and allied healthcare units.

AUTHOR CONTRIBUTIONS

Nadeemuddin:	Idea, design, drafting, manuscript writing
Yaqoob M:	Review, data collection, final approval of manuscript
Ali A:	Statistical analysis, editing of manuscript
Siddiqui F:	Literature review, data collection
Rehan M:	Data collection, data entry, drafting

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