



NURSES COMPETENCIES OF ELECTROCARDIOGRAM INTERPRETATION IN EMERGENCY SETTINGS: A LITERATURE REVIEW

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ABSTRACT

Considering the increasing number of cardiovascular diseases around the world, early diagnosis and easy accessibility are required to appropriate treatment in order to reduce mortality rate and to prevent heart disorders. Electrocardiogram (ECG) is the most widely diagnostic tool that used to detect electrical and muscular functions of the heart. Nurses, as a part of the emergency services team, are the most number of health workers in the hospital with high interaction to patients, so the ability of nurses who are capable in interpreting electrocardiogram is urgently needed to provide accurate interpretation during emergency situation. The goal of this literature review is to evaluate the nurses competencies of electrocardiogram interpretation in emergency settings. A review of the literature was undertaken using the online databases: PubMed, Science direct, Research Gate and Google scholar. Search terms were 'electrocardiogram or ECG', 'competency or capability', 'nurses' and 'emergency' A total of 8 articles from 2016-2021 used in this literature review were quantitative research, 7 of which were cross sectional studies while one was a quasi-experimental. Inductive content analysis was carried out to analyse and categorise the data. From eight studies selected, it was found that three articles showed a lack of emergency nurses' competence in electrocardiogram interpretation, two articles indicated that above half of nurses has low and moderate competence, one article presented 54% has ability in interpreting electrocardiogram while only one article indicated the result that emergency nurses has good competence (93%) respectively. The competence in electrocardiogram interpretation of emergency nurses are still lack, thus, continuous training is urgently needed.

Keywords: competencies; electrocardiogram ; emergency; interpretation; nurses

INTRODUCTION

Since 1970, one of prior cause of mortality rate in worldwide was heart diseases. At present day, the distribution of heart diseases respond to a massive reduction in heart disease deaths in high-income nations, and blended trends in low and middle income nations (Arroyo-Quiroz et al., 2020). Furthermore, sudden death accounts for nearly half of of all coronary heart disease related mortality (Silverman et al., 2020). Around 17 million people die caused by cardiovascular diseases per year, contributing for more than a third of all global deaths (Pagan E, et al. 2013).

Considering the ever-increasing rate of cardiovascular disease around the world (World Health Organization, 2018), early diagnosis and easy accessibility are urgently needed to appropriate treatment can help manage symptoms of heart disease, so that people could live longer (Ganggin, 2008; Morton, 2017; Wang Y, 2015). Electrocardiogram (ECG) is a major initial tools that is routinely used non-invasively to assess the electrical and muscular functions of the heart. ECG has been regarded to be the first diagnostic tool in chest pain and enables specialists to examine the risks and symptoms. It also provides information about diagnosing acute coronary syndromes and cardiac arrhythmias (Tahboub & Dal Yılmaz,

2019). The ECG can be implemented to various clinical scenarios, including patients with chest pain, dyspnea, syncope, and poisonous ingestions, in addition to people with electrolyte abnormalities and pacemakers (Kessen & Williamson, 2020).

A variety of clinical settings require the healthcare professional's skill in recognizing disturbances in the electrical conduction system of the heart and interpreting a patient's ECG tracings (Sarker, 2014). The ability of healthcare providers such as doctors, nurses and emergency personnel to use, record and interpret ECGs to diagnose pathological cardiac disorders can assist in anticipating heart disorders and help in decreasing mortality number (Alghamdi et al., 2018; Compriet et al., 2018; Ghahramanian et al., 2020).

Nurses in emergency setting should have capability in knowledge and practice to use and interpret electrocardiogram (ECG) as it is the most extensively screening tool used and it use to help early diagnose and manage some environmental emergencies. Thus, accurate ECG interpretation is an urgent skill for critical nurses that provide care for patients during emergency situations and allow the anticipation of potentially fatal events to the patients (Rahimpour et al., 2021).

Besides, nurses are the most number of health workers in the hospital and most interact with patients, so the ability of nurses who are professional in interpreting electrocardiogram is very much needed due to their role as the emergency services team. Furthermore, upgrading the competency of ECG interpretation among healthcare professionals who work in emergency areas is a potential patient safety issue and would possibly diminish interpretation errors during emergency situations (Mobrad, 2020; Vand Tamadoni et al., 2020). It is important for nurses in critical care settings to carry out a more accurate assessment, which can help to identify dysrhythmias quickly and accurately to ensure prompt interventions and lifesaving measures when necessary.

METHOD

This is an integrative review, whose study design is a principal tool, as it permits the analysis of facts in the literature in a wide and systematic way and reveals scientific features provided by other authors. A review of the literature was undertaken using the electronic databases: PubMed, Science direct, Research Gate, and Google scholar. The following inclusion criteria have been defined: studies published in complete text, electronically available both in Bahasa and English, whose the results were correlated to aspects of capability of nurses to interpret electrocardiograph in emergency settings. Editorials, letters to the editors, theses, reports of experience, and reflective studies were excluded. Besides, this literature review is limited by year 2016 to 2021. Below is the flow chart of citations that have been reviewed.

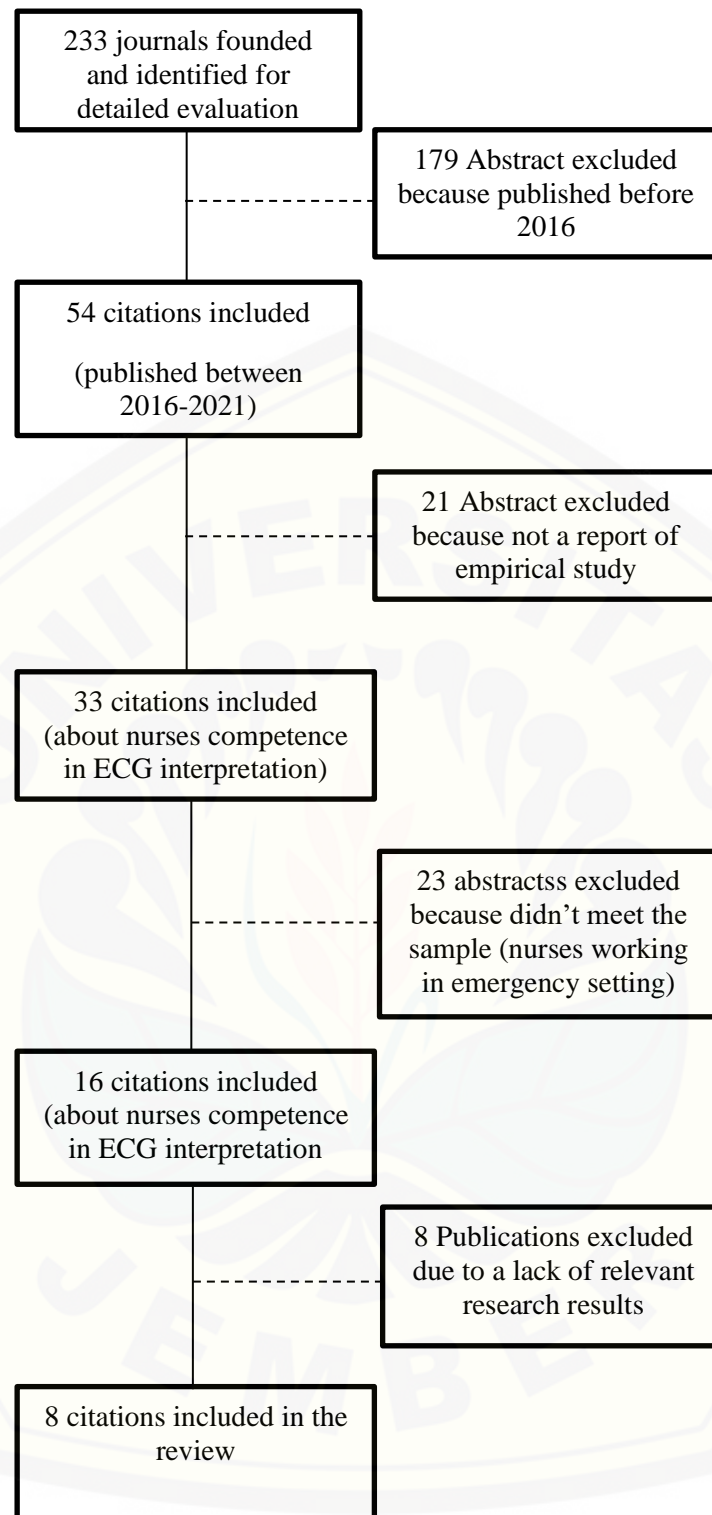


Figure 1. Phases of the literature review. In each phase are presented the number (n) of studies that remained in the sample.

RESULTS

Eight studies selected, seven were taken from foreign journals that available in English and one from a national journal available in Bahasa.

Dinnah I, et al that conducted a cross-sectional study to assess the knowledge and skill level of nurses employed in critical care settings of Muhimbi National Hospital discovered the level of knowledge regarding life-threatening arrhythmias was generally high which 85 of 141 scored a high level, but nurses' skill was generally poor which there were 119 nurses scored a low level. This study also presented there was an association between skill observed along with educational background and ECG training. Besides, availability of resources such as cardiac monitors and ECG machines improved nurses' knowledge as they are able to interpret arrhythmias regularly. Working overload has been found as the barrier for nurses in interpreting accurately.

Another study by Girishon that assesses 58 emergency nurses' ability of Kenyatta National Hospital to perform accurate assessment of chest pain indicated that 35 (61%) of nurses couldn't interpret 12-lead ECG rhythm correctly, but majority (42) of respondents had ability in determining normal and not-normal ECGs. Other than thorough interviews and questionnaires, this study also used interview to explore challenges encountered by nurses to perform better management in chest pain which described the followings: workload, negative attitude towards ECG, lack of knowledge, lack of policy guidelines or standard operating procedure on ECG and also lack of administration support.

Maryam Rahimpour, et al, with the study "Electrocardiogram interpretation competency among emergency nurses and emergency medical service (EMS) personnel" found that of 105 emergency nurses, there were 15 nurses scored low competent, 38 nurses scored medium, 46 nurses scored good and only 6 nurses scored as very good level in ECG interpretation. The findings of this study showed that nurses of cardiac specialty hospital gained higher score comparing with the general hospitals. Furthermore, ECG courses had a significant relationship with nurses' skill in ECG.

Maryam Sabry Shehab, et al conducted the research which aims to evaluate the effect of an educational program of electrocardiogram interpretation of medical and maternity nurses' knowledge and skill. In this quasi-experimental design research, the assessment was done by using questionnaire which consists of 22 questions and by using skills sheet that composed of 20 examples of normal and not-normal ECG strips. It was found that of 55 nurses involved in emergency departments, intensive care units and high-risk pregnancy unit, 39 nurses (70.9%) were not able to interpret ECG correctly, while the nurses' skill increased statistically significant as the effect of educational program of ECG interpretation.

Marina Coll Badell, et al that conducted a study "Emergency nurse competence in electrocardiographic interpretation in Spain" suggested that more than 93% of participants could interpret ECG correctly, but the capability to identify acute myocardial infarction were still lacking. This study also suggested that the nurses with recent training scored higher than those without. On the other hand, no positive correlation between professional nursing experience with the ability in interpreting ECG was founded in this study.

Eduesley, et al. Study of Ability of nurses interpret A-12 lead electrocardiography. This cross-sectional study consists of 100 nurses, 64 of which were working in critical units. This results concluded that nurses have ability to recognize changes related cardiac arrhythmias but have difficulties to identify myocardial infarction. This study presented that nurses had undergone training or the certification of Acute Cardiac Life Support may justify the good results on the test. Besides, it was founded that nurses working in critical units could interpret the ECGs faster and felt more confident to interpret than nurses in non-critical units.

The other study by Kristofer Werner, et al, examined electrocardiogram interpretation mastery among nurses working in ambulance which used questionnaires and the knowledge test consisted of nine different ECGs of varying difficulties. Overall, the results relatively low which 54% of nurses could answer the test correctly and only 46% were able to identify the ECGs indicating myocardial infarction. Neither of education nor working experience had positive correlation on ECG interpretation showed in this study.

One national journal “Overview of Nurses’ Knowledge on Electrocardiogram Interpretation for Arrhythmia Patients at ICCU RSUD DR Pirngadi Medan”. by Marlisa and Dian Nur Pratiwi explained that of 13 nurses at Intensive Cardiac Care Unit, based on questionnaires (20 questions), only 4 nurses scored high while 6 with moderate level and 3 had low score. Based on observation that consists of 6 checklist items, only 3 nurses had high score whereas 4 with moderate and 6 with low score. Both the findings based on questionnaires and observation indicated that nurses’ competence in ECGs interpretation were still poor. This article also explored nurses’ education, working experience and trainings which founded that majority of nurses who had more than 10 years experience had better skill in ECG interpretation.

Table 1.
Overview of Articles

Title	Author	Design	Sample	Instrument	Results
Life threatening arrhythmias: Knowledge and skills among nurses working in critical care settings at Muhimbili National Hospital, Dar es Salaam, Tanzania	Dinnah I. Ruhwanya, Edith A.M. Tarimo And Menti Ndil	I. Crossectional	141 nurses were involved (Emergency Medicine Department (EMD), Coronary Care Unit (CCU), Main Intensive Care Unit (ICU), Highly Dependent Unit (Ward -1 HDU), and Cardiothoracic Intensive Care Unit (CICU)	Questionnaires (ECG strips) and Observational checklists	The level of skill of nurses regarding life threatening arrhythmias was generally poor. 119 (84.4%) scored a low skill level. This means only 15.6% scored highly. However, The level of knowledge regarding life threatening arrhythmias among study participants was generally high. 85 (60 %) scored a high level of overall knowledge, answering above half of the questions accurately
Determination of Nurses’Practice in Assesment and Initial Management of Cardiac Related Chest Pain Among Adult Patient at Accident and Emergency Department, Kenyatta National Hospital	Grishon Njoroge Chege,	Crossectional	58 nurses selected from Accident and Emergency Department	Six questionnaires, six observational checklists and one interview guided.	Abikity to interpret the 12 lead ECG rhythm: the average of 61% (n=35) of nurses interpret ECG incorrectly while 39% (n=23) have the ability in interpreting ECG correctly
Electrocardiogram interpretation competency among emergency nurses and emergency	Maryam Rahimpour, Shahla Shahbazi, Mansour Ghafourifard,	A cross-sectional comparative descriptive study	105 emergency nurses and 65 Emergency Medical Services	questionnaires	Self rated interpretation competency for emergency nurses: Weak : 15 Medium: 38 Good:46

Title	Author	Design	Sample	Instrument	Results
medical service (EMS) personnel	Neda Gilani,Cathal Breen		Personnel in northwest of Iran		Very good:6
Effect of an Educational Program of Electrocardiogram Interpretation on Medical and Maternity Nurses' Knowledge and Skills	Mariam Sabry Shehab, Nagwa Mohamed Helmy, Emam, Maha Ramadan Ali	quasi-experimental design	55 nurses, including 20 nurses working in emergency departments, 20 nurses working in intensive care units and 15 nurse working at high-risk pregnancy unit	questionnaires	Skill in Electrocardiogram interpretation: Only 16 could interpret ECG correctly while 39 nurses interpret ECG incorrectly before education program of ECG interpretation
Emergency Nurse Competence In Electrocardiographic Interpretation In Spain	Marina Coll-Badell, RN, María F. Jiménez-Herrera, RN, MB, PhD, and Mireia Llaurodo-Serra, RN, MSc, PhD		57 nurses working in emergency department from three hospitals	questionnaires	93% of sample has ability to interpret electrocardiograph correctly
Ability Of Nurses Interpret A 12-Lead Electrocardiography at the Clinical Hospital of the Medical School of the University of São Paulo (HCFMUSP), Brazil.	Eduesley Santana-Santos, Emile Clara Pires, Juliana Teixeira Silva, Vanessa Santos Sallai, Diego Gutierrez Bezerra, Renata Eloah de Lucena Ferretti-Rebustini	cross-sectional	64 nurses at critical units (clinical, surgical and coronary intensive care units and emergency unit)	questions for sociodemographic characterization of participants and with 10 clinical cases	Majority of nurses were able to interpreting the tracings related to cardiac arrhythmias, but less of half were able to identify changes related to acute myocardial infarction
Electrocardiogram interpretation skills among ambulance nurses	Kristoffer Werner1, Kristofer Kander2 and Christer Axelsson3	prospective quantitative survey	132 ambulance nurses	questionnaires for sociodemographic characterization and with 9 variants of ECGs with difficult cases	On average, the respondents had 54% correct answers on the test
Overview of Nurses' Knowledge on Electrocardiogram Interpretation for Arrhythmia Patients at ICCU RSUD DR Pirngadi Medan.	Marlisa, Dian Nur Pratiwi	Crossectional	13 nurses at ICCU RSUD DR Pirngadi Medan	Questionnaire and observation	Based on answers questionnaire: Good: 4 nurses Moderate: 6 nurses Low: 3 nurses Based on Observations: Good: 3 nurses Moderate: 4 nurses Low : 6 nurses

The table showed an overview of all eight studies selected, highlighting their methodologies and results.

DISCUSSION

This study purposes was to identify the ability of nurses to interpret electrocardiogram. This study was conducted in emergency settings such as Intensive care unit, accident and emergency department, coronary care unit, high risk pregnant women and ambulance where knowledge and competence of interpretation of ECG is very important since mostly encountered patients with cardiac abnormalities. Majority of the results showed that nurses competence was moderate and low level.

The studies revealed that not only education nor working experience, but also the trainings such as ALS, ATLS, BLS and ECG courses influenced nurses competence in ECG interpretation. Several studies showed an association between the nurses' level of knowledge and educational qualifications. Study by Ruhwanya et al., revealed a significant association between educational qualification and ECGs' skill on nurses. In agreement with study by Girishon that found having higher qualification in nursing such as BScN, or higher diploma in critical care nursing improved the performance of nurses including skill in electrocardiogram interpretation. The more educational or professional qualifications a participant had, the higher participants' score in both knowledge and skills of ECG. This may be due to the fact that most of the nurses had been educated from diploma level or above, thus having been taught the theory in the classroom. These findings were different from several studies that presented no positive correlation between educational background to nurses competence in ECG interpretation. These may be affected by other variables such as trainings and working experience.

Inspite of professional qualification, attending trainings also suggested has impact on nurses skill and knowledge in ecg interpretation. Study by Mariam Sheehab found that there was a significant increasing in nurses knowledge and skill after education program implementation that higher than before statistically. This finding was also in line with other studies, one of those was study by Coll-Badell et al, concluded that electrocardiographic trainings could affect ecg knowledge and interpretation. Moreover, they demonstrated the importance of periodically conducting training courses and recommended nurses to take the courses at least every 5 years.

Another study conducted separately at Muhimbi National Hospital demonstrated a tremendous improvement in the number of nurses who have attended BLS and ACLS trainings (Ruhwanya et al., 2018). These findings are consistent with a study in American Hospital which nurses were trained with educational program to help them to identify arrhythmias. At the end of the one-day course, the nurses performed a knowledge assessment and those who obtained an average over 80% were approved (Santana-Santos et al., 2017). In contrast to study conducted by Werner, et al., that examined factors such as education and professional experience has no correlation with the ECG interpretation skill among ambulance nurses but working experience was associated with better results on the ECG test.

Despite the fact that taking an educational course is helpful in improving nurses' ECG interpretation competency, no longer utilizing those skills would possibly decrease their capability (Coll-Badell et al., 2017). Besides, recurrent training on an annual basis with support of an ECG specialist could be one way to achieve the amount of training that studies have shown is necessary to obtain a better ability regarding ECG interpretation (Werner et al., 2016)

There were three articles indicated that the barriers to perform accurate assesment related chest pain were lack of education on assesment tools, work load and also lack of policy or standard operating procedure on electrocardiogram.

CONCLUSION

From eight studies selected, it was found that three articles showed a lack of emergency nurses' competence in electrocardiogram interpretation, two articles indicated more than half of nurses has low and moderate competence, one article presented 54% has ability in interpreting electrocardiogram while only one article indicated the result that emergency nurses has good competence (93%) respectively. The competence in electrocardiogram interpretation of emergency nurses are still lack, thus, continuous training is urgently needed.

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