T.R.N.C

NEAR EAST UNIVERSITY
INSTITUTE OF HEALTH SCIENCES

Knowledge and Practices of Electrocardiogram Interpretation of Nurses

Obaydah Yaser Hamed Tahboub

In Partial Fulfilment of the Requirements for the Degree of
Master of Nursing (Adult Acute Care)

NICOSIA 2018

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Advisor: Assoc. Prof. Ümran Dal Yılmaz

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APPROVAL

The Directorate of Graduate School of Health Sciences, this study has been accepted by the thesis committee in nursing program as a master of Adult Acute Care nursing thesis.

Thesis Defence Date: 2018-08-08

Jury Members Signature

Supervisor: Assoc. Prof. Ümran Dal YILMAZ (Near East University) .....

Chair: Assoc. Prof. Hatice Bebiş (Near East University) .....

Member: Assist. Prof. Gülten Sucu Dağ (Eastern Mediterranean University) .....

Approval:

According to the relevant article of the Near East University Postgraduate Study-Education and Examination Regulation, this thesis has been approved by the above-Mentioned members of the thesis committee and the decision of the board of Directors of the Institute.

Prof. Dr. Hüsnü Can Başer
Director of Graduate Institute of Health Sciences

DECLARATION

I hereby declare that the work in this thesis entitled **"Knowledge and Practices of Electrocardiogram Interpretation of Nurses"** is the study of my own research efforts undertaken under the supervision of Assoc. Prof. **Ümran Dal Yılmaz.**

My deepest thanks to Assoc. Prof. **Ümran Dal Yılmaz**, my supervisor, for her expertise, on-going support and mentorship during my research.

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Knowledge and Practices of Electrocardiogram Interpretation of Nurses

ABSTRACT

Introduction: Electrocardiogram (ECG) interpretation for nurses is an important of the initial evaluation for patients presenting with cardiac problems which maybe cause to potentially life threatening complications. Nurse usually the first one who faces ECG interpretation which made him be more creative to take appropriate dissection to save a life specially in critical area in hospital. Which there is a need to increase knowledge and practice of nurses on ECG interpretation to provide right intervention and avoid complications.

Objectives: The aim of the study is to determine the knowledge and practice of electrocardiogram among nurses.

Methods: This descriptive study was conducted on the registered nurses who work in both Near East university hospital and Dr. Suat Günsel Girne university hospital. Total 65 voluntary nurses were composed the sample of the study. A questionnaire that was developed by the researchers on the basis of the literature was used as data collection tool in this study. Data were collected using a questionnaire in May 2018, after the ethical approval. Descriptive statistics and Pearson Chi-Square tests were used in analysis of the data.

Results: Results of the present study showed high level of knowledge and practice of electrocardiogram among nurses. Were statistically significant differences in terms of working unit in hospital and previous ECG training courses affected and play important role in defining the proffesinality of nurses to had experience in ECG interpretation.

Conclusions: Working unit in hospital and previous ECG training courses play important role in defining the professionalism of nurses to had experience in ECG interpretation. Training courses for nurses under the supervision of qualified well trained staff especially for nurses who work in critical area in hospital with continuing self learning and staying up to date to any changing and development of new protocols or technology to increase patient outcomes.

Keywords: Electrocardiogram, electrocardiogram interpretation, nursing, knowledge and practices.

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List of Abbreviations

Items of Abbreviations	Context
ACS	Acute Coronary Syndrome
AF	Atrial Fibrillation
AHA	American Heart Association
AMI	Acute Myocardial Infarction
CAD	Coronary Artery Disease
CCU	Coronary Care Unit
ECG	Electrocardiogram
ED	Emergency Department
ICU	Intensive Care Unit
LBBB	Left Bundle Branch Block
NSTEMI	Non-ST segment Elevation Myocardial Infarction
STEMI	ST segment Elevation Myocardial Infarction
SVT	Supraventricular Tachycardia
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia

1. INTRODUCTION

1.1 Problem Definition

Electrocardiography is a commonly used, non-invasive procedure for recording electrical changes in the heart. The record,which is called an electrocardiogram (ECG), shows the series of waves that relate to the electrical impulses which occur during each beat of the heart. Nowadays ECG is an important of the initial evaluation for patients presenting with cardiac problems, and its considered as the first diagnostic tool in chest pain and it provide objective information's about the structure and function of the heart (AlGhatrif et al 2012). Also ECG make a focal point of modern medicine because it gives hole background about diagnosing acute coronary syndromes and cardiac arrhythmias (George et al 2010).

Globally ischaemic heart disease and stroke takes the first place in the top 10 causes of death worldwide which it accounting for a combined 15 million deaths in 2015 (WHO, January 2017). A previous studies show that most of patients coming to emergency department suffering from symptoms of chest pain, one of these studies show that ECG done to 88.4% of patient who comes to emergency and discussed that 59% of patients the most frequent diagnoses for them were atypical chest pain (Martínez-Sellés, et al 2008).

In health care centres nurses are usually the first responders to an in-hospital cardiac arrest and they must be master in basic resuscitation skills (Hernández-Padilla et al 2016). Every nurse should be able to recognize basic ECG rhythms, such as normal sinus rhythm, sinus tachycardia, sinus bradycardia, atrial fibrillation, atrial flutter, heart blocks, ventricular fibrillation and asystole (Atwood et al 2015). This is required that the nurse must be responsible for monitoring and clinical decision-making based on information obtained from the monitor (Funk et al 2017).

Doğan and Dilek (2012) in their study stated that only 38.1% of the nurses were found to be able to identify the ventricular fibrillation, 54,3% myocardial infarction, 33,3% third degree atrioventricular block, 40,5% ventricular tachycardia. However, 20.5% of the nurses stated that they could carry out defibrillation. 60,5% of the nurses expressed that they did not know the right electrocardiography monitoring and thus could not recognize the type of the arrhythmia.

In Iraq study that was carried out to identify nurses' knowledge concerning early intervention for patients with ventricular tachycardia at Baghdad teaching hospitals which show result of overall assessment of the studied sample's knowledge was low (Mousa et al 2016). That led to a lot of responsibility on nurses to be qualified in continuous monitoring especially in critical care units, to ensure ongoing safe and effective ECG monitoring and to know the determine what courses needed and quality improvement program should be initiated (Drew et al 2006). Also result of inappropriate interpretation use increases the cost of healthcare and can delay the admission process an unpleasant burden which the hospital and its patients must bear (Larson et al 2008).

In England it was established what called a Rapid Access Chest Pain Clinic (RACPC) that made nurses to assess the patient and to form a care plan immediately without waiting for a physician, and also when a patient with chest pain arrives in the clinic, an ECG recorded and the nurse consultant then examines the patient and decides if further investigation is required (Pottle, 2005).

Many methods had made and designed algorithms like CRISP (Cardiac Rhythm Identification for Simple People) method to help nurses rapidly interpret ECGs that nurses often confusing with identifying ECG rhythms (Atwood et al 2015). Also American Heart Association designed what's called PULSE trial (Practical Use of the Latest Standards for Electrocardiography trial) which is online ECG monitoring education program and strategies to implement and sustain change in practice, led by nurse champions on each unit and this trial increase nurses' knowledge of ECG monitoring, quality of care related to ECG monitoring and patient outcomes (Funk et al 2010).

Facility work area affected the knowledge and practice toward ECG, one study done to measured the effectiveness of an education program on nurses' knowledge of ECG interpretation which explain that pre test result of education show test scores of nurses in the cardiology department were higher than those in the emergency department (ED) and intensive care unit (ICU) (Zhang et al 2013). In other hand, study in Iraq show that most nurses worked in coronary care unit (CCU), ICU and ED pass the questions regarding knowledge except question concerning ECG changes regarding to new and old myocardial infarction which mean that there is weakness in practical section which need intensive training courses (A. AL-Husaunawy 2015).

The educated and qualified nurse play important role in preventing complication that maybe occurred in patients who have arrhythmias, difficulties in interpreting the ECG patients with Acute Myocardial Infarction (AMI) who present with Left Bundle Branch Block (LBBB) may delay treatment and affects their prognosis (Spiers 2007). Previous studies (Fuenzalida et al 2015) show that an educational intervention by nurses at discharge from the ED decreased atrial fibrillation (AF) related complications at 3-month follow-up, one of these studies done in tertiary hospital in Barcelona which also emphasise this result but for long time up to one-year of follow-up (Fuenzalida et al 2017).

Also as known training and education play important role in being qualified in interpretation ECG, one study held in CCU and ICU of Benha University hospital in Egypt that show in it result improvement of nurse's performance about recording a 12-lead ECG and dysrhythmia interpretation after program implementation and the nurse's performance scores were satisfactory (Refaey, 2012). In additional another study conducted in the southeast of Spain which evaluated emergency nurse competence in ECG interpretation this study shows that training within the previous 5 years have high score and level of knowledge was not influenced by experience or hospital (Coll-Badell et al 2017).

The nurse working in ICU and ED of their patients' critical conditions, are highly responsible of determination and application of attempts as well as early detection of diagnosing the signs and symptoms of their disease.

There is need to increase knowledge and practice of nurses on electrocardiogram to provide health care outcomes for the patient and avoid any mistake in ECG interpretation and interventions. Determination of knowledge and practice of nurses on electrocardiogram maybe useful in improvement their level and enhance their initiation to become more professional in interpretation ECG. However, no previous studies found about this subject in Turkish Republic of North Cyprus.

1.2 Aim of the Study

The aim of the study is to determine the knowledge and practice of electrocardiogram among nurses in University Hospital in North Cyprus. Questionnaire includes the following questions:

1. What are knowledge of nurses on Electrocardiogram?
2. What are practices of nurses on ECG interpretations?
3. Are there any differences between descriptive characteristics and knowledge and the practice of nursing on ECG interpretation?

2. BACKGROUND OF THE STUDY

2.1. Definition of Electrocardiogram

Electrocardiogram (ECG) is a procedure of recording the electrical activity of the heart within a period of time using electrodes placed over chest. As known that heart has four chambers two atria and two ventricles, the electrical discharge generated from sinoatrial node (SA node) and move through atrial muscle fibres delay while the depolarization to atrioventricular node (AV node) then it gone through out bundle of his to the right and left bundle branch among purkinje fibres, The contraction of atria associated with the ECG wave called P wave then when ventricular are depolarization it causes QRS complex finally when ventricular repolarization T wave occurs (Hampton, 2008).

The standard 12-lead, ten electrodes are placed on the patient's limbs and on the surface of the chest which records the electrical activity of the heart from 12 different viewpoints or leads by attaching cables to the patient's limbs and chest so the overall magnitude and direction of the heart's electrical depolarization is captured at each moment throughout the cardiac cycle (Jevon, 2009). It is important that a 12-lead ECG is recorded accurately because poor technique can lead to misinterpretation of the results, mistaken diagnosis, mismanagement of the patient and inappropriate transfer to hospital (Jevon, 2010).

ECG plays an important role in diagnosing of patients and providing whole information in many clinical scenarios for examples; Arrhythmias, Coronary artery disease (CAD), Electrolytes abnormalities, inherited cardiomyopathies and drug induced abnormalities (Huitema et al 2014).

2.2 Coronary Artery Disease (CAD)

Coronary Artery Disease (CAD) is a blockage or narrowing of the coronary arteries usually caused by atherosclerosis (Libby et al 2005) which may restrict flow of the blood to the heart muscle by physically blocking the artery or by causing abnormal artery function and tone (Cleveland clinic, June 2017). CAD is the most common cardiovascular disease (Montalescot et al 2014). Which was in 2013 the most common cause of death globally resulting in 8.14 million deaths (16.8%) up from 5.74 million deaths (12%) in 1990 (GBD 2015).

American heart association (AHA) statistical update show that the prevalence total of 11.5% of American adults (27.6 million) have been diagnosed with heart disease and mortality in every year since 1919, CAD accounted for more deaths than any other major cause of death in the United States (Benjamin et al 2017). Among Indian women with CAD continues to be a major public health problem that represents a leading cause of death and disability (Pathak et al 2017). Also the presence of diabetes, hypertension, low levels of high-density lipoprotein, high levels of total cholesterol, low-density lipoprotein and triglycerides all are correlated with CAD (Gupta et al 1999).

Almost two-thirds of heart failure cases are attributed to underlying CAD (Gheorghiade et al 2006). Also CAD was a factor for heart failure in more than 50% of incident cases in North America and Europe; 30% to 40% in Asia, Latin America, and the Caribbean; and less than 10% in sub-Saharan Africa (Khatibzadeh et al 2012).

2.2.1 Stable angina

Stable angina result in chest pain during exertional activity while heart muscle doesn't get as much blood as it needs which resolves with rest or sublingual administration of nitro-glycerine (Tobin et al 2010). Angina reflects transient regional myocardial ischaemia caused by inadequate coronary perfusion which The most common cause is atherosclerotic (Abrams J 2005).

Angina which increases prevalence with age for men 4-7% of who aged 45-64 to 12-14% aged 65-84 and women 5-7% of who aged 45-64 to 10-12% aged 65-84 (Montalescot et al 2013). While there is is estimated that approximately 9 million patients in the USA suffer from angina (Mensah et al 2007).

Angina clinical symptoms characterized by heaviness, tightness, pressure or burning across the chest and may radiate to the jaw, arms or back which duration is brief and the sensation generally resolves with rest or sublingual nitrates (Whittaker et al 2014). ECG maybe have change if it done during an attack likely to show ST segment depression portends a poorer prognosis than T-wave inversion alone or no ECG changes (Bhatheja et al 2007).

2.2.2 Unstable angina

Unstable angina is characterized by the clinical presentation of angina with or without ischemic ECG changes (Bhatheja et al 2007). In unstable angina the chest pain usually is more severe and longer lasting may occur at rest or at a lower level of physical exertion (Braunwald et al 2002). The diagnosis of unstable angina still a clinical challenge and reflects one end of the chain of Acute coronary syndrome (ACS) (Manning et al 2007)

ECG findings during an episode of unstable angina include ST depression, T wave inversions or transient ST segment elevations (Fanaroff et al 2015). Medical management of unstable angina includes therapies aimed at relief pain, inhibition of platelet aggregation and thrombosis also consideration of revascularization of the stenosis vessels (Amsterdam et al 2014).

2.2.3 Non-ST segment elevation myocardial infarction or heart attack (NSTEMI)

NSTEMI is similar to unstable angina but it's associated with positive biomarkers like troponin or creatine kinase in the setting of angina (Bhatheja et al 2007). Also ECG changes complemented by echocardiography, coronary angiography and other imaging modalities (Basra et al 2016).

NSTEMI typically results from more distally located coronary thrombosis and coronary arteries blockage often is only partial (Bassand et al 2011). Atherosclerotic changes in the vessel wall or extent of calcification and subsequent intracoronary thrombus formation may vary extremely in NSTEMI patients (de Winter et al 2012). European Society of Cardiology (ESC) guidelines recommend urgent or immediate transfer to the catheterization laboratory for patients with ongoing signs and symptoms of ischemia and for patients with hemodynamic or electric instability (Hamm CW et al 2011).

2.2.4 ST segment elevation myocardial infarction or heart attack (STEMI)

STEMI continues to be one of the most dangerous acute complications of coronary artery disease (Timmis et al 2017). Which need medical emergency and secondary prevention promptly in order to not only improve the survival but also long-term prognosis of the patient (Sachdewani et al 2018).

The most common cause is coronary artery narrowing from a disrupted atherosclerotic plaque with overlay acute thrombosis that suddenly and significantly compromises coronary blood flow but is usually not 100% occlusive (Anderson et al 2012). Therapeutic measures focus on reperfusion of the occluded artery by pharmaceutical or by percutaneous coronary intervention as early as possible (Deckers et al 2013).

2.3 Heart arrhythmias

Heart arrhythmias are abnormality or disturbance in the normal activation sequence of the myocardium and can be classified by rate, mechanism, duration or site of origin (Bhaumik et al 2016). Also arrhythmias could be indicative of structural heart disease which may lead to complications like stroke or result in deterioration of hemodynamic and cardiac arrest (Papadopoulos et al 2017).

ECG has been considered an important diagnostic and prognostic tool for the management of patients with arrhythmias (Delgado et al 2016). Also evaluation of the ECG during tachycardia can give us significant evidences regarding the arrhythmia mechanism and even the arrhythmia site of origin in some particular cases (Cano et al 2017). Now most challenge problem faced by today's ECG examination is the huge difference in the morphologies of ECG signs (Li X et al 2009). As arrhythmias classify by site of origin it might be Atrial arrhythmias, Junctional arrhythmias, Ventricular arrhythmias and Heart blocks.

2.3.1 Atrial arrhythmias

Atrial arrhythmias are the most frequent rhythm disorder in humans and often lead to severe complications such as heart failure and stroke (Virag et al 2002). Which consider those arising from the atria like: sinus tachycardia and bradycardia, atrial fibrillation, atrial flutter, and atrial tachycardia.

Atrial fibrillation (AF) is the most common cardiac arrhythmia (Kirchhof et al 2016). It is estimated that approximately 7 million of patients in United States and European Union suffer from AF (Fuster et al 2011). Up to 15% of all strokes in the United States can be attributable this disorder (Rockson et al 2004). Unluckily these numbers maybe multiply by at least 2.5-fold by 2050 (Alan S. Go et al 2001).

Patients with AF presented a lot of common symptoms include chest pain, shortness of breath, tachycardia, palpitations, fatigue, anxiety, decreased activity tolerance heart failure, light headedness, hypotension, stroke, and arterial embolization (Dewar et al 2007). Also patients with AF the overall incidence of coronary artery disease is relatively high (Michniewicz et al 2018)

The risk of stroke is significant in the patient with AF (Fuster et al 2011). So initial assessment must be focused on determination of stability and prompt intervention (Cottrell et al 2008). Medical treatment advanced Before cardioversion which can be used administration of drugs such as amiodarone, ibutilide, propafenone flecainide or sotalol as there is evidence of enhancement of the success of cardioversion and decreased recurrence of AF (Fuster et al 2011).

Medical treatment is often focused on control of heart rate and anticoagulation unless the patient has significant symptoms. Controversy has existed for some time about rate control versus rhythm control as the primary approach to treatment (Nattel et al 2006). Also conversion of AF to normal sinus rhythm has been shown to decrease symptoms (January CT et al 2014).

Supraventricular tachycardia (SVT) is a clinical syndrome characterized by a rapid tachycardia with an abrupt onset and termination (Badhwar N 2010). Presentation of SVT on ECG is as a narrow-QRS-complex tachycardia which QRS interval of less than 120 milliseconds (Delacrétaz E 2006). SVT originate from supraventricular tissue or require it to be a part of the re-entrant circuit which usually regular with heart rate of 160 to 200 beats per minute (Lee et al 2008).

SVT account for approximately 50 000 patients visits ED each year (Huang et al 2013). Patients with SVT present symptoms like palpitations, chest pain, Shortness of breath, syncope and sudden cardiac death (Cheng et al 2000). Vagal maneuvers and adenosine are recommended for treatment patients with regular SVT also synchronized cardioversion is recommended for acute treatment in patients with hemodynamically stable SVT when pharmacological therapy is ineffective or contraindicated (Page et al 2016).

2.3.2 Ventricular Arrhythmias

Ventricular arrhythmias cover a large spectrum of ventricular myocardium rhythm disturbances, extending from premature ventricular complexes (PVCs) to ventricular tachycardia (VT) and ventricular fibrillation (VF) (Papadopoulos et al 2017). Sustained ventricular arrhythmias are an important cause of morbidity and the most common cause of sudden cardiac death which accounting for 75–80% of cases (Zipes et al 2006). Risk increase for sudden cardiac death or ventricular arrhythmias after AMI has been associated with scar burden (Bello et al 2005).

Ventricular tachycardia is a heart rate more than 100 beats per min with three or more consecutive beats originating from the ventricles which independent of atrial or atrioventricular (AV) nodal conduction QRS more than 120 ms on ECG (Harris et al 2015). VT can be classified based on its morphology which monomorphic VT has a single QRS morphology suggesting a stable structural focus while polymorphic VT presents with continuously changing QRS configuration from a more global activation sequence (Hunter et al 2008). Most patients with VT receive an implantable cardioverter defibrillator (ICD) for the prevention of sudden cardiac death and antiarrhythmic therapy which can prevent VT recurrence but does not reduce mortality also catheter ablation is useful in preventing VT recurrence (Roberts et al 2011).

Ventricular fibrillation is a life-threatening with marked variability in cycle length and morphology up to 300 beats per min with loss of cardiac output (Harris et al 2015). VF annual incidence of 12.1 per 100,000 people which remains the leading cause of sudden cardiac death and out-of-hospital cardiac arrest (Benjamin et al 2017). Current management guidelines for VF emphasize the importance of early high-quality cardiopulmonary resuscitation (CPR) and defibrillation and antiarrhythmic medications (Link et al 2015).

2.4 Importance of first interpretation of ECG

ECG interpretation is an important clinical skill as it allows rapid diagnosis of potentially life-threatening arrhythmias and diseases (Salerno et al 2003). Which this interpretation shows some abnormalities and first indication of ischemia, metabolic disturbance training and an attention to detail to distinguish physiological ECG findings from abnormal ECG findings that might indicate the presence of cardiac pathology (Sharma et al 2017).

The American College of Cardiology/American Heart Association (ACC/AHA) guidelines specify that an ECG should be obtained and interpreted within 10 minutes of arrival to the ED in patients with symptoms suspicious of ACS (Amsterdam et al 2014). Delay in acquiring a diagnostic ECG to patients with suspected ACS could delay treatment and potentially lead to increased tissue damage of the heart muscle (NHLBI, January 2015).

2.5 Nursing considerations and responsibility about ECG

Nurses play important role in obtaining, interpreting and communicating ECG findings which knowledge and skills in detecting any arrhythmia are key factors in determining the quality of nursing care (Sheiline, M 2008). Nurses must have sufficient knowledge to perform these responsibilities in ways that increase care and patient outcomes (Pettersen et al 2014).

When applying continuous monitoring ECG to detect deterioration produces a situation that may in fact subvert the nurse's ability to provide proper clinical surveillance of patients conditions (Larson et al 2008). So the nurse's knowledge and skills in detecting any arrhythmia on the ECG monitors are important key factors in determining the quality of nursing care (Shieline 2008). Nurses in acute clinical areas are able to record and interpret 12-lead electrocardiograms so the treatment can be initiated as soon as possible which leading to better clinical outcomes for this patient group (Docherty 2003).

Also arrhythmias present a unique challenge to the ED nurse as knowledge of the emergency procedures such as cardioversion and essential medications like patients with atrial fibrillation is often complex and present with comorbid conditions leading to a myriad of choices in medical treatment (Cottrell et al 2008).

2.6 Why study is important

ECG interpretation is an important clinical skill as it allows rapid diagnosis of potentially life-threatening diseases (Salerno et al 2003). Because accuracy of the diagnosis derived from an ECG tracing is key to patient outcome (Morrison et al 2006). Many hospitalized patients exhibit signs of clinical deterioration, such as changes in vital signs prior to experiencing critical events (Gazarian et al., 2010).

As known ECG is not the only diagnostic tool in the diagnosis of related diseases but it's benchmark door to balloon time of 90 min is highly dependent on quick and accurate ECG Interpretation in chest pain cases (Calder, 2008). The national service framework for coronary heart disease puts guidance on significant aspects of therapy that may make a substantial difference to patient care which identify and fast-track patients with an ACS so that thrombolysis or interventional therapy can be applied as soon as possible to decrease myocardial damage and reduce door-to-needle time (Docherty 2003).

The ECG was and remains the most widely used initial screening test for evaluating patients with chest pain (Lancia et al 2008). So there is evidence that continuous ECG monitoring is of use in specific patient populations such as those with ACS and that sophisticated monitoring parameters such as ST segment monitoring are useful in detecting cardiac ischemia in those at risk (Drew et al 2004).

So that study so important to increase level of care outcome because most investigators have observed that the level of knowledge of nursing professionals is lower than desired (Stephens et al 2007). Also accuracy of the diagnosis derived from an ECG tracing is key to patient outcome (Morrison et al 2006).

3. METHODOLOGY

3.1 Study Design

The study was planned as descriptive design.

3.2 Study Setting:

The study was conducted at the Near East University hospital in Lefkoşa city and at Dr. Suat Günsel Girne University hospital in Girne city in North Cyprus. The Near East University hospital the largest and leading university of Cyprus which is located in northern part of Nicosia, the capital of North Cyprus. The services of Hospital of Near East University 209 private, single patient rooms, 8 operating theatres, 30-bed Intensive Care Unit, 17-bed Neonatal Intensive Care Unit, an advanced laboratory where a wide array of medical and experimental tests can be carried out, 22 other labs specializing on certain medical tests.

Dr. Suat Günsel Girne University Hospital, with its high technological equipment have about 150 bed capacity, there are a total of 15 beds in intensive care unit with 2 isolated rooms. These intensive care units consist of 4 parts: child, cardiovascular surgeon, cardiology and general intensive care unit. The hospital comprises 3 fully equipped operation theatres of which was designed especially to carry out cardiac surgeries. There is one delivery unit, a blood bank, sterilization and dialysis units, an emergency service; biochemistry, microbiology and pathology labs; radiology, physiotherapy and rehabilitation clinics, cardiac centre, 20 policlinics, nutrition and dietetic and check-up centers, 4 sound-insulated classrooms with 120 people capacity, a restaurant with a capacity to serve up to 200 people, clinic pharmacy, normal and cold air stores and a call center.

In both hospitals the nurses doing ECG to patients after taking orders from doctors in all departments and following doctors' orders in arrhythmias cases, also in both of hospital if any emergency case happened the senior nurse or supervisor has responsibility to give order to do ECG and dealing with any arrhythmias if there are no doctors.

3.3 Sample Selection:

The study was performed on the register nurses who work in critical care units like: intensive care unit, coronary care unit, emergency department, recovery department and cardiology department in both of the Near East University hospital and Dr. Suat Günsel Girne University hospital. A total of 72 register nurses work in both hospitals. Total 65 voluntary nurses were composed the sample of the study with 95% access rate.

3.4 Study Tools:

A questionnaire was developed by the researcher on the basis of the literatures were used as data collection tool in this studies (Ahmed A. AL-Husaunawy 2015; Coll-Badell et al 2017; Zhang et al 2013).

The questionnaire contains 3 sections:

- The first section regarding for demographics characteristics of nurses which consisted 11 questions.
-The second section consisted 15 questions with 2 choices (True and False) regarding knowledge of nurses on electrocardiogram.
-Third section regarding practice of nurses on ECG interpretations which consisted 8 questions with 4 choices (just one of choices is true and others choices are false).

Since all of nurses in both hospitals speaks Turkish; So the questionnaire prepared in Turkish language and credence after reviewed by 3 specialist nurses' and one cardiologist.

3.5 Pilot study

A pilot study was performed on ten nurses after approval from the Near East Institutional Reviews Board (IRB) of Near East University hospital and Dr. Suat Günsel Girne University hospital. After the pilot study, revision was not necessary and the nurses who included in pilot study were added to main sample.

3.6 Data collection

Data were collected by researcher using questionnaire in May 2018. While the nurses on their duty questionnaire was given to nurses with self completion method then collected from them. Completion the questionnaire was taken about 15 minutes.

3.7 Ethical aspect

Ethical approval was obtained from the Near East Institutional Reviews Board (IRB) (Appendix 3). Informed consent from the nurses and organizational permission were also obtained (Appendix 4).

3.8. Data analysis

Statistical Package for the Social Sciences (SPSS) software version 22 MAC OS was used to analyze the data. The analyzing of descriptive statistic variables like percentages and frequency for categorical variables “True” and “false” statements were used in evaluation of knowledge questions. Also comparisons were made between years of working experience as registered nurse, currently working unit in hospital and previous ECG training course with only correct answers of questions. The Pearson Chi-Square test was used in determined the differences. Also the measurement of significance results are $p < 0.05$.

4. RESULTS

In this chapter, results of the study conducted to determine the knowledge and practice of electrocardiogram among nurses.

Table 4.1 descriptive characteristics of the nurses (N=65)

Descriptive characteristics	**n**	**%**
Age (Mean: 26.94)		
< = 25	29	44.6
26 – 30	28	43.1
> =31	8	12.3
Gender		
Male	22	33.8
Female	43	66.2
Years of working experience as registered nurse		
< 1 year	11	16.9
1-5 years	35	53.8
>= 6 years	19	29.2
Currently working unit in hospital		
Emergency department	15	23.1
Intensive care unit	18	27.7
Coronary care unit	16	24.6
Cardiology department	7	10.8
Recovery unit	9	13.8
Education level		
Bachelor’s	61	93.8
Master	4	6.2
Do you taking ECG for patients		
Yes	58	89.2
No	7	10.8

Descriptive characteristics of the nurses are shown in table 4.1. A total of 65 questionnaires were administered for this survey and the mean ages of the participants were 26.94 years. Majority of the participants were female (66.2%), Most of the nurses had experience less than five years as registered nurses (53.8%), The questionnaires were administered for this survey in goal to target nurses which work in critical department: Emergency department (23.1%), Intensive care unit (27.7%), Coronary care unit (24.6%), Cardiology department (10.8%) and recovery unit (13.8%). Majority and most frequent of the nurses had bachelor degree (93.8%). And most of participant nurses taking ECG for patients (89.2%). (Table 4.1).

Table 4.2 characteristics of the nurses on ECG education (N=65)

Descriptive characteristics	n	%
Previous ECG training course		
Yes	39	60.0
No	26	40.0
ECG information resource*		
University	57	87.7
Courses	28	43.1
Internet	15	23.1
Self learning books	15	23.1
Congress / conferences	25	38.5
Years since taking the last ECG course		
I don't take	6	9.2
Less than 2 years	29	44.6
Between 2 to 5 years	18	27.7
More than 5 years	12	18.5
ECG competency level		
Beginner	15	23.1
Intermediate	42	64.6
Advanced	8	12.3
Desire to learn about ECG		
Yes	60	92.3
No	5	7.7

*more than one choses answer

Characteristics of the nurses on ECG education as show in table 4.2. The majority participants have previous ECG training course (60.0%). Nurses who received ECG information's reported in five category of resource. The university was higher percentage (87.7%). Other resources were courses (43.1%), internet (23.1%), self learning books (23.1%) and congress/conferences (38.5%). Most of participants had take ECG course less than 2 years (44.6%). Most of nurses answer that there ECG competency level intermediate (64.6%). Also most majority of nurses said that they desire to learn about ECG (92.3%). Table 4.2.

Table 4.3 Knowledge of nurses on electrocardiogram (N=65)

Statements on ECG	True/False	Correct answer		Wrong answer	
		n	%	n	%
The P wave represented right and left atrial repolarization	False	41	63.1	24	36.9
QRS complex represented right and left ventricular depolarization	True	56	**86.2**	9	13.8
T wave represents ventricular repolarization	True	55	**84.6**	10	15.4
T wave is one of the negative waves in ECG	False	41	63.1	24	36.9
Normal PR interval between 0.12 and 0.20 seconds	True	56	**86.2**	9	13.8
In normal ECG V1 and aVR leads are negative waves	True	43	66.2	22	33.8
Pathologic Q waves are a sign of previous myocardial infarction	True	49	**75.4**	16	24.6
Atrial fibrillation could be regular rhythm	False	40	61.5	25	**38.5**
ECG can detects left ventricular hypertrophy (LVH)	True	37	56.9	28	**43.1**
ST elevation in inferior myocardial infarction appears in leads: V1-V6	False	38	58.5	27	**42.5**
ST elevation in lateral myocardial infarction appears in leads: I, aVL, V5, V6	True	47	**72.3**	18	27.7
ST elevation in anterior myocardial infarction appears in leads: II, III, aVF	False	45	69.2	20	30.8
ST depression in ECG indicated ischemia myocardial	True	60	**92.3**	5	7.7
RSR pattern appear in V1, V2 and V3 in right bundle branch block rhythms	True	38	58.5	27	**41.5**
T long wave is and QRS wide wave seen in case of hypokalemia	False	29	44.6	36	**55.4**

Knowledge of nurses on electrocardiogram which described in table 4.3 show that the most frequently known and correct items with (92.3%) were "ST depression in ECG indicated ischemia myocardial", After this range two items come in same percent (86.2%) "QRS complex represented right and left ventricular depolarization" and "Normal PR interval between 0.12 and 0.20 seconds", "T wave represents ventricular repolarization" with (84.6%), "Pathologic Q waves are a sign of previous myocardial infarction" with (75.4%), "ST elevation in lateral myocardial infarction appears in leads: I, aVL, V5, V6" with (72.3%) respectively. However, the most frequently wrong answer with (55.4%) "T long wave is and QRS wide wave seen in case of hypokalemia", "ECG can detects left ventricular hypertrophy (LVH)" with (43.1%), "ST elevation in inferior myocardial infarction appears in leads: V1-V6" with (42.5%), "RSR pattern appear in V1, V2 and V3 in right bundle branch block rhythms" with (41.5%), "Atrial fibrillation could be regular rhythm" with (38.5%) respectively.

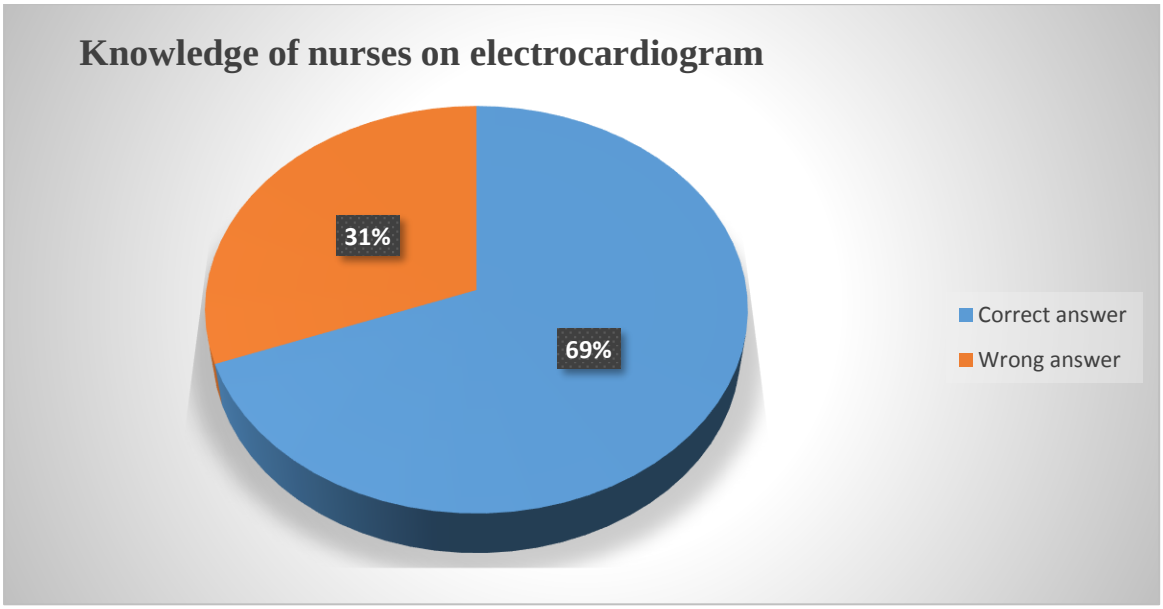

Figure 1. Knowledge of nurses on electrocardiogram

Knowledge of nurses on electrocardiogram was shown in figure 4.1 as general and in table 4.3 with details. The total frequency of correct answer is 69% and the total frequency of wrong answer is 31% (Figure 1). It was determined that the majority of the nurses had correct answers in majority of the items (14 of 15 items) (Table 4.3).

Table 4.4 Practice of nurses on ECG interpretations

Scenario of ECG interpretations	True interpretations	Correct answer	
		n	%
You perform an ECG and observe this rhythm. What do you think it might be ?	An atrial flutter	55	84.6
You perform an ECG and observe this rhythm. How would you act ?	Ask for help without leaving the patient alone because it is a ventricular fibrillation	44	67.7
A patient comes to the emergency department due to a respiratory distress. He has 140 beats per minute. You perform an ECG and observe the following	It is an atrial fibrillation	41	63.1
A hospitalized patient who had surgery due to an Acute myocardial infarction, his vital signs are unstable. You perform an ECG and observe the following	The patient presents a Ventricular tachycardia	57	87.7
You performed ECG to patient who have chest pain appeared after leaving an important meeting two hours ago. He is 52 years of age and hypertensive and a few months ago he was diagnosed with Diabetes Mellitus II. The ECG as the following	It is an acute myocardial infarction	47	72.3
A 24-year-old male comes to the emergency department He is athletic and slim. He reports feeling a pricking sensation in the left area of his chest since he finished doing exercise (3 hours earlier). You perform an ECG and observe the following	It is a normal ECG	35	53.8
A 30-year-old woman comes to the emergency department reporting palpitations, chest tightness and dyspnea. You perform an ECG and observe the following	It is an atrial tachycardia	33	50.8
What pathology you think the patient with this ECG has?	A third-degree heart block	39	60.0

Table 4.4 presented practice of nurses on ECG interpretations which include 8 questions of scenario of ECG interpretations which show that most majority frequently known items were interpretation and recognizing ventricular tachycardia with (87.7%), Atrial flutter with (84.6%), Interpretation ECG with acute myocardial infarction (72.3%), Cases with ventricular fibrillation (67.7%), Atrial fibrillation with frequently of (63.1%), After that interpretation of a third-degree heart block with (60.0%), Then normal ECG with (53.8%) and finally atrial tachycardia with (50.8%) respectively.

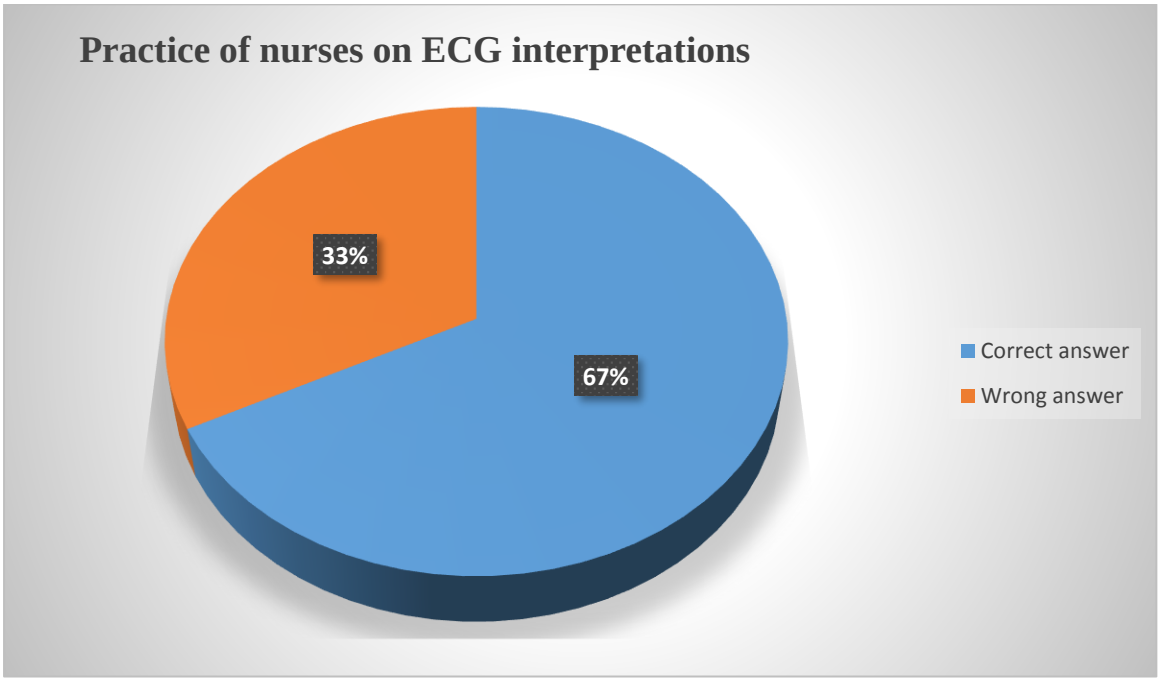

Figure 2 Practice of nurses on ECG interpretations

Practice of nurses on ECG interpretations was shown in figure 4.2 as general and in table 4.4 with details. The total frequency of correct answer is 67% and the total frequency of wrong answer is 33% (Figure 2). It was determined that the majority of the nurses had correct answer in majority of the items (8 of 8 items) (Table 4.5).

Table 4.5 comparison of years of working experience as registered nurse, currently working unit in hospital and previous ECG training course with knowledge of nurses on electrocardiogram

Knowledge of nurses on Electrocardiogram	Years of working experience as registered nurse						P value	Likelihood Ratio	Currently working unit in hospital										P value	Likelihood Ratio	Previous ECG training course				P value	Likelihood Ratio
	< 1		1-5		>=6				ED		ICU		CCU		CD		RU				YES		No			
	Correct answer								Correct answer												Correct answer					
	N	%	N	%	N	%			N	%	N	%	N	%	N	%	N	%			N	%	N	%		
The p wave represented right and left atrial repolarization	5	45.5	21	60.0	15	78.9	.160	.151	12	80.0	9	50.0	11	68.8	7	100.0	2	22.2	.008	.003	30	76.9	11	42.3	.005	.005
QRS complex represented right and left ventricular depolarization	9	81.8	28	80.0	19	**100.0**	.114	.033	14	93.3	15	83.3	15	93.8	6	85.7	6	66.7	.354	.402	37	**94.9**	19	73.1	.013	.013
T wave represents ventricular repolarization	9	81.8	31	88.6	15	78.9	.620	.623	14	93.3	17	94.4	13	81.3	7	100.0	4	44.4	.005	.012	37	**94.9**	18	69.2	.005	.005
T wave is one of the negative waves in ECG	7	63.6	17	48.6	17	89.5	**.012**	.007	10	66.7	12	66.7	10	62.5	7	100.0	2	22.2	.030	.012	29	74.4	12	46.2	.021	.021
Normal PR interval between 0.12 and 0.20 seconds	10	90.9	28	80.0	18	94.7	.228	.257	13	86.7	12	66.7	15	93.8	7	100.0	9	100	.059	.039	36	92.3	20	76.9	.079	.081
In normal ECG V1 and aVR leads are negative waves	7	63.6	20	57.1	16	84.3	.131	.111	11	73.3	9	50	11	68.8	7	100.0	5	55.6	.163	.072	29	74.4	14	53.8	.087	.088
Pathologic Q waves are a sign of previous myocardial infarction	8	72.7	26	74.3	15	78.9	.907	.906	10	66.7	16	88.9	12	75	7	100.0	4	44.4	.054	.032	31	79.5	18	69.2	.347	.350
Atrial fibrillation could be regular rhythm	3	**27.3**	21	60.0	16	84.2	**.008**	.007	8	53.3	12	66.7	11	68.8	7	100.0	2	22.2	.024	.009	27	69.2	13	50.0	.118	.119
ECG can detects left ventricular hypertrophy (LVH)	3	**27.3**	20	57.1	14	73.7	**.047**	.044	6	40	11	61.1	9	56.3	7	100.0	4	44.4	.101	.035	24	61.5	13	50.0	.357	.358
ST elevation in inferior myocardial infarction appears in leads: V1-V6	5	45.5	20	57.1	13	68.4	.457	.457	14	93.3	9	50	8	50	7	100.0	0	0.0	.001	.001	28	71.8	10	38.5	.008	.007
ST elevation in lateral myocardial infarction appears in leads: I, aVL, V5,V6	7	63.6	25	71.4	15	78.9	.655	.655	13	86.7	13	72.3	10	62.5	7	100.0	4	44.4	.075	.038	35	89.7	12	46.2	.001	.001

ST elevation in anterior myocardial infarction appears in leads: II, III, aVF	6	54.5	25	71.4	14	73.7	.504	.521	13	86.7	9	50	12	75	7	100.0	4	44.4	.024	.011	33	84.6	12	46.2	.001	.001
ST depression in ECG indicated ischemia myocardial	11	**100.0**	30	85.7	19	**100.0**	.098	.038	14	93.3	14	77.8	16	100	7	100.0	9	100	.090	.065	37	49.9	23	88.5	.342	.348
RSR pattern appear in V1, V2 and V3 in right bundle branch block rhythms	7	63.6	16	45.7	15	78.9	.057	.050	10	66.7	10	55.6	10	62.5	6	85.7	2	22.2	.108	.093	28	71.8	10	38.5	.008	.007
T long wave is and QRS wide wave seen in case of hypokalemia	4	36.4	22	62.9	10	52.6	.292	.291	6	40	7	38.9	7	43.8	6	85.7	3	33.3	.229	.201	23	59.0	6	23.1	.004	.004

ED: Emergency Department, ICU: Intensive Care Unit, CCU: Coronary Care Unit, CD: Cardiology Department, RU: Recovery Unit

Table 4.5 represented comparison between years of working experience as registered nurse, currently working unit in hospital and previous ECG training course with Knowledge of nurses on electrocardiogram. Nurses with >=6 years' experience have highest in 2 percentage of correct answer in questions "QRS complex represented right and left ventricular depolarization" and "ST depression in ECG indicated ischemia myocardial". Nurses who had years of experience <1 years had the lowest 2 percentage of correct answers (27.3%) were in "Atrial fibrillation could be regular rhythm" and "ECG can detects left ventricular hypertrophy (LVH)" items. There were statistically significant differences between correct answers of some items and currently working unit in hospital which cardiology department nurses had highest percentage of correct answers. Also there is statistically significant differences in most of items compering with previous ECG training course ($p< 0.05$) which the nurses who had previous ECG training courses had highest percentage of correct answers (94.9%) in "QRS complex represented right and left ventricular depolarization" and "T wave represents ventricular repolarization".

Table 4.6 Comparison of years of working experience as registered nurse, currently working unit in hospital and previous ECG training course with practice of nurses on ECG interpretations

Practice of nurses on ECG interpretation	Years of working experience as registered nurse						P value	Likelihood Ratio	Currently working unit in hospital										P value	Likelihood Ratio	Previous ECG training course				P value	Likelihood Ratio
	< 1		1-5		>=6				ED		ICU		CCU		CD		RU				YES		No			
	Correct answer								Correct answer												Correct answer					
	N	%	N	%	N	%			N	%	N	%	N	%	N	%	N	%			N	%	N	%		
Scenario number 1 of ECG interpretation	8	72.7	29	82.9	18	94.7	.319	.285	14	93.3	14	77.8	15	93.8	7	100.0	5	55.6	.075	.081	38	97.4	17	65.4	.002	.001
Scenario number 2 of ECG interpretation	6	54.5	22	62.9	16	84.2	.144	.147	11	73.3	12	66.7	12	75.0	7	100.0	2	22.2	.017	.012	29	74.4	15	57.7	.072	.044
Scenario number 3 of ECG interpretation	6	54.5	20	57.1	15	78.9	.408	.247	13	86.7	10	55.6	9	56.3	7	100.0	2	22.2	.002	.001	32	82.1	9	34.6	.001	.001
Scenario number 4 of ECG interpretation	8	72.7	32	91.4	17	89.5	.129	.160	14	93.3	12	66.7	16	100.0	7	100.0	8	88.9	.221	.145	37	94.9	20	76.9	.109	.071
Scenario number 5 of ECG interpretation	6	54.5	25	71.4	16	84.2	.157	.133	15	100.0	13	72.2	12	75.0	7	100.0	0	0.00	.001	.001	35	89.7	12	46.2	.001	.001
Scenario number 6 of ECG interpretation	4	36.4	16	45.7	15	78.9	.010	**.017**	9	60.0	7	38.9	8	50.0	7	100.0	4	44.4	.187	.099	25	64.1	10	38.8	.097	.071
Scenario number 7 of ECG interpretation	1	9.1	19	54.3	13	68.4	.001	**.001**	10	66.7	7	38.9	9	56.3	7	100.0	0	0.00	.002	.001	23	59.0	10	38.5	.016	.006
Scenario number 8 of ECG interpretation	4	36.4	21	60.0	14	73.7	.162	.063	10	66.7	12	66.7	10	62.5	7	100.0	0	0.00	.003	.001	31	79.5	8	30.8	.001	.001

Table 4.6 represented comparison between years of working experience as registered nurse, currently working unit in hospital and previous ECG training course with practice of nurses on ECG interpretations. Study represented statistically significant differences in years of working experience as registered nurse in scenario number 7 and 8 of ECG interpretations" ($p < 0.05$), Also currently working unit in hospital and previous ECG training course represented the comparison with practice of nurses on ECG interpretations represented statistically significant differences in most of items ($p < 0.05$).

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5. DISCUSSION

The finding from this study was determined the knowledge and practice of electrocardiogram among nurses. The study was conducted on 65 nurses with a different age, experience and level of education. The study contact with critical care units like: Intensive care unit, Coronary care unit, Emergency department, Recovery department and Cardiology department which made knowledge and practice of ECG interpretation very important. In the current study, no specific courses, educational programs or associations stated by participants that they take it to improve their knowledge and practice of ECG.

Regarding to knowledge of nurses on electrocardiogram were shown in Table 4.3 it was found that; majority of the nurses had correct answers about 69% in most of the items (14 of 15 items) and this is a satisfying result. In our study the lowest percent of correct answer was "T long wave is and QRS wide wave seen in case of hypokalemia" about 55.4% of nurses' wrong answer so nurses should attend to educational course to prepare them and endorse with patients. In other hand the study had similar in results with AL-Husaunawy 2015 study that indicate most nurses pass the questions regarding knowledge except question concerning ECG changes regarding new and old myocardial infarction, comparing to current study with question of "Pathologic Q waves are a sign of previous myocardial infarction" the percentage of correct answer was 75.4% which indicate high knowledge. As important of educated nurses they must had a critical thinking and knowledge in detection of myocardial infarction that Stanfield L. 2018 explained in her study that the first-nurse educational intervention to include other high-risk populations that need rapid intervention upon arrival at the emergency department which in current study participant nurses had pass all questions related to myocardial infarction that "ST elevation in lateral myocardial infarction appears in leads: I, aVL, V5, V6" with 72.3% (True), "ST elevation in anterior myocardial infarction appears in leads: II, III, aVF" with 69.2% (false) and "ST elevation in inferior myocardial infarction appears in leads: V1-V6" with 58.5% (false) respectively. Also the the most frequently known and correct item in this study with 92.3% were "ST depression in ECG indicated ischemia myocardial".

This study is one of studies which evaluate nurses' competence those working in critical area of there practice on ECG interpretation. In our study, the current practice of nurses on ECG interpretation results are satisfying with 67% of nurses passing the questionnaire which this score is higher than those of other studies like Werner et al 2016 which had 54% correct answers on the test from participate nurses. In current study the lowest percent of correct answer was identifying the case scenario of atrial tachycardia question which maybe confusing the participate nurses because 32.3% of answers was "It is an atrial extra-systole". Focusing on literature regarding to practice of nurses on ECG interpretations the most majority recognizing arrhythmias of different cases were ventricular tachycardia and atrial flutter which this reflex finding similar with study conducted by Coll-Badell et al 2017. Also in our study defining ECG that included acute myocardial infarction were 72.3% of answers cases which also similar to Coll-Badell et al 2017 result which was of 71.9% of participates and compering to Doğan et al 2012 study result was 54.3% of participates identify myocardial infarction which mean that our study participates had high knowledge and practice to recognize this type of critical case that may cause life threatening.

In comparison of years of working experience as registered nurse, currently working unit in hospital and previous ECG training course with knowledge of nurses on electrocardiogram (Table 4.5). In currently study it was showed that nurses who less than one year of experience had lowest average of correct answers and nurses who experience >=6 years had highest average of correct answers. As shown up the comparison of years of working experience with knowledge of nurses on electrocardiogram wasn't statistically significant differences in terms of majority of the items ($p>0.05$). Results showed statistically significant differences in 3 items of "T wave is one of the negative waves in ECG", "Atrial fibrillation could be regular rhythm" and "ECG can detects left ventricular hypertrophy (LVH)" were $p< 0.05$. Back to current result in comparison of currently working unit in hospital with knowledge of nurses on electrocardiogram which the cardiology department had the highest percent of correct answers between nurses who work in hospital this result is similar to result of Zhang et al 2013 study that show the test scores of nurses in the cardiology department were higher than those in ED and ICU. There were statistically significant differences between correct answers of some items on knowledge of nurses on electrocardiogram and currently working unit in hospital which recovery unit nurses had the lowest percent of correct answers between participate nurses which item that no one of these nurses answer correct "ST elevation in inferior myocardial infarction appears in leads leads: V1-V6" ($p< 0.05$).

Also “The p wave represented right and left atrial repolarization”, “T wave represents ventricular repolarization”, “T wave is one of the negative waves in ECG”, “Atrial fibrillation could be regular Rhythm”. “ECG can detects left ventricular hypertrophy (LVH)” and “ST elevation in anterior myocardial infarction appear in leads: II, III, aVF” which these differences were found significant statistically ($p<0.05$). Also there were significant differences between knowledge of nurses on electrocardiogram and previous ECG training course. Which the percentage of nurses who had previous ECG training course in this study were 60% of total participate, in addition the current study presented that the nurses who had previous ECG training course score more percentage correct answers than who didn’t had which also the comparison for most of items had differences were found significant statistically ($p< 0.05$) this results are similar to Coll-Badell et al 2017 that shown nurses who had received training within the previous five years scored significantly higher than those who had not.

In comparison years of working experience as registered nurse, currently working unit in hospital and previous ECG training course with practice of nurses on ECG interpretations (Table 4.6). As current study results the comparison of years of working experience with practice of nurses on ECG interpretations had same result as knowledge comparison part that nurses who less than one year of experience had lowest average of correct answers. Results showed statistically significant differences only in 2 scenarios 6 and 7 that’s contact with recognizing of case of normal ECG and atrial tachycardia that’s the participated nurses had confusing to analyzed ($p<0.05$). And more of scenario items were highest average of correct answers but no statistically significant differences in terms of majority of the items ($p>0.05$) which similar to Lak et al 2013 study results. The current study represented that currently working unit in hospital was significant statistically affected on practice of nurses on ECG interpretations the nurses who working in cardiology department had correct answers which also similar to Zhang et al 2013 study. Also CCU staff nurses had higher percent of correct answers which similar to Lak et al 2013 study results that CCU working experience was associated with better results on the ECG test. The nurses who work in recovery unit had lowest average of correct answers were statistically significant differences in most of items ($p< 0.05$). Referred to comparison between previous ECG training course with practice of nurses on ECG interpretations the percentage of nurses who had previous ECG training course score more correct answers than who didn’t had which also statistically significant differences in most of items ($p< 0.05$).

6. CONCLUSION

Results of the present study showed high level of knowledge and practice of electrocardiogram among nurses. Also working unit in hospital and previous ECG training courses play important role in defining the professionalism of nurses to had experience in ECG interpretation. Training courses for nurses abroad for knowledge and practice with more intensive detailed lectures about ECG in universities. Also regular courses under the supervision of qualified well trained staff especially for nurses who work in critical area in hospital. Nurses must be continuing self learning and staying update to any changing and development of new protocols or technology in the world.

7. FINDINGS AND RECOMMENDATIONS

7.1. Findings

Main findings of the study that was performed with the aim of determination of the knowledge and practices of electrocardiogram interpretation of nurses were listed as followings:

- The mean ages of the participants were (26.94) years. Majority of the participants were female (66.2%), while (33.8%) of them were male. Majority of the nurses had bachelor degree (93.8%). Most of the nurses had experience less than five years as registered nurses (53.8%) (Table 4.1).

- The majority of (60.0%) of the participants had received previous ECG courses. The higher percentage ECG education resource was university (87.7%) among the resources (Table 4.2).

- Regarding to Knowledge of nurses on Electrocardiogram, it was found that; majority of the nurses had correct answers (69%) (Figure 1). In most of the items (14 of 15 items) (Table 4.3).

- Regarding to practice of nurses on ECG interpretations, it was found that; majority of the nurses had correct answers (67%) (Figure 2). In most of the items (8 of 8 items) (Table 4.4).

- There were statistically significant differences in terms of currently working unit in hospital and previous ECG training course with different items at Knowledge and practice of nurses on ECG interpretations (Table 4.5, Table 4.6).

7.2. Recommendations

Based on the results of the study following recommendations were made:

- Refresher intensive training courses under the supervision of qualified well trained staff in electrocardiography should be run at least every 2 years.

- Training courses for nurses abroad for knowledge and practice exchange more detailed lectures about ECG in universities.

- Initiation of education program and self-learning handbook material were effective in improving the nurses' ECG knowledge.

8. REFERENCES

AlGhatrif, M., & Lindsay, J. (2012). A brief review: history to understand fundamentals of electrocardiography. Journal of community hospital internal medicine perspectives, 2(1), 14383.

Atwood, D., & Wadlund, D. L. (2015). ECG interpretation using the CRISP method: A guide for nurses. AORN journal, 102(4), 396-408.

Amsterdam, E. A., Wenger, N. K., Brindis, R. G., Casey, D. E., Ganiats, T. G., Holmes, D. R., ... & Levine, G. N. (2014). 2014 AHA/ACC guideline for the management of patients with non–ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Journal of the American College of Cardiology, 64(24), e139-e228.

Authors/Task Force Members, Hamm, C. W., Bassand, J. P., Agewall, S., Bax, J., Boersma, E., ... & Huber, K. (2011). ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: The Task Force for the management of acute coronary syndromes (ACS) in patients presenting without persistent ST-segment elevation of the European Society of Cardiology (ESC). European heart journal, 32(23), 2999-3054.

Anderson JL, Adams CD, Antman EM, et al. (2012). ACCF/AHA focused update incorporated into the ACCF/AHA 2007 guidelines for the management of patients with unstable angina/non-ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines;127(23): e663–828.

Atlas Writing Group, Timmis, A., Townsend, N., Gale, C., Grobbee, R., Maniadakis, N., ... & Bax, J. (2017). European Society of Cardiology: cardiovascular disease statistics 2017. European heart journal, 39(7), 508-579.

Authors/Task Force Members, Hamm, C. W., Bassand, J. P., Agewall, S., Bax, J., Boersma, E., ... & Huber, K. (2011). ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: The Task Force for the management of acute coronary syndromes (ACS) in patients presenting without persistent ST-segment elevation of the European Society of Cardiology (ESC). European heart journal, 32(23), 2999-3054.

Abrams J.(2005) Clinical practice. Chronic stable angina. N Engl J Med; 352: 2524e33.

Benjamin, E. J., Blaha, M. J., Chiuve, S. E., Cushman, M., Das, S. R., Deo, R., ... & Jiménez, M. C. (2017). Heart disease and stroke statistics-2017 update: a report from the American Heart Association. Circulation, 135(10), e146-e603.

Bhaumik, A., Kumar, P. S., Saha, S., & Aishwarya, M. N. L. (2016). A review on cardiac arrhythmia and cardiac ablation: Invasive techniques and future perspective. World journal of pharmaceutical and medical research, 2, 105-111.

Badhwar, N. (2010). Introduction to Supraventricular Tachycardia. Cardiac Electrophysiology Clinics 2, 179–181.

Bhatheja, R., & Mukherjee, D. (2007). Acute coronary syndromes: unstable angina/non-ST elevation myocardial infarction. Critical care clinics, 23(4), 709-735.

Braunwald, E., Antman, E. M., Beasley, J. W., Califf, R. M., Cheitlin, M. D., Hochman, J. S., ... & Pepine, C. J. (2002). ACC/AHA 2002 guideline update for the management of patients with unstable angina and non–ST-segment elevation myocardial infarction—summary article: a report of the American College of Cardiology/American Heart Association task force on practice guidelines (Committee on the Management of Patients With Unstable Angina). Journal of the American College of Cardiology, 40(7), 1366-1374.

Bello, D., Fieno, D. S., Kim, R. J., Pereles, F. S., Passman, R., Song, G., ... & Goldberger, J. J. (2005). Infarct morphology identifies patients with substrate for sustained ventricular tachycardia. Journal of the American College of Cardiology, 45(7), 1104-1108.

Basra, S. S., Virani, S. S., Paniagua, D., Kar, B., & Jneid, H. (2016). Acute Coronary Syndromes: Unstable Angina and Non–ST Elevation Myocardial Infarction. Heart failure clinics, 12(1), 31-48.

Cleveland clinic (June 22, 2017). Coronary Artery Disease. Retrieved from: https://my.clevelandclinic.org/health/diseases/16898-coronary-artery-disease

Cheng, C. H., Sanders, G. D., Hlatky, M. A., Heidenreich, P., McDonald, K. M., Lee, B. K., ... & Owens, D. K. (2000). Cost-effectiveness of radiofrequency ablation for supraventricular tachycardia. Annals of internal medicine, 133(11), 864-876.

Coll-Badell, M., Jiménez-Herrera, M. F., & Llaurado-Serra, M. (2017). emergency nurse competence in electrocardiographic interpretation in Spain: A cross-sectional study. Journal of emergency nursing, 43(6), 560-570.

Calder, S., 2008. Clinical pearls and pitfalls of electrocardiogram interpretation in acute myocardial infarction. Journal of Emergency Nursing 34, 324–329. ACP/ACC/AHA Task Force, 1995. Clinical competence in electrocardiography. Journal of the American College of Cardiology 25, 1465–1469.

Cottrell, D. B., & Mack, K. (2008). Atrial fibrillation: an emergency nurse's rapid response. Journal of emergency nursing, 34(3), 207-210.

Cano, Ó., Andrés, A., Alonso, P., Osca, J., Sancho-Tello, M. J., Rueda, J., ... & Martínez-Dolz, L. (2017). Essential ECG clues in patients with congenital heart disease and arrhythmias. Journal of electrocardiology, 50(2), 243-250.

Doğan, H. D., & Melek, M. (2012). Hemşirelerin acil kalp hastalıklarında g.rülen, EKG bulgularını tanıyabilme ve uygun tedavi yaklaşımlarını değerlendirebilme düzeylerinin tespiti, 60-69.

Drew, B. J., & Funk, M. (2006). Practice standards for ECG monitoring in hospital settings: executive summary and guide for implementation, 157-168.

Delacrétaz, E. (2006). Supraventricular tachycardia. New England Journal of Medicine, 354(10), 1039-1051.

Deckers, J. W. (2013). Classification of myocardial infarction and unstable angina: a re-assessment. International journal of cardiology, 167(6), 2387-2390.

Delgado, V., Bucciarelli-Ducci, C., & Bax, J. J. (2016). Diagnostic and prognostic roles of echocardiography and cardiac magnetic resonance. Journal of Nuclear Cardiology, 23(6), 1399-1410.

Dewar, R. I., & Lip, G. Y. (2007). Guidelines Development Group for the NICE Clinica l Guideline for the management of atrial fibrillation. Heart, 93.

Docherty, B., 2003. 12-Lead ECG interpretation and chest pain management. British Journal of Nursing 12, 1248–1255.

de Winter, R. J., & Tijssen, J. G. (2012). Non–ST-Segment Elevation Myocardial Infarction: Revascularization for Everyone? 903-905.

Drew, B.J.C., Califf, R.M., Funk, M., Kaufman, E.S., Krucoff, M.W., Laks, M.M., Macfarlane, P.W., Sommargren, C., Swiryn, S., Van Hare, G.F., 2004. Practice standards for electrocardiographic monitoring in hospital settings: an American Heart Association scientific statement from the Councils on Cardiovascular Nursing, Clinical Cardiology, and Cardiovascular Disease in the Young. Circulation 110 (17) 2721–2746.

Fuenzalida, C., Ferro, I., Ambrós, A., Siches, C., Sánchez, M., & Cabrera, J. (2015). An educational intervention nursing at discharge from the emergency department reduces complications and admissions in the short term in patients with atrial fibrillation. Emergencias, 27, 75-81.8

Fuenzalida, C., Hernández, G., Ferro, I., Siches, C., Ambrós, À., & Coll- Vinent, B. (2017). Long-term benefits of education by emergency care nurses at discharge of patients with atrial fibrillation. International emergency nursing, 35,7-12.

Funk, M., Fennie, K. P., Stephens, K. E., May, J. L., Winkler, C. G., Drew, B. J., & PULSE site investigators. (2017). Association of implementation of practice standards for electrocardiographic monitoring with nurses' knowledge, quality of care, and patient outcomes. circulation: cardiovascular quality and outcomes, 10(2), e003132.

Funk, M., Winkler, C. G., May, J. L., Stephens, K., Fennie, K. P., Rose, L. L., ... & Drew, B. J. (2010). Unnecessary arrhythmia monitoring and underutilization of ischemia and QT interval monitoring in current clinical practice: baseline results of the practical use of the latest standards for electrocardiography trial. journal of electrocardiology, 43(6), 542-547.

Fuster, V., Rydén, L. E., Cannom, D. S., Crijns, H. J., Curtis, A. B., Ellenbogen, K. A., ... & Olsson, S. B. (2011). 2011 ACCF/AHA/HRS focused updates incorporated into the ACC/AHA/ESC 2006 Guidelines for the management of patients with atrial fibrillation: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines developed in partnership with the European Society of Cardiology and in collaboration with the European Heart Rhythm Association and the Heart Rhythm Society. Journal of the American College of Cardiology, 57(11), e101-e198.

Fanaroff AC, et al. (2015) Does this patient with chest pain have acute coronary syndrome? The rational clinical examination systematic review. JAMA 314(18): 1955–1965.

GBD 2013 Mortality and Causes of Death Collaborators. (2015). Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet, 385(9963), 117–171.

Gupta R, Puri V, Narain VV(1999). Cardiovascular risk profile in Indian women(Abstr). Indian Heart J; 51:679.

Go, A. S., Hylek, E. M., Phillips, K. A., Chang, Y., Henault, L. E., Selby, J. V., & Singer, D. E. (2001). Prevalence of diagnosed atrial fibrillation in adults: national implications for rhythm management and stroke prevention: The Anticoagulation and Risk Factors in Atrial Fibrillation (ATRIA) Study. Jama, 285(18), 2370-2375.

Gheorghiade, M., Sopko, G., De Luca, L., Velazquez, E. J., Parker, J. D., Binkley, P. F., ... & Bonow, R. O. (2006). Navigating the crossroads of coronary artery disease and heart failure. Circulation, 114(11), 1202-1213.

Gazarian, P.K., Henneman, E.A., Chandler, G.E., 2010. Nurse decision making in the prearrest period. Clinical Nursing Research 19 (1) 21–37.

George, A., Arumugham, P. S., & Figueredo, V. M. (2010). aVR–the forgotten lead. experimental & clinical cardiology, 15(2), e36.

Hernández-Padilla, J., Suthers, F., Fernández-Sola, C., & Granero-Molina, J. (2016). Development and psychometric assessment of the basic resuscitation skills self-efficacy scale. European journal of cardiovascular nursing, 15(3), e10-e18.

Hampton, J. R. (2008). The ECG Made Easy. Elsevier Health Sciences, (8), 4-5.

Huitema, A. A., Zhu, T., Alemayehu, M., & Lavi, S. (2014). Diagnostic accuracy of ST-segment elevation myocardial infarction by various healthcare providers. International journal of cardiology, 177(3), 825-829.

Huang HD, Tamarisa R, Mathur N, et al. (2013). Stellate ganglion block: a therapeutic alternative for patients with medically refractory inappropriate sinus tachycardia? J Electrocardiol.46:693-6.

Harris, P., & Lysitsas, D. (2015). Ventricular arrhythmias and sudden cardiac death. BJA Education, 16(7), 221-229.

Hunter, J. D., Sharma, P., & Rathi, S. (2008). Long QT syndrome. Continuing Education in Anaesthesia, Critical Care & Pain, 8(2), 67-70.

Iosr journals, & Ahmed A. AL-Husaunawy. (2015). Evaluation of nurses knowledge and practical of electrocardiogram toward adolescent patient, 10-16.

Jevon, P. (2010). Procedure for recording a standard 12-lead electrocardiogram. British Journal of Nursing, 19(10), 649-651.

Jevon, P. (2010). Recording an accurate ECG. Practice nursing, 21(8), 404-408.

January CT, et al. 2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines and the Heart Rhythm Society. Circulation 2014;130(23):e199-e267.

Khatibzadeh, S., Farzadfar, F., Oliver, J., Ezzati, M., & Moran, A. (2013). Worldwide risk factors for heart failure: a systematic review and pooled analysis. International journal of cardiology, 168(2), 1186-1194.

Kirchhof, P., Benussi, S., Kotecha, D., Ahlsson, A., Atar, D., ... & Hendriks, J. (2016). 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. EP Europace, 18(11), 1609-1678.

Lak, K., Zareie, F., Habibzadeh, H., Mohammadpour, Y., Rahnemoon, K., Zare, H., & Zaviyeh, M. (2013). A survey on the effect of educational software method of arrhythmias stimulator on the level of knowledge of electrocardiograms interpretation in nurses. Iran J Crit Care Nurs, 6(3), 173-80.

Lancia, L., Pisegna Cerone, M., Vittorini, P., Romano, S., Penco, M., 2008. A comparison between EASI system 12-lead ECGs and standard 12-lead ECGs for improved clinical nursing practice. Journal of Clinical Nursing 17, 370– 377.

Libby, P., & Theroux, P. (2005). Pathophysiology of coronary artery disease. Circulation, 111(25), 3481-3488.

Li X, Shu L, Hu H (2009) Kernel-based nonlinear dimensionality reduction for electrocardiogram recognition. Neural Comput Appl 18(8):1013–1020.

Link, M. S., Berkow, L. C., Kudenchuk, P. J., Halperin, H. R., Hess, E. P., Moitra, V. K., ... & White, R. D. (2015). Part 7: adult advanced cardiovascular life support: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation, 132(18 suppl 2), S444-S464.

Larson, T. S., & Brady, W. J. (2008). Electrocardiographic monitoring in the hospitalized patient: a diagnostic intervention of uncertain clinical impact. The american journal of emergency medicine, 26(9), 1047-1055.

Lee, K. W., Badhwar, N., & Scheinman, M. M. (2008). Supraventricular tachycardia—part I. Current problems in cardiology, 33(9), 467-546.

Montalescot, G., Sechtem, U., Achenbach, S., Andreotti, F., Arden, C., Budaj, A., ... & Ferreira, J. R. (2014). 2013 ESC guidelines on the management of stable coronary artery disease. The Task Force on the management of stable coronary artery disease of the European Society of Cardiology. Revista Española de Cardiología, 67(02), 135-135.

Michniewicz, E., Mlodawska, E., Lopatowska, P., Tomaszuk-Kazberuk, A., & Malyszko, J. (2018). Patients with atrial fibrillation and coronary artery disease–double trouble. Advances in medical sciences, 63(1), 30-35.

Morrison, L. J., Brooks, S., Sawadsky, B., McDonald, A., & Verbeek, P. R. (2006). Prehospital 12- lead Electrocardiography Impact on Acute Myocardial Infarction Treatment Times and Mortality: A Systematic Review. Academic emergency medicine, 13(1), 84-89.

Montalescot, G., Sechtem, U., Achenbach, S., Andreotti, F., Arden, C., ... & Di Mario, C. (2013). 2013 ESC guidelines on the management of stable coronary artery disease: the Task Force on the management of stable coronary artery disease of the European Society of Cardiology. European heart journal, 34(38), 2949-3003.

Martínez-Sellés, M., Bueno, H., Sacristán, A., Estévez, Á., Ortiz, J., Gallegoa, L., &Fernández-Avilés, F. (2008). Dolor torácico en urgencias: frecuencia, perfil clínico y estratificación de riesgo. Revista española de cardiología, 61(9), 953-959.

Mousa, A. M., & Ahmed, H. A. O. R. S. (2016). Nurses' knowledge concerning early interventions for patients with ventricular tachycardia at Baghdad teaching hospitals. Kufa journal for nursing sciences 6(2).

Mensah, G. A., & Brown, D. W. (2007). An overview of cardiovascular disease burden in the United States. Health affairs, 26(1), 38-48.

Manning, P., & Awtry, E. H. (2014). Unstable Angina: Presentation, Diagnosis, and Management. Encyclopedia of Cardiovascular Research and Medicine, 606-615.

Nattel, S., & Opie, L. H. (2006). Controversies in atrial fibrillation. The Lancet, 367(9506), 262-272.

National Heart, Lung, and Blood Institute NHLBI (January 27, 2015). What is a heart attack? Retrieved from: http://www.nhlbi.nih.gov/health/health-topics/topics/heart attack.

Pettersen, T. R., Fålun, N., & Norekvål, T. M. (2014). Improvement of in-hospital telemetry monitoring in coronary care units: An intervention study for achieving optimal electrode placement and attachment, hygiene and delivery of critical information to patients. European Journal of Cardiovascular Nursing, 13(6), 515-523.

Pathak, L. A., Shirodkar, S., Ruparelia, R., & Rajebahadur, J. (2017). Coronary artery disease in women. Indian Heart Journal, 69(4), 532-538.

Page, R. L., Joglar, J. A., Caldwell, M. A., Calkins, H., Conti, J. B., Deal, B. J., ... & Indik, J. H. (2016). 2015 ACC/AHA/HRS guideline for the management of adult patients with supraventricular tachycardia: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. Journal of the American College of Cardiology, 67(13), e27-e115.

Papadopoulos, C. H., Oikonomidis, D., Lazaris, E., & Nihoyiannopoulos, P. (2017). Echocardiography and Cardiac Arrhythmias. Hellenic Journal of Cardiology.

Pottle, A. (2005). A nurse-led rapid access chest pain clinic—experience from the first 3 years. European journal of cardiovascular nursing, 4(3), 227-233.

Rockson, S. G., & Albers, G. W. (2004). Comparing the guidelines: anticoagulation therapy to optimize stroke prevention in patients with atrial fibrillation. Journal of the American College of Cardiology, 43(6), 929-935.

Refaey, A. S. T. (2012). Impact of designed teaching protocol about advanced cardiac life support (ACLS) on critical care nurse's knowledge and practices at Benha university hospital, Cairo, Egypt. J Am Sci, 8(12), 838-50.

Roberts-Thomson, K. C., Lau, D. H., & Sanders, P. (2011). The diagnosis and management of ventricular arrhythmias. Nature Reviews Cardiology, 8(6), 311.

Spiers, C. M. (2007). Using the 12-lead ECG to diagnose acute myocardial infarction in the presence of left bundle branch block. Accident and emergency nursing, 15(1), 56-61.

Sharma, S., Drezner, J. A., Baggish, A., Papadakis, M., Wilson, M. G., Prutkin, J. M., ... & Asif, I. M. (2017). International recommendations for electrocardiographic interpretation in athletes. European heart journal, ehw631.

Stephens, K. E., Anderson, H., Carey, M. G., & Pelter, M. M. (2007). Interpreting 12-lead electrocardiograms for acute ST-elevation myocardial infarction: what nurses know. Journal of cardiovascular nursing, 22(3), 186-193.

Sheiline, M. (2008). Effectiveness of a competency program on ECG monitoring and interpretation for staff nurses working in critical care areas and to determine the factors influencing their competency. Asian Journal of Cardiovascular Nursing, 16(1), 1-7.

Salerno, S. M., Alguire, P. C., & Waxman, H. S. (2003). Training and competency evaluation for interpretation of 12-lead electrocardiograms: recommendations from the American College of Physicians. Annals of internal medicine, 138(9), 747-750.

Sachdewani, r. K., dingra, l. C., & memon, a. H. (2018). Acute stemi: prevalence of hypertension and diabetes in patients of acute stemi admitted in ccu ghulam muhammad teaching hospital, sukuur sindh pakistan. Professional medical journal, 25(5).

Tobin, K. J. (2010). Stable angina pectoris: what does the current clinical evidence tell us? Journal of the American Osteopathic Association, 110(7), 364.

Virag, N., Jacquemet, V., Henriquez, C. S., Zozor, S., Blanc, O., Vesin, J. M., ... & Kappenberger, L. (2002). Study of atrial arrhythmias in a computer model based on magnetic resonance images of human atria. Chaos: An Interdisciplinary Journal of Nonlinear Science, 12(3), 754-763.

WHO (2017, January). The top 10 causes of death. Retrieved from: http://www.who.int/mediacentre/factsheets/fs310/en/

Whittaker, A., Jokhi, P., & Curzen, N. (2014). Ischaemic heart disease: stable angina. Medicine, 42(9), 495-501.

Zipes, D. P. et al (2006). ACC/AHA/ESC 2006 Guidelines for Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death: a report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines (writing committee to develop Guidelines for Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death): developed in collaboration with the European Heart Rhythm Association and the Heart Rhythm Society. Circulation 114, e385–e484.

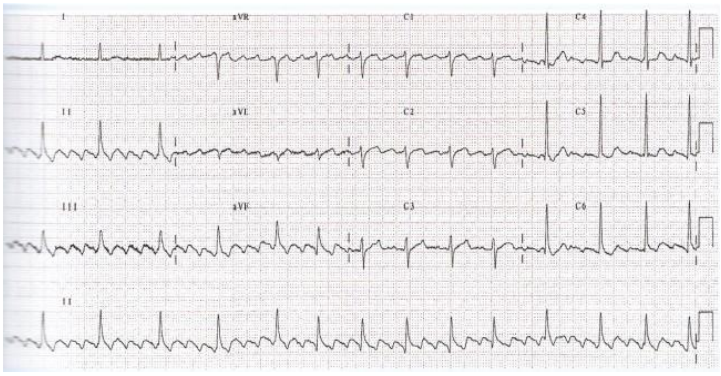
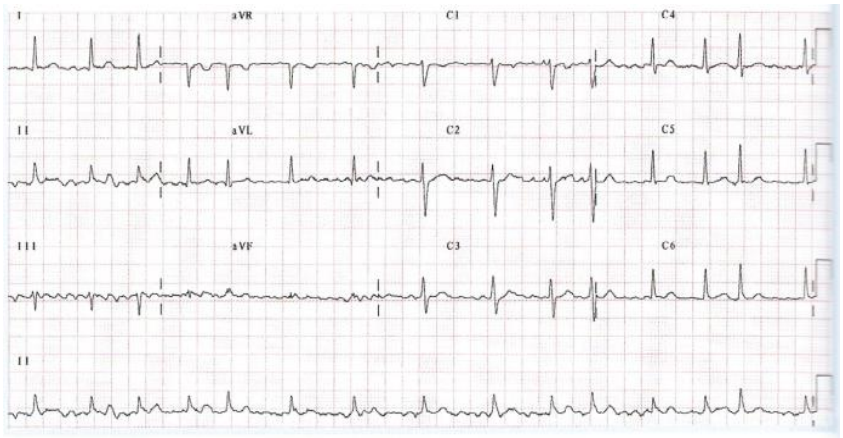
Zhang, H., & Hsu, L. L. (2013). The effectiveness of an education program on nurses' knowledge of electrocardiogram interpretation. International emergency nursing, 21(4), 247-251.

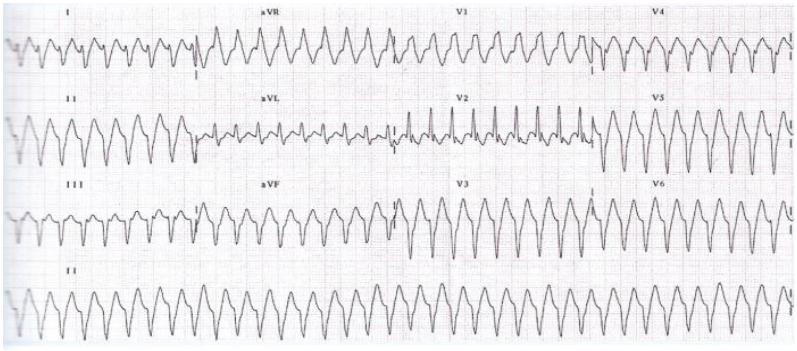
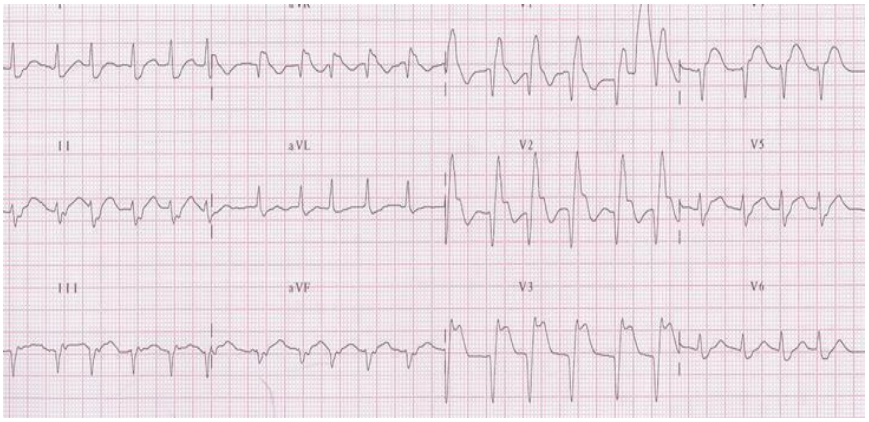
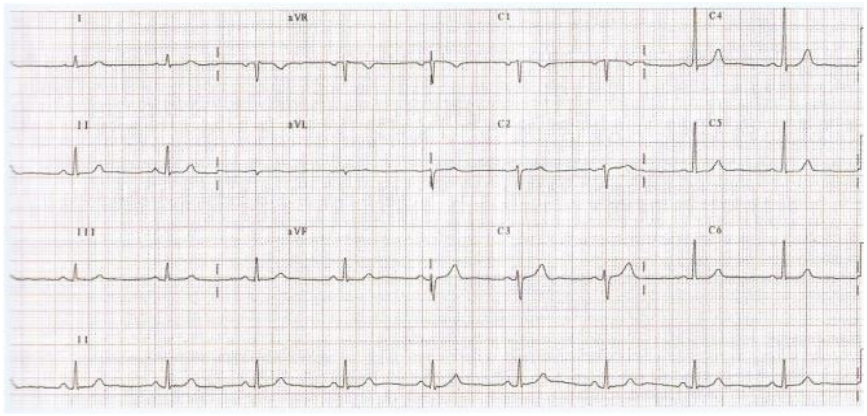
Appendix 1. Knowledge and Practices of Electrocardiogram Interpretation of Nurses (Turkish Version)

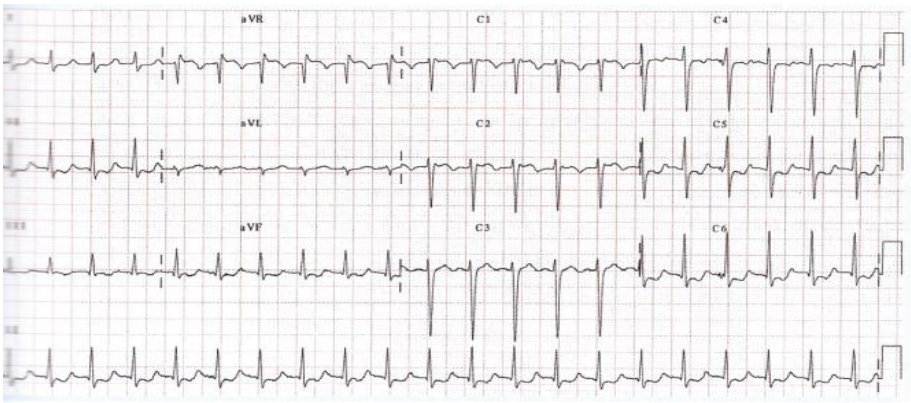
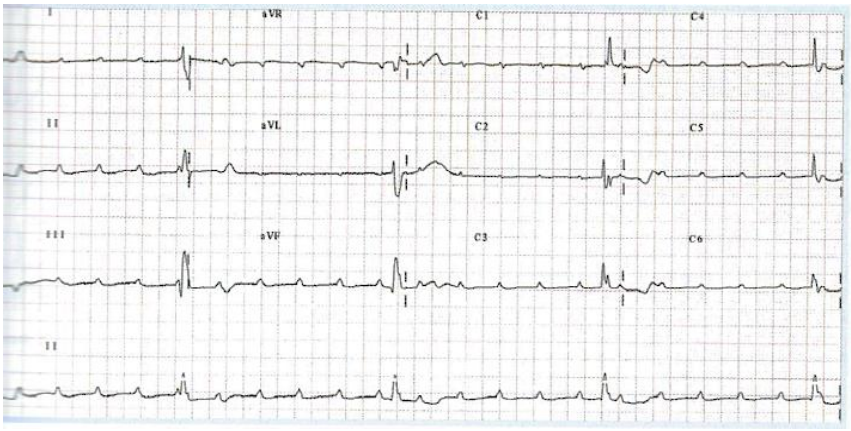
A- Hemşirelerin demografik özellikleri		
1- Yaş		
2- Cinsiyet	☐ **Erkek**	☐ **Kadın**
3- Kayıtlı hemşire olarak iş tecrübesi	☐ **< 1 yıl** ☐ **1-5 yıl** ☐ **6-10 yıl** ☐ **11-20 yıl** ☐ **>20 yıl**	
4- Şu anda hastanede çalıştığı birim	☐ **Acil Servis** ☐ **Yoğun bakım ünitesi** ☐ **Koroner bakım ünitesi** ☐ **Kardiyoloji bölümü** ☐ **Kurtarma ünitesi**	
5- Eğitim Seviyesi	☐ **Lisans** ☐ **Yüksek Lisans** ☐ **Doktora**	
6- Hastalara EKG çekiyor musunuz?	☐ **Evet** ☐ **Hayır**	
7- EKG eğitim kursu aldınız mı?	☐ **Evet** ☐ **Hayır**	
8- EKG eğitim kaynağı	☐ **Üniversite** ☐ **Dersler** ☐ **Internet** ☐ **Kitaplar** ☐ **Kongre / konferanslar** ☐ **Diğerleri ……..**	
9- Son EKG kursundan itibaren geçen yıllar	☐ **EKG çekmem** ☐ **2 yıldan az** ☐ **2 ila 5 yıl arasında** ☐ **5 yıldan fazla**	
10- EKG yeterlilik seviyesi	☐ **Acemi** ☐ **Orta düzey** ☐ **ileri**	
11- EKG hakkında bilgi edinme arzusu	☐ **Evet** ☐ **Hayır**	

B- Elektrokardiyogram hakkında hemşirelerin bilgisi	
1- P dalgası sağ ve sol atriyal repolarizasyonu temsil eder	☐ **Doğru** ☐ **Yanlış**
2- QRS kompleksi sağ ve sol ventriküler depolarizasyonu temsil eder	☐ **Doğru** ☐ **Yanlış**
3- T dalgası ventriküler repolarizasyonu temsil eder	☐ **Doğru** ☐ **Yanlış**
4- T dalgası EKG'deki negatif dalgalardan biridir	☐ **Doğru** ☐ **Yanlış**
5- Normal PR aralığı 0,12 ve 0,20 saniye arasındadır	☐ **Doğru** ☐ **Yanlış**
6- Normal EKG'de V1 ve aVR derivasyonları negatif dalgalardır.	☐ **Doğru** ☐ **Yanlış**
7- Patolojik Q dalgaları, önceki miyokard infarktüsünün bir göstergesidir.	☐ **Doğru** ☐ **Yanlış**
8- Atriyal fibrilasyon düzenli ritim olabilir	☐ **Doğru** ☐ **Yanlış**
9- EKG, sol ventrikül hipertrofisini (LVH) tespit edebilir	☐ **Doğru** ☐ **Yanlış**
10- İnferior miyokard infarktüsünde ST yükselmesi bu leadlerde görülür: V1-V6	☐ **Doğru** ☐ **Yanlış**
11- Lateral miyokard infarktüsünde ST yükselmesi bu leadlerde gibi görünür: I, aVL, V5, V6	☐ **Doğru** ☐ **Yanlış**
12- Anterior miyokard infarktüsünde ST yükselmesi bu leadlerde görülür: II, III, aVF	☐ **Doğru** ☐ **Yanlış**
13- EKG'de ST depresyonu miyokard iskemisini gösterir	☐ **Doğru** ☐ **Yanlış**
14- Sağ dal bloğu ritimlerinde V1, V2 ve V3'te RSR paterni belirir	☐ **Doğru** ☐ **Yanlış**
15- Hipokalemi durumunda QRS dalgası genişler ve sivri T dalgası görülür.	☐ **Doğru** ☐ **Yanlış**

C- Hemşirelerin EKG yorumları üzerine uygulaması

1- EKG çektiniz ve bu ritmi gözlemlediniz. Ne olabileceğini düşünürsünüz? 	**☐ Üçüncü derece kalp bloğu** **☐ Atriyal flutter** **☐ Supraventriküler taşikardi** **☐ Bilmiyorum**
2- EKG çektiniz ve bu ritmi gözlemlediniz. Nasıl davranırsınız? 	**☐ Hastayı yalnız bırakmadan yardım isterim çünkü bir ventriküler fibrilasyon** **☐ Hastayı yalnız bırakmadan yardım isterim çünkü bir atriyal fibrilasyon** **☐ Başka bir EKG gerçekleştiririm çünkü parazit olabilir** **☐ Nasıl davranacağını bilmiyorsun ama bunun ciddi bir sorun olduğunu biliyorsun.**
3- Bir hasta solunum sıkıntısı nedeniyle acil servise geldi. Dakikada 140 nabız saptandı. EKG çektiniz ve aşağıdaki gibi saptadınız. Ne düşünürsünüz 	**☐ Bu bir atriyal taşikardidir.** **☐ Bu bir Atriyal fibrilasyondur** **☐ Bu bir atriyal ekstra sistoldür** **☐ Bilmiyorum**

4- Akut miyokard infarktüsü nedeni ile ameliyat olan hospitalize hastanın vital bulguları stabil değildir. EKG çektinizve aşağıdaki gibi saptadınız: 	**☐ Ventriküler taşikardi** **☐ Supra-ventriküler taşikardi** **☐ Atriyal taşikardi** **☐ Bilmiyorum**
5- İki saat önce önemli bir toplantıdan çıktıktan sonra göğüs ağrısı olan hastaya EKG uyguladınız. Hasta 52 yaşında, hipertansif ve birkaç ay önce Diabetes Mellitus II tanısı aldı. EKG aşağıdaki gibidir: 	**☐ Bir Supra-ventriküler taşikardidir.** **☐ Akut miyokard enfarktüsüdür** **☐ Bir atriyal taşikardir.** **☐ Bilmiyorum**
6- 24 yaşında atletik ve zayıf bir erkek acil servise geldi. Egzersiz yaptıktan sonra (3 saat önce) göğsünün sol bölgesinde iğneleyici bir his tarifliyor. EKG çektiniz ve aşağıdaki gibi saptadınız: 	**☐ Bu bir atriyal bradikardidir** **☐ Hastada İletim sorunları vardır** **☐ Bu normal bir EKG'dir** **☐ Bilmiyorum**

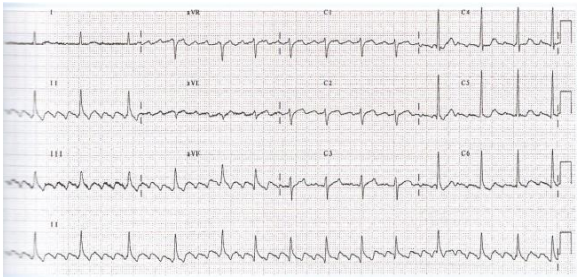
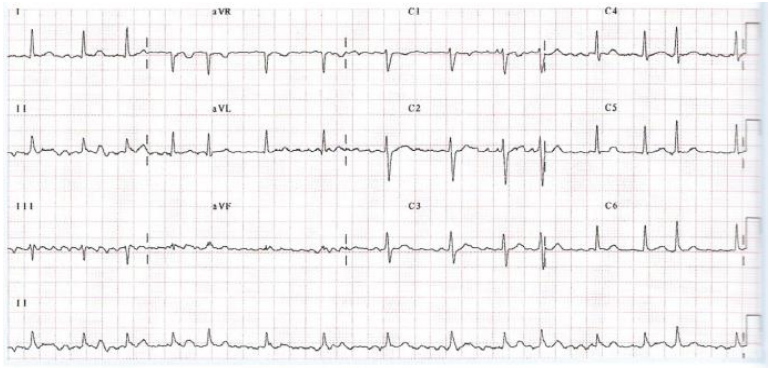
7- Otuz yaşında bir kadın acil servise çarpıntı, göğüste sıkışma ve nefes darlığı şikayeti ile başvurdu. EKG çektiniz ve aşağıdaki gibi saptadınız:  	☐ **Bir ventriküler taşikardidir** ☐ **Bir atriyal ekstra sistoldür** ☐ **Bir atriyal taşikardidir** ☐ **Bilmiyorum**
8- Bu EKG'ye sahip hastada hangi patalojiyi düşünürsünüz?  	☐ **Birinci derece kalp bloğu** ☐ **Herhangi bir patolojisi yok** ☐ **Üçüncü derece kalp bloğu** ☐ **Bilmiyorum**

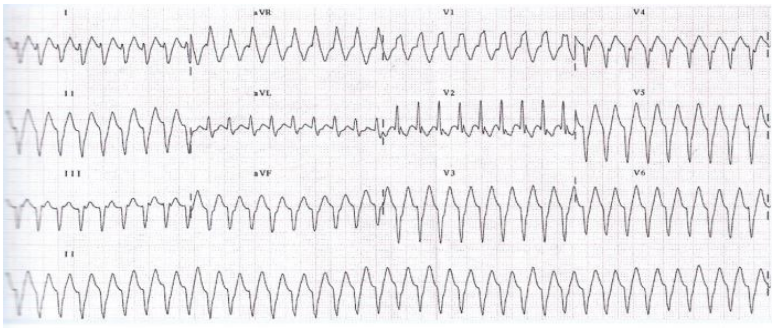
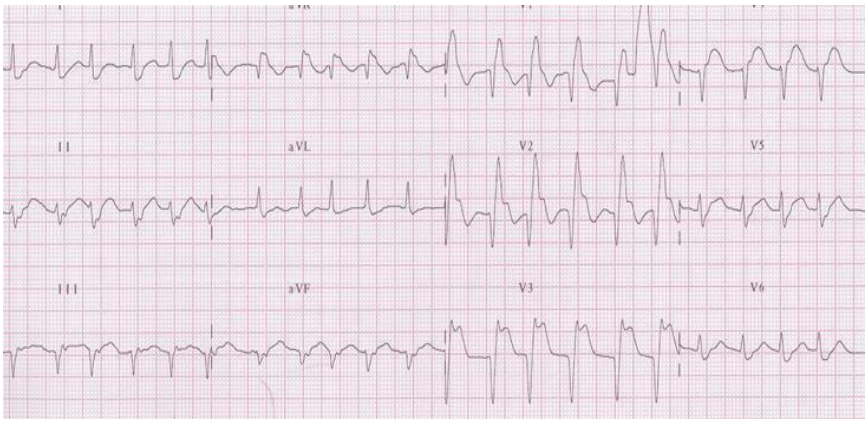
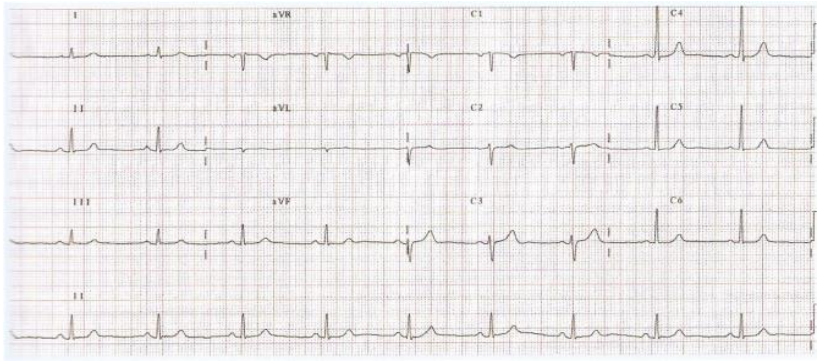
Appendix 2. Knowledge and Practices of Electrocardiogram Interpretation of Nurses (English Version)

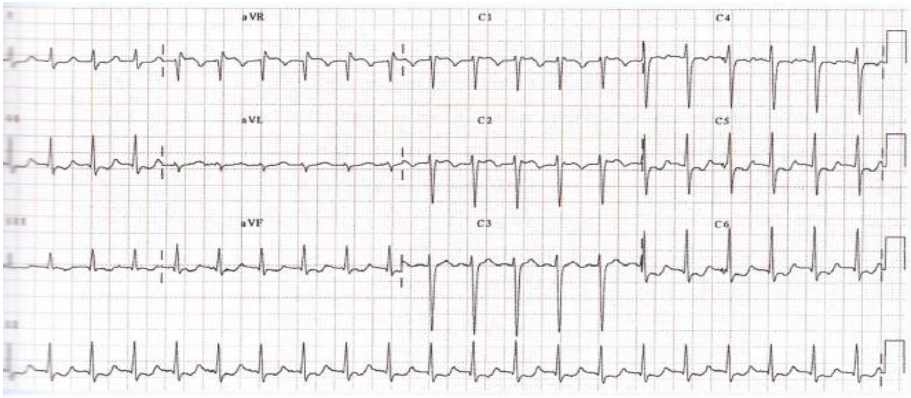
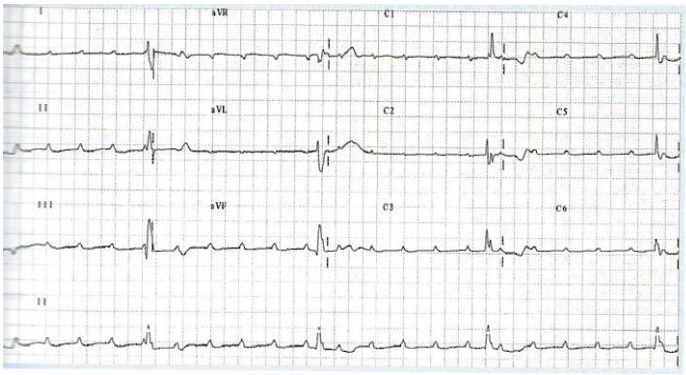
A- Demographics characteristics of nurses		
1- Age		
2- Gender	☐ **Male**	☐ **Female**
3- Years of working experience as registered nurse	☐ **< 1 year** ☐ **1-5 years** ☐ **6-10 years** ☐ **11-20 years** ☐ **>20 years**	
4- Currently working unit in hospital	☐ **Emergency department** ☐ **Intensive care unit** ☐ **Coronary care unit** ☐ **Cardiology department** ☐ **Recovery unit**	
5- Education level	☐ **Bachelor's** ☐ **Master** ☐ **PhD**	
6- Do you taking ECG for patients	☐ **Yes** ☐ **No**	
7- Previous ECG training course	☐ **Yes** ☐ **No**	
8- ECG education resource	☐ **University** ☐ **Courses** ☐ **Internet** ☐ **Self learning books** ☐ **Congress / conferences** ☐ **Others ……..**	
9- Years since taking the last ECG course	☐ **I don't take** ☐ **Less than 2 years** ☐ **Between 2 to 5 years** ☐ **More than 5 years**	
10- ECG competency level	☐ **Beginner** ☐ **Intermediate** ☐ **Advanced**	
11- Desire to learn about ECG	☐ **Yes** ☐ **No**	

B- Knowledge of nurses on Electrocardiogram	
1- The p wave represented right and left atrial repolarization	☐ **True** ☐ **False**
2- QRS complex represented right and left ventricular depolarization	☐ **True** ☐ **False**
3- T wave represents ventricular repolarization	☐ **True** ☐ **False**
4- T wave is one of the negative waves in ECG	☐ **True** ☐ **False**
5- Normal PR interval between 0.12 and 0.20 seconds	☐ **True** ☐ **False**
6- In normal ECG V1 and aVR leads are negative waves	☐ **True** ☐ **False**
7- Pathologic Q waves are a sign of previous myocardial infarction	☐ **True** ☐ **False**
8- Atrial fibrillation could be regular rhythm	☐ **True** ☐ **False**
9- ECG can detects left ventricular hypertrophy (LVH)	☐ **True** ☐ **False**
10- ST elevation in inferior myocardial infarction appear in leads: V1-V6	☐ **True** ☐ **False**
11- ST elevation in lateral myocardial infarction appear in leads: I, aVL, V5, V6	☐ **True** ☐ **False**
12- ST elevation in anterior myocardial infarction appear in leads: II, III, aVF	☐ **True** ☐ **False**
13- ST depression in ECG indicated ischemia myocardial	☐ **True** ☐ **False**
14- RSR pattern appear in V1, V2 and V3 in right bundle branch block rhythms	☐ **True** ☐ **False**
15- T long wave is and QRS wide wave seen in case of hypokalemia	☐ **True** ☐ **False**

C- practice of nurses on ECG interpretations

1- You perform an ECG and observe this rhythm. What do you think it might be? 	☐ **A third degree heart block** ☐ **An atrial flutter** ☐ **A supra-ventricular tachycardia** ☐ **I do not know**
2-You perform an ECG and observe this rhythm. How would you act? 	☐ **Ask for help without leaving the patient alone because it is a ventricular fibrillation** ☐ **Ask for help without leaving the patient alone because it is an atrial fibrillation** ☐ **Perform another ECG because it looks like there may be interference** ☐ **You do not know how to act but you know it must be a serious problem**
3- A patient comes to the emergency department due to a respiratory distress. He has 140 beats per minute. You perform an ECG and observe the following: 	☐ **It is an atrial tachycardia** ☐ **It is an atrial fibrillation** ☐ **It is an atrial extra-systole** ☐ **I do not know**

4- A hospitalized patient who had surgery due to an Acute myocardial infarction, his vital signs are unstable. You perform an ECG and observe the following: 	**☐ The patient presents a ventricular tachycardia** **☐ The patient presents a supra-ventricular tachycardia** **☐ The patient presents an atrial tachycardia** **☐ I do not know**
5- You performed ECG to patient who have chest pain appeared after leaving an important meeting two hours ago. He is 52 years of age and hypertensive and a few months ago he was diagnosed with Diabetes Mellitus II. The ECG as the following: 	**☐ It is a supra-ventricular tachycardia** **☐ It is an acute myocardial infarction** **☐ It is an atrial tachycardia** **☐ I do not know**
6- A 24-year-old male comes to the emergency department He is athletic and slim. He reports feeling a pricking sensation in the left area of his chest since he finished doing exercise (3 hours earlier). You perform an ECG and observe the following: 	**☐ It is an atrial bradycardia** **☐ He has conduction problems** **☐ It is a normal ECG** **☐ I do not know**

7- A 30-year-old woman comes to the emergency department reporting palpitations, chest tightness and dyspnea. You perform an ECG and observe the following:  	☐ **It is a ventricular tachycardia** ☐ **It is an atrial extra-systole** ☐ **It is an atrial tachycardia** ☐ **I do not know.**
8- What pathology you think the patient with this ECG has?  	☐ **A first-degree heart block** ☐ **He does not have any pathology** ☐ **A third-degree heart block** ☐ **I do not know.**

Appendix 3: Ethical Approval Near East Institutional Reviews Board (IRB)

YAKIN DOĞU ÜNİVERSİTESİ
BİLİMSEL ARAŞTIRMALAR DEĞERLENDİRME ETİK KURULU

ARAŞTIRMA PROJESİ DEĞERLENDİRME RAPORU

Toplantı Tarihi : 26.04.2018
Toplantı No : 2018/57
Proje No : 554

Yakın Doğu Üniversitesi Health Sciences Institute öğretim üyelerinden Assoc. Prof. Dr. Ümran Dal Yılmaz'ın sorumlu araştırmacısı olduğu, YDU/2018/57-554 proje numaralı ve **"Knowledge and Practices of Electrocardiogram Interpretation of Nurses"** başlıklı proje önerisi kurulumuzca değerlendirilmiş olup, etik olarak uygun bulunmuştur.

1. Prof. Dr. Rüştü Onur (BAŞKAN)
2. Prof. Dr. Nerin Bahçeciler Önder (ÜYE)
3. Prof. Dr. Tamer Yılmaz (ÜYE)
4. Prof. Dr. Şahan Saygı (ÜYE)
5. Prof. Dr. Şanda Çalı (ÜYE)
6. Prof. Dr. Nedim Çakır (ÜYE)
7. Prof. Dr. Kaan Erler (ÜYE)
8. Doç. Dr. Ümran Dal Yılmaz (ÜYE)
9. Doç. Dr. Nilüfer Galip Çelik (ÜYE)
10. Yrd. Doç.Dr. Emil Mammadov (ÜYE)

YAKIN DOĞU ÜNİVERSİTESİ
HASTANESİ

17/04/2018

YDH-300/2018

Doç. Dr. Ümran Dal
Hemşirelik Faültesi Dekan Yardımcısı

Yakın Doğu Üniversitesi Hemşirelik Yüksek Lisans Öğrencisi Obaydah Yaser Hamed Tahboud " Knovledge and Practices of Electrocardiogram Interpretation of Nurses" (Hemşirelerde Elektrokardiyogram Yorumlarnın Bilgi ve Uygulamaları" konulu araştırmasını ilgili bölümlerde 02.05.2018- 31.05.2018 tarihleri arasında uygulaması programlanmıştır. Saygı ile bilginize getirilir.

Dr. Sevim ERKMEN
Yakın Doğu Hastanesi
Başhekim

A: Yakın Doğu Üniversitesi Hastanesi, Lefkoşa / KKTC
T: +90 392 444 05 35
www.neareasthospital.com

Ref No: HF-484/2018
Konu: Çalışma izni hk.

17.04.2018

Dr. Suat Günsel Girne Üniversitesi Hastanesi Başhekimliği'ne;

Yakın Doğu Üniversitesi Hemşirelikte Yüksek Lisans programında kayıtlı öğrencimiz Hemşire Obaydah Yaser Hamed Tahboub; tez çalışması olarak "Knowledge and Practices of Electrocardiogram Interpretation of Nurses" (Hemşirelerin Elektrokardiyogram Yorumlarının Bilgi ve Uygulamaları" konulu araştırmasını yapmak üzere 2-31 Mayıs 2018 tarihleri arasında Dr. Suat Günsel Girne Üniversitesi Hastanesi Yoğun Bakım Üniteleri, Acil Servis ve Kardiyoloji kliniklerinde anketlerini uygulayabilmesi için gerekli iznin verilmesi konusunda bilgilerinizi ve gereğini arz ederim.

Saygılarımla,

Doç. Dr. Ümran Dal Yılmaz
Hemşirelik Fakültesi Dekan Yrd.

Uygundur 17/04

Dr. Suat Günsel Girne Üniversitesi Hastanesi Prof. Dr. Nail Bulakbaşı Başhekim 4892524-3866708

EK-1. Soru formu

Appendix 4. Informed Consent Form Participant

INFORMED CONSENT FORM FOR ADULTS

(FOR THE PATIENTS / PARTICIPANTS)

You are invited to participate in a research study conducted by Obaydah Yaser Hamed Tahboub Supervised by Assoc. Prof. Dr. Ümran Dal Yılmaz from the NEAR EAST UNIVERSITY Faculty of Health Sciences, Nursing Department. I have learned that Knowledge and Practices of Electrocardiogram Interpretation of Nurses. You were selected as a possible participant in this study because findings of the study may be useful in determine nurses' Knowledge and Practices of Electrocardiogram Interpretation in health care institutions. If you decide to participate, a questionnaire will be used as data collection tool in this study. The questionnaire contains questions regarding for demographics, knowledge and practices of nurses on ECG. However, I cannot guarantee that I personally will receive any benefits from this research. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Subject identities will be kept confidential participation is voluntary. Your decision whether or not to participate will not affect your relationship with Near East University hospital and Dr. Suat Günsel Girne University hospital. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty. If you have any questions about the study, please feel free to contact [+905428734098, Obaydah.1990@gmail.com]. [+905326603086, umrandal65@gmail.com]. If you have questions regarding your rights as a research subject, please contact the NEAR EAST INSTITUTIONAL REVIEW BOARD. You will be offered a copy of this form to keep. Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, that you will receive a copy of this form, and that you are not waiving any legal claims.

Participant
Name, Surname:
Address:
Phone:
Signature:

Witness
Name, Surname:
Address:
Phone:
Signature:

Interviewer:
Name, Surname:
Address:
Phone:
Signature: