
**ADDIS ABABA UNIVERSITY**

**COLLEGE OF HEALTH SCIENCE**

**DEPARTMENT OF EMERGENCY AND SURGICAL NURSING**

# KNOWLEDGE, PRACTICE AND ASSOCIATED FACTOR ON ELECTROCARDIOGRAPHY AMONG NURSES WORKING AT EMERGENCY AND INTENSIVE CARE UNIT OF SELECTED PUBLIC HOSPITAL IN ADDIS ABABA, ETHIOPIA

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**THIS THESIS IS TO BE SUBMITTED TO THE SCHOOL OF NURSING AND THE MIDWAYFRIARY DEPARTMENT OF EMERGENCY AND SURGICAL NURSING, FOR PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE IN MASTER OF SCIENCE IN EMERGENCY, MEDICINE, AND CRITICAL CARE NURSING.**

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## APPROVAL BY THE BOARD OF EXAMINATION

This thesis by Marta Teklemariam is accepted in its present form by the board of examiners as satisfying thesis requirement for the degree of masters in emergency medicine and critical care nursing.

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## DECLARATION

**Letter of declaration**

By my signature below, I declare and affirm that this is entirely that this thesis is my original work. I have followed all ethical principles of scholarship in the preparation, data collection, data analysis, and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every effort has been made to avoid plagiarism in the preparation of this thesis. This thesis submitted to Addis Ababa University College of health sciences department of emergency medicine and critical care, for partial fulfillment of the requirements for the Master of Science emergency medicine and critical care nursing.

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## Contents

## List of tables

## List of figure

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AAU | Addis Ababa University |
| ART | Anti-Retroviral Therapy |
| CCU | Cardiac Care Unit |
| CI | Confidence Interval |
| CVD | Cardiovascular Disease |
| ECG | Electrocardiograph |
| ED | Emergency Department |
| ER | Emergency Room |
| HIV | Human Immunodeficiency Virus |
| ICU | Intensive Care Unit |
| MI | Myocardial Infarction |
| PI | Principal Investigator |
| SPSS | Statistic product and social service |
| TASH | Tikur Anbessa Hospital |

# ABSTRACT

**Background:** Electrocardiographs are very important to assess heart activity and diagnose any abnormalities. A fast ECG helps to decrease mortality and morbidity in patients who have heart disease. Even if ECG interpretation is very important, many health providers are struggling with its proficiency.

**Objective: -** The study aimed to assess knowledge, practice, and associated actors in electrocardiograph interpretation among nurses who work in selected public hospitals in Addis Ababa, Ethiopia.

**Method: -** An institutional based cross-sectional study was done to assess knowledge, practice, and associated actors in electrocardiograph interpretation among nurses. Data were collected using a self-administered questionnaire, checked for completeness, entered Excel, and exported to SPSS version 26 for analysis. Descriptive statistics and logistic regression were done; p value less than 0.05 was considered significant and reported using the Odes ratio.

**Result: -** Participant's (N = 255) mean age was 30.2 ± 4.7, majority male (n = 157, 61.6), hold a B. Sc. degree (n = 188, 73%), and ICU staff (n = 135, 52.1%). Only a quarter of the study participants had good knowledge (n = 60, 23.5%) and good practice (n = 69, 27.1%) about ECG strip interpretation. Some variables have association, for instance, masters' holders are six times more likely to have good knowledge and practice. [Knowledge: AOR = 6.23; CI: (1.7–22.3) p = 0.005; practice: AOR = 5.6; CI: (1.5–20.65) p = 0.010] Those nurses who have been working in intensive care units are also three times more likely to have good knowledge and practice. [Knowledge: AOR = 2.75; CI: 1.35–4.9; p = 0.009]; [practice: AOR = 2.7; CI: 1.27–5.6; p = 0.010], and those nurses who had previous training are also associated [Knowledge- AOR= 3.29; CI: (1.3-8.3) p=0.012], [practice- AOR= 4.41; CI: (1.79-10.9) p=0.001].

**Conclusion:** This study has revealed poor knowledge and practice among emergency and intensive care unit nurses on electrocardiography. Having training, being an MSC degree holder, and working in an intensive care unit have associations. This study underscores the need for a multi-faceted approach to fill this gap.



***Keywords:*** electrocardiograph, nurse, practice, intensive care unit, emergency department

# 1. INTRODUCTION

## 1.1. Background

Nurses are a higher stakeholder in delivering quality patient care. Nowadays, as technology advances, it is mandatory for all health professionals, especially nurses, to possess a wide range of skills, including the interpretation of electrocardiograms (ECG) (1). ECG is an essential, non-invasive modern tool to check heart muscular and electrical activity by placing electrodes on the chest and limbs of patients, which show 12 different viewpoints of the heart (2, 3).

ECG has a high capacity for detecting heart rate and rhythm and identifying any change in the heart (4). Cardiovascular disease (CVD) has increased worldwide; surprisingly, in 2021, almost half a billion people were affected, and 20.5 million deaths occurred (5). ECG is the best diagnostic method to check for problems in people with chest pain. It can identify CVD (6).

When patients have clear symptoms of a heart attack, it is essential to get and analyze an ECG within 10 minutes (6, 7). Early ECG enhances the ability of healthcare providers to detect lethal heart-related disease and decrease death and complications (8). Arrhythmia, characterized by an irregular heartbeat, occurs when the impulses that govern the heart's rhythm cannot come at the proper moment; these might be mild or severe, necessitating medical intervention (9).

To be proficient in ECG interpretation, health care professionals need a combination of work experience with clinical knowledge and practice (10). Effective interpretation needs an understanding of rhythm and concepts (11). Even if ECG is very important in health care, healthcare providers are struggling with its interpretation (7). Failing to grasp the intricacies of ECG interpretation can lead to limited knowledge retention and superficial understanding (10).

A nurse’s lack of proficiency in ECG interpretation can have consequences for patient care, including delay in diagnosis, treatment, medication error, a poor outcome, and complications that may arise. Additionally, it carries legal and ethical implications and compromises patient safety, quality of care, and healthcare costs (6, 12).

Nurses are the first respondent in many hospitals, especially in cardiac arrest, so it is important for nurses to be proficient in ECG interpretation, which helps them diagnose cardiac abnormalities. This proficiency enables them to develop treatment strategies, enhance patient outcomes, and prevent life-threatening complications (1, 11).

Providing continuous education, training, and quality assurance measures additionally, self-directed learning, lectures, workshops, and small group peer teaching should be included to bridge a gap in knowledge and practice of ECG interpretation among nurses who are working in emergency and intensive care units (6, 10, 12).

To enhance the management of heart problems and decrease mortality and morbidity rates in Ethiopia, it is important to focus on nurses. Improvement can be achieved through advanced knowledge and a positive outlook on ECG interpretation. However, there is no sufficient study on the knowledge and practice of ECG interpretation, especially in Ethiopia. As a result, this study aimed to assess the knowledge and practice of nurses regarding ECG interpretation among nurses who are working in the emergency department (ED) and intensive care unit (ICU). This research also assesses the associated factors that are related to the knowledge and practice of nurses regarding ECG interpretation. Any findings that are gained from this study will help to develop nurses' education and training (12).

## 1.2. Statement of the problem

Healthcare professionals in the ED and ICU must have an extensive understanding of ECG interpretation, this is important because they often come across patients suffering from cardiac emergencies (13). In such units, the ability to detect ailments concerning the heart like arrhythmias is vital since they can be life-threatening (1). Among medical workers, nurses play a significant role because of their proximity to patients. Their skills in interpreting ECGs help produce useful results for other members of the healthcare team, hence ensuring quick and appropriate care for patients (2, 13).

In ED and ICU settings where time is critical, accurate interpretation of ECGs could mean saving lives or losing them for patients with cardiac emergencies. Prolonged treatment duration, worse outcomes, delayed diagnosis, higher medical costs, and reduced job satisfaction among healthcare workers are some effects of the wrong interpretation of ECGs (1).

Around the world, the issue of poor ECG interpretation knowledge and practice is clear. This problem is not limited to low-income countries like Ethiopia but also affects high-income countries. In a study in China, it was found that 70.9% of ICU nurses had low ECG knowledge. Saudi Arabia's study also states that poor nurses' competency is similar. Similar studies in developing countries like Egypt and Ethiopia found that the proficiency level of nurses on ECG interpretation was very low, at 80% and 90.9%, respectively (2, 14–16). This result showed a lack of understanding among nurses, which can lead to inadequate management of potentially life-threatening cardiac arrhythmias (1).

Many studies have stated that a gap in nurses' ability to interpret ECGs impacts their decision-making, patient safety, communication, and professional development. Nevertheless, numerous factors void nurses' competence in this field (2, 14, 17).

Poor knowledge of electrocardiograph (ECG) interpretation may make it difficult for healthcare providers to accurately identify abnormal electrical activity in the heart. ECG waveforms are complex and require precise electrode placement, which can be difficult for individuals who have not been adequately trained to interpret them. Moreover, the scarcity of experience with a

wide range of ECG cases limits expertise in interpreting these tests, thereby leading to misdiagnosis or even poor management of patients (18).

Nursing knowledge and practice in interpreting ECGs relies on clinical experience, which facilitates continuous learning in real-life patient care scenarios, fosters critical thinking, and provides practical exposure (2). There are still knowledge and skill gaps that need to be addressed. To bridge these gaps, a comprehensive approach is necessary. This can be accomplished through formal education, specialized training, clinical experience, certification, ongoing education, simulation and skill laboratories, and collaboration among different healthcare disciplines. These measures ensure nurses possess a thorough understanding of ECG interpretation (19).

Even if ECG procedures were done many times in the ED and ICU, nurses have good exposure to interpreting ECG and the management of upcoming heart abnormalities in the workplace, but there is still a huge gap in their knowledge and practice. As a result, studying nurses' knowledge and practice of ECG interpretation is crucial.

## 1.3. Significance of the study

Fast and precise diagnosis of cardiac diseases is very important for ER and ICU nurses because it makes them competent in interpreting ECGs, thus affecting patient outcomes. This is not only about patients' confidence but also their lives saved as well as the experience gained in the hospital. Additionally, there is an increase in the shortage of physicians, which has shifted the weight of ECG interpretation to nurses. Nurses are now given more duties that make the interpretation of the ECG mandatory for them.

Moreover, it may help to identify specific areas where staff might need additional support in terms of training or resources, thereby improving patient outcomes. As a result, this study will serve as baseline data to create new clinical guidelines and protocols that emphasize the importance of accurately interpreting ECGs. Moreover, such findings are useful to policymakers and hospital administrators whenever they want to address gaps in staff knowledge, allocate resources, or make budgeting decisions. In this respect, by determining those places where additional help should be provided to nurses, this study could enhance quality care within ED and ICUs. It can also inform targeted training programs and the development of protocols to ensure standardized and accurate ECG interpretation and arrhythmia detection. Additionally, it can help identify areas where further study is needed to continue improving patient care.

# 2. OBJECTIVE

## 2.1. General objective

To determine Knowledge, practice, and associated factors on electrocardiograph interpretation among nurses working at emergency and intensive care units of selected public hospitals in Addis Ababa, Ethiopia, 2024

## 2.2. Specific objective

- To determine level of Knowledge on electrocardiograph interpretation among nurses
- To determine level of practice on electrocardiograph interpretation among nurses
- To identify factor associated with Knowledge on electrocardiograph interpretation among nurses among nurses
- To identify factor associated with Knowledge on electrocardiograph interpretation among nurses among nurses

# 3. LITERATURE REVIEW

## 3.1. Introduction

ECG is a very important instrument to record heart activity, but despite its importance as a diagnostic test, it is often misunderstood. Even experts in the medical field can have a hard time interpreting ECGs accurately (19). Nurses are typically the first responders to make informed decisions. Incorrect interpretations can increase healthcare expenses and hinder the admission process, burdening hospitals and patients (20).

## 3.2. Knowledge of ER and ICU nurses in ECG interpretation

Many studies state the importance of knowledge in ECG interpretation and measure their knowledge level. A study in Turkey showed that participant knowledge was high. Of much knowledge-related questions, the question called ‘ST depression in ECG shows myocardial infarction’ was the most correctly answered, with a response rate of 92.3%. And also, the diagnosis of myocardial infarction EGC was 72.3%. However, it was noticed that the nurses often got a question wrong about' T long waves and QRS wide waves are seen in cases of hypokalemia' with rates of 55.4% (2).

A study in China shows that most nurses have poor ECG integration knowledge (70.9%). Surprisingly, only 0.8% of nurses (three nurses) could answer all the questions correctly. Most nurses could correctly answer questions about the QRS complex representing ventricular depolarization and the absence of a P wave showing a problem with atrial conduction, with response rates of 89.9% and 86.3%, respectively. A question called 'type II second degree AV block', ‘PR intervals are not constant with conduction beat’ was received with a lower response rate (12).

According to a quasi-experimental study in Indonesia, the findings revealed that out of the 55 nurses from emergency departments, intensive care units, and high-risk pregnancy units who took part in the study, 39 nurses (70.9%) could not accurately interpret ECGs (21).

Spain’s study on emergency nurses' competency showed the competency level was very high (93%; 22). A study at Beni-Suef University Hospital in Egypt found high rates of inaccurate ECG interpretation among nurses. Results showed incorrect practices in heart rate determination (61.7%), heart rhythm determination (66.7%), P wave identification (61.7%), PR interval identification (68.4%), and QRS complex identification (83.3%). These findings highlight the nurses' shortcomings in ECG interpretation (23).

### 3.3. Practice of ER and ICU nurses in ECG interpretation

A lower level of ECG interpretations was shown in Saudi Arabia's study; from the total of the study participants, only 14.9 of the study's questions were answered, which was ten out of ten. Other than 27.1% of the nurse’s answers to 8 questions and above, additionally, 45% answer 6 or fewer questions. The most well-known irregular heartbeats were systole (94.1%) and ventricular tachycardia (75.7%). Sinus tachycardia and pulse-less electrical activity were correctly identified by around two-thirds of participants. Approximately half of the participants correctly identified atrial fibrillation, ventricular fibrillation, atrial flutter, and third-degree heart block. Related to the first line management question, their competency was poor; no one answered all ten questions correctly. 61.6% of the study participants had 6 questions or fewer. The most correctly managed arrhythmia was management of asystole (76.9%), and the most correctly answered ECG strip was management of atrial fibrillation (32.9%) (14).

A similar study was carried out at Kenyatta National Hospital to evaluate the proficiency of nurses in accurately evaluating chest pain. The findings of the examination indicated that a considerable proportion (61%) of nurses could not accurately interpret 12-lead ECG rhythms. Nevertheless, the majority of participants exhibited competence in distinguishing between normal and abnormal ECGs (24).

The findings of a study conducted at Muhimbi National Hospital showed that there was a generally high score, but out of the 141 participants, 119 nurses scored low, which shows a poor skill level among nurses in ECG interpretation (21). Similar study findings revealed in the Turkish study showed that the most commonly recognized ECG strips were ventricular tachycardia (87.7%), atrial fibrillation (84.6%), and myocardial infarction (72.3%) (2).

In another study at Dow University Hospital, 120 nurses were assessed on their ability to recognize various ECG patterns. It was found that 61.7% accurately answered the correct order of ECG waves and intervals. 71.7% were proficient in identifying conduction issues within the atrium, and 72.5% accurately identified atrial flutter. In ventricular fibrillation, 60.0% showcased competence in tracing, while 53.33% successfully traced atrial fibrillation. 52.5% identified the pathological pause, and 53.3% diagnosed a third-degree block. Only 8.3% correctly identified supraventricular tachycardia. On a positive note, 61.7% successfully traced an acute myocardial infarction. 50.0% accurately answered ventricular extra-systole, and 38.3% identified atrial tachycardia (9).

In Addis Ababa, a study discovered that the majority of nurses had inadequate skills in interpreting ECGs. Out of 175 nurses, 159 (90.9%) were considered incompetent, with an average score of 6.82 ± 3.65 SD. However, nearly all participants (98.5%) were able to accurately identify asystole. Other conditions like atrial flutter, ventricular tachycardia, and third-degree heart block were correctly answered by 45.7%, 14.35%, and 64% of respondents, respectively. Identification of antero-septal myocardial infarction, inferior wall myocardial infraction, and Wolf-Parkinson white syndrome was less common, with only 4%, 3.4%, and 2.7% of participants correctly identifying them (15).

## 3.4. Factors associated with ECG interpretation

### Trainings

Some studies suggest the importance of training in the competency of ECG interpretation. It is necessary to provide training and periodic competency evaluations (4). A study in Turkish also supports this idea; it has been reported that nurse's knowledge was highly associated with that of the training; nurses who had previous ECG training had good knowledge and gave a more correct answer than those nurses who didn't take it (2). Similarly, a study in Malaysia found a positive relationship between good practice and having previous training (25). A study in Spain also found that nurses who had received recent training scored higher in competency than others (22). Another study in Addis Ababa also revealed a significant correlation between nurses' competency in ECG interpretation and nurses' level of education, ECG training, and work environment (15). However, a cross-sectional study in Iraq disagrees with a study that didn't find

a link between the nurses training sessions and showed no statistical association between previous training and their knowledge (26).

### Working area

A study conducted at Dow University Hospital indicated that, nurses who work in critical care had poor knowledge of ECG interpretation, while a minority of participants demonstrated adequate competency. Additionally, the study found that nurses in the CCU and ED had similar scores in ECG competence, with a 20% and 19.5 respectively. in contrast ICU nurses score 15.6%, which is relatively low (9). Moreover, a study in Malaysia found that practice level of nurses among nurses from CCU was highly associated when compared to emergency nurses ($U = 128.5$, $p = 0.003$) and ICU ($U = 302$, $p = 0.001$) (25). Similarly study in turkey also showed that department of cardiology had high rates of answering the correct answer to other ED and ICU nurses (2).

### Work experience

The study conducted on Turkish nurses has provided new insights into the relationship between work experience and knowledge. Interestingly, the results showed that nurses who worked for less than one year had a lower average of correct answers, whereas nurses who worked for over six years had a higher average of correct answers (2). This finding aligns with a similar study conducted in Malaysia, which also found a significant difference in ECG interpretation skills based on years of experience ($2 = 13.726$, $p = 0.003$). Specifically, nurses with one to five years of experience had a significantly lower practice level compared to those with six to ten years ($p = 0.033$) and those with 11 to 20 years ($p < 0.001$) (25).

In a national journal in Indonesia, this article found that most nurses who had over 10 years of experience had better skills in ECG interpretation (21). Interestingly, the study in Spain and the study in Iraq did not find a positive correlation between professional nursing experience and the ability to interpret ECGs, which is also similar to the study in Addis Ababa, which didn’t find any association (15, 22, and 26).

### Educational background

A study in Malaysia showed that diploma-degree-holder nurses have a lower practice level than those with a post-basic certificate (U = 674.0, p = 0.003) and a bachelor's degree (U = 102.0, p = 0.006) (25).

## Conceptual frame work

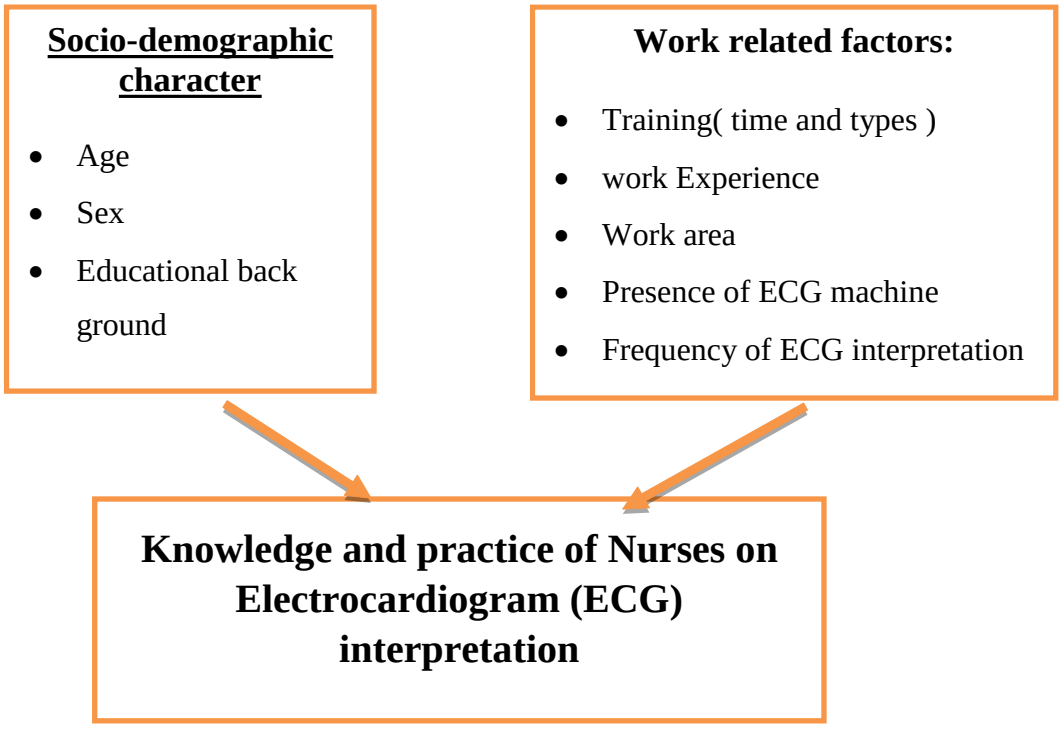


Figure 1: Conceptual Framework Adopted From different literature in knowledge and practice among ICU and ER nurses in ECG interpretation.(2, 9, 12, 15, 16, 21, 22, 25, 27)

# 4. METHODOLOGY

## 4.1. Study area and study period

This study was done in five randomly selected public hospitals in adds Ababa from march to April. Ethiopia is a capital city of Addis Ababa. It has 13 hospitals from which 12 hospitals have both ICU and ED setups. These public hospitals have a total of 320 nurses for the ICU department and 415 nurses for the ER department.

**Tikur Anbessa Specialized Hospital**, established in 1964, is home to a dedicated team of many health professions. Together, they offer a wide range of medical services, ensuring comprehensive care for patients. With a capacity of 850 beds, the hospital boasts 48 emergency nurses and 32 ICU nurses. Additionally, it is affiliated with Addis Ababa university school of medicine, making it a leading center for clinical and preclinical training across various disciplines(28).

**AaBET Hospital (Addis Ababa Burn, Emergency and Trauma); -** it is a It is a dedicated trauma and burn unit affiliated with Saint Paul's Hospital. Established in 2015, G.C. has 55 ER beds, 11 ICU beds, and a total of 130 inpatient beds. The hospital employed 63 emergency nurses and 26 ICU nurses(29)

**Menelik II comprehensive hospital**; -, it is one of the tertiary health facilities currently managed by the Addis Ababa Health Bureau. It serves as a key referral center for individuals with glaucoma and other chronic eye conditions. With over 800 beds, the hospital caters to more than 15,000 patients daily and employs a staff of over 2,300 members. Specifically, the hospital has 30 emergency nurses and 18 ICU nurses(30).

**Zewditu Memorial hospital; -** was established in 1976 by the Seventh-day Adventist Church. However, later on, the government took over its operations. It is now known as Ethiopia's top hospital for ART patients, treating over 6,000 individuals monthly Zewditu is the largest HIV clinic in Ethiopia, caring for 14,000 patients. The hospital has 35 emergency nurses and 30 ICU nurses (31).

**St peter specialized hospital**; - it was established in 1953, the hospital is widely reorganized by the leading TB referral center in the country, with a long history of TB management. Its main focus is to provide exceptional care for TB patients. The hospital currently employs 32 emergency nurses and 28 ICU nurses(32).

## 4.2. Study design

An institutional based cross-sectional study design was conducted from march to April 2024.

## 4.3. Population

### 4.3.1. Source population

All nurses working in the ICU and ED at public hospital in Addis Ababa.

### 4.3.2. Study population

Selected nurse working in the ICU and ED at public hospital in Addis Abeba during the study period were study population.

## 4.4. Eligibility criteria

### 4.4.1. Inclusion criteria

All nurses who had at least six month of work experience during the data collection of time were included on the study.

### 4.4.2. Exclusion criteria

All nurses who are involuntary to participate and who are not available during the data collection time due to maternal leave, annual leave, or sick leave was excluded.

## 4.5. Sample size determinations and sampling techniques

### 4.5.1. Sample size determinations

The sample size was calculated using single population proportion formula. The p value was taken 50% following assumption was used to come up with the final sample size. The p value was taken as 50%, as there is no study that was done in both emergency and intensive care unit In Ethiopia.

With confidence interval (CI) 95%, marginal errors (d) 0.05, with constant standard distribution (Z) value 1.96 calculated as following: -

$$n = \frac{(Z\infty/2)P(1-P}{D^2}$$

n=is desired sample size Z- Is standard normal distribution

D - Marginal errors p=population proportion

$$= \frac{(Z\infty/2)P(1-P}{D^2}$$

$$n = \frac{= (1.96)^2(0.5)(1-0.5}{0.05^2}$$

n=384

Since the total population is less than 10,000, then correctional formula was used nf=n/(1+n/N), nf = 384/ (1+384/ 736) = 252.1=252

Since the non-respondents of 10% were added to calculate sample size, the final sample size become 277

### 4.5.2. sampling techniques

From a total of 12 public hospitals with an ICU and ED setup First, five public hospitals were selected by using simple random sampling (lottery method), and then the sample size was allocated for each hospital according to the staff number of both emergency and ICU nurses using stratified sampling techniques. Finally, each of the sample participants was selected using simple random sampling (lottery method) from each stratum until the desired number was fulfilled by using the nurse's sample frame.

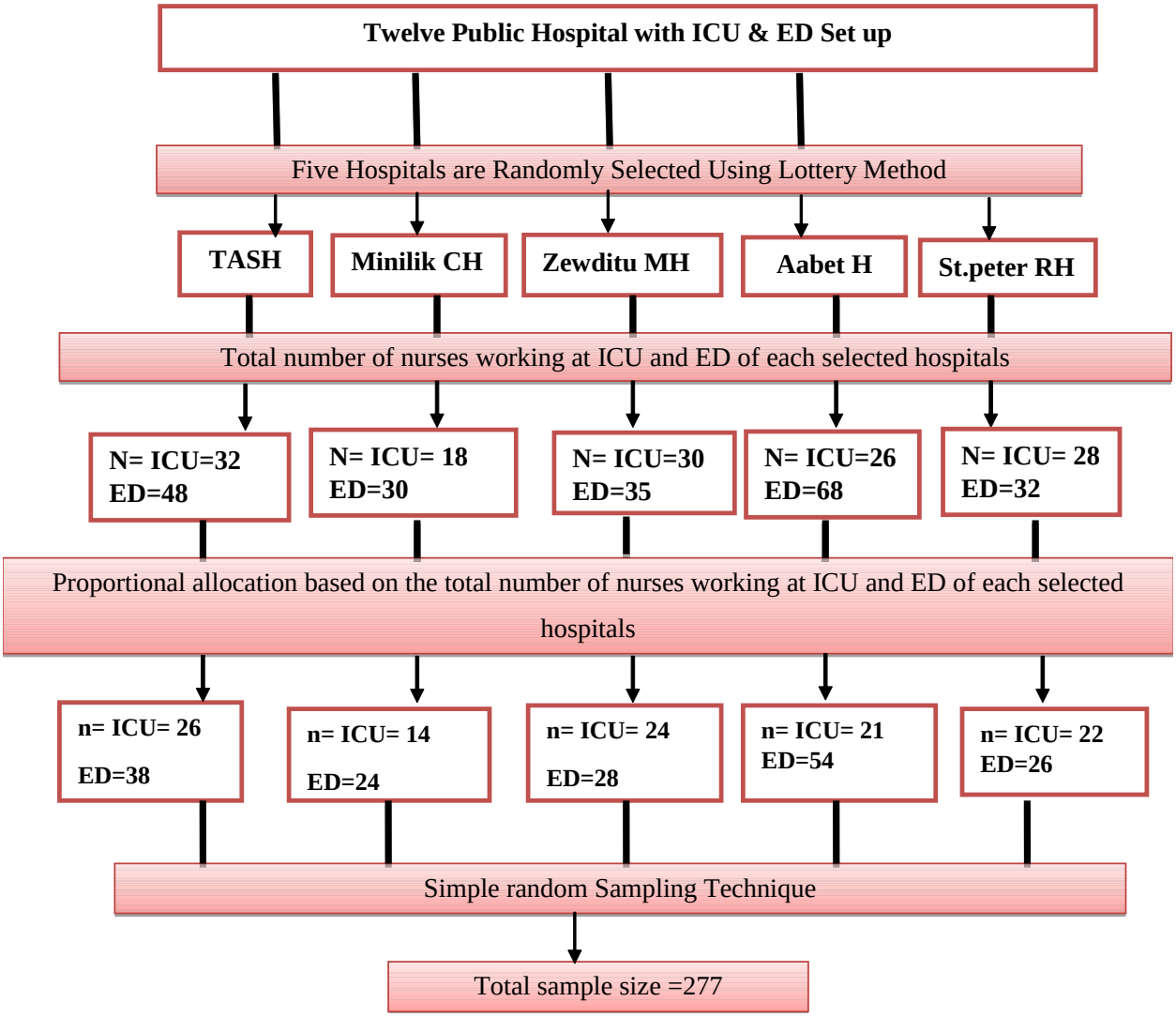


Figure 2; - figures of sampling techniques of study on knowledge and practice of nurses in ECG interpretation

## 4.6. Data collection and techniques

A structured self-administered questionnaire was used to assess knowledge, practice, and associated factors on electrocardiograph interpretation among nurses working at emergency and intensive care units of selected public hospitals in Addis Ababa, Ethiopia, in 2024. A structured questionnaire was collected by two data collectors. The questionnaire was given to a nurse when they were at the workplace, as it is a self-completion method, and then collected after they finished. The questioners were adopted from different literature (2, 7, 9, 10, 12, and 33) and ECG interpretation guide lines (34) and modified according to our setup.

This prepared questionnaire had three parts. The first part focused on the socio-demographic characteristics of the study participants, which included 12 questions. These questions contain variables such as age, sex, working area, educational level, work experience, cardiac-related training, time of last training, frequency of ECG interpretations, and presence of an ECG machine in the workplace. The second part of the questionnaire was about 12 true or false knowledge-assessing questions. Answers were made for every question, which helped categorize correct and incorrect answers. Each participant who answered more than 65% of the correct questions was deemed to have good knowledge of electrocardiographic interpretation, and others who scored less than 65% were deemed to have poor knowledge (15).

The third part of the questionnaire was about 10 ECG strips and the first line management of the ECG strips. The technique used to create these particular ECG strips was the same in order to exclude any technical variances that might have an adverse effect on the identification of arrhythmias. No. 1: Participants were asked to interpret the rhythm that was provided by choosing just one answer from the list of options. Question No. 2: Participants were asked to select only one response from a list of four options to indicate the initial (first-line) care of the cardiac issue depicted in the ECG strip. Answers were made for every question, which helped categorize correct and incorrect answers. Each participant who answered more than 65% of the correct questions was deemed to have good practice in electrocardiographic interpretation, and others who scored less than 65% were deemed to have poor practice (12, 15). The questionnaire was written in English because nurses could communicate in English. Prior to the data collection, the questioner was examined by experts on this.

## 4.7. Study variables

### 4.7.1. Dependent variables

Knowledge of electrocardiograph interpretation among nurses

Practice of electrocardiograph interpretation among ED and ICU nurses

### 4.7.2. independent variables

- sociodemographic variables- sex, and area of practice
- educational background
- Training, types and time of training attended
- Professional qualification
- Work experience in the ICU and ER
- Presence of an ECG machine in the workplace
- Frequency of ECG interpretation

## 4.8. Operational Definition

**Good Knowledge**: A nurse was considered to have good knowledge of ECG interpretation if they scored more than 65% on the knowledge assessment question (15).

**Poor Knowledge**: A nurse was considered to have poor knowledge of ECG interpretation if they scored less than 65% on the knowledge assessment question (15).

**Good Practice**: Good practice in ECG interpretation was indicated by nurses who scored more than 65% out of the total of practice-assessing questions were deemed to have good practice (15).

**Poor practice:** poor practice in ECG interpretation was indicated by nurses who scored less than 65% out of the total of practice-assessing questions were deemed to have poor practice (15).

## 4.9. Data quality control and management

The data collector was a nurse, with a background in research education. Training was given to the data collectors to ensure data quality and to avoid data incompleteness. The principal investigator was daily checking the data. On the other hand, to ensure data validity, an accuracy pretest was done on 5% of the total sample size at Yekait 12 Hospital. This pretest was used to assess dependent and independent variables to avoid any confusion during the actual data collection time. After the pretest, some modifications were made to the ways of asking questions.

## 4.10. Data process and statistic analysis

Before the data was entered into Excel, it was checked for completeness and consistency and exported to SSS version 26. Descriptive statistics such as frequency, proportion, and percentage were conducted. A binary logistics regression was done to show the association between dependent and independent variables. Variables with a p-value less than 0.25 were considered candidates for the multivariable mode. In a multivariable model, variables with a p-value less than 0.05 were deemed to be statistically significant. A report using an odds ratio with a 95% confidence interval

## 4.11. Ethical consideration

Ethical clearance was obtained from Addis Ababa university college of health science, department of emergency and surgical nursing. Letter of permission was taken from all of studied hospital medical directors and this permission letter were given to the study hospital ED and ICU head nurses. finally purpose of the study was discussed with participants and informed consent was taken from all of the study participant. Confidentiality and privacy were ensured.

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# 5. Result

## 5.1. socio-demographic

Of a total of 277 participant only 255 nurses were participated with 92% respondent rate. Mean ± SD age of the study participant were 30.02 ± 4.7 years and majority were male (n =157, 61.6%). Most works at emergency (n = 134, 52.5%) and (n=188 73.7%) were college/university graduates hold bachelor degree.

Table 1; - socio-demographic characteristics of participant nurses working in ED and ICU

| **Variables** | **Category** | **FREQUENCY (N)** | **PERCENTAGE (%)** |
|---|---|---|---|
| Sex of nurses | Male | 157 | 61.6 |
| | Female | 98 | 38.4 |
| Workplace | Aabet Hospital | 69 | 27.1 |
| | Menelik comprehensive hospital | 31 | 12.2 |
| | St peter specialized hospital | 43 | 16.9 |
| | Tikur anbessa specialized hospital | 66 | 25.9 |
| | Zewditu memorial hospital | 46 | 18.0 |
| level of education | BSc in ECCN | 26 | 10.2 |
| | BSc. Nursing | 189 | 74.1 |
| | Msc | 40 | 15.7 |
| Area of practice | ED | 134 | 52.5 |
| | ICU | 121 | 47.5 |
| Year of experience | 1-5years | 165 | 64.7 |
| | 6-10 years | 88 | 34.5 |
| | >10 years | 2 | 0.8 |

Table 2; - independent variables on ECG interpretations of participant nurses working in ED and ICU

| Variables | Category | FREQUENCY (N) | PERCENTAGE (%) |
|---|---|---|---|
| ECG training | Yes | 137 | 53.7 |
| | No | 118 | 46.3 |
| BLS training | Yes | 94 | 36.9 |
| | No | 161 | 63.1 |
| ACLS training | Yes | 52 | 20.4 |
| | No | 203 | 79.6 |
| Last training time | <1 year | 42 | 16.5 |
| | 2-5 years | 74 | 29.0 |
| | >5 years | 35 | 13.7 |
| | None | 104 | 40.8 |
| Presence of ECG machine in hospital | Yes | 248 | 97.3 |
| | No | 7 | 2.7 |
| Frequency of ECG interpretation | 1-3times/day | 52 | 20.4 |
| | 1-3times/week | 46 | 18.0 |
| | 1-3times/month | 56 | 22.0 |
| | 1-3times/year | 54 | 21.2 |
| | None | 47 | 18.4 |

## 5.2. Description of knowledge of ECG interpretation

Participant's percentage knowledge scores out of a total score of 100% using >65 % score as the cut-off value, (n = 60, 23.5%) with 95% CI (0.19-0.29) participants were found to have good knowledge and majorities 195 (76.5%) with 95% CI (0.71-0.82) of the nurses had poor ECG knowledge.

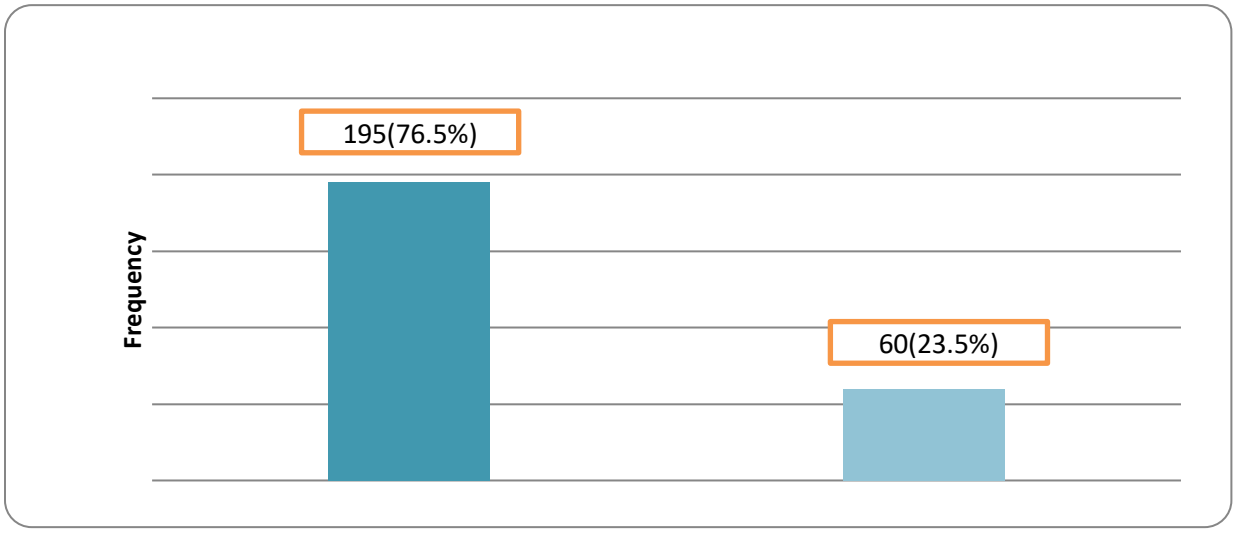



Figure 3; - knowledge about ECG interpterion among ICU and ED nurses

The Majority of nurses correctly answer 207(81.2%) question called 'QRS complex represented right and left ventricular depolarization' whereas only 125 (49%) could correctly answered the correct ECG waves and intervals.

Table 3- Correct and incorrect responses of ECG wave and interval questions (n = 255) of participants working at and public hospital of Addis Ababa, Ethiopia

| Knowledge Assessment question | Correct N (%) | Incorrect N (%) |
|---|---|---|
| The correct order of ECG waves and interval? | 125(49) | 130(51) |
| P wave represents left and right ventricular Depolarization | 152(59.6) | 103(40.4) |
| QRS complex represents right and left ventricular Depolarization? | 207(81.2) | 48(18.8) |
| T waves represent ventricular depolarization? | 193(75.7) | 62(24.3) |
| Pathologic Q waves are a sign of previous myocardial Infarction | 169(66.3) | 86(33.7) |
| Normal PR interval is between 0.12-0.20sec | 199(78) | 56(22) |
| The ST segment should be flat and isotonic | 174(68.2) | 81(31.8) |
| Atrial fibrillation could have a regular rhythm? | 124(48.6) | 131(51.4) |
| If in an ECG the P wave does not appear, there is Conduction problem between the atriums? | 180(70.6) | 75(29.4) |
| Atrial flutter is characterized by a regular ventricular Rhythm with a consistent R-R? | 104(40.8) | 151(59.2) |
| Ventricular fibrillation is characterized by no identifiable P waves and T waves, but the QRS complex is identifiable? | 68(26.7) | 187(73.3) |
| ST depression in ECG indicated ischemia myocardial? | 155(60.8) | 100(39.2) |

## 5.3. Description of Practice in ECG interpretation

Participant's percentage practice score was above 65% out of a total score of 100%. Using >65 % score as the cut-off value, (n = 69, 27.1 with 95% CI (0.217-0.33) participants were found to have good practice and 186(72.9%) with CI (0.67-0.783) poor practice.

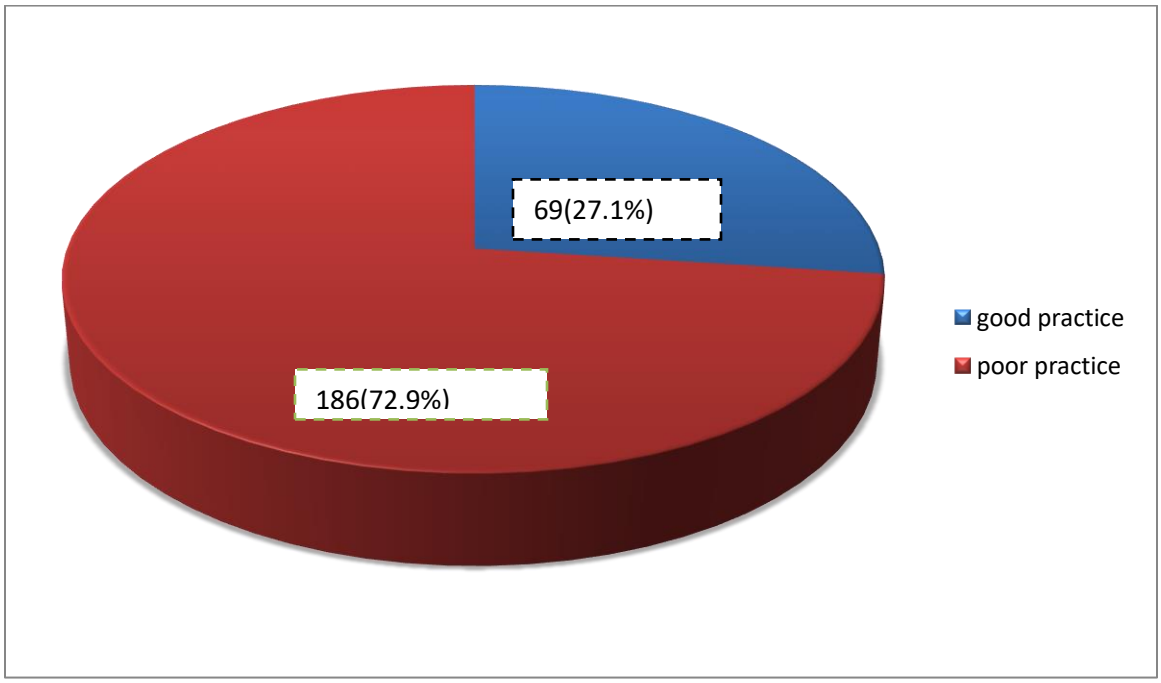



Figure 4; - practice about ECG interpterion among ICU and ED nurses

The findings from the practice-related question revealed that the interpretation and recognition of sinus Bradycardia were the most commonly known items, with a percentage of 76.1%. Asystole and Myocardial infarction were also frequently recognized, with percentages of 76.5% and 57.3% respectively. On the other hand, Atrial flutter and SVT were poorly identified, with percentages of 33.3% and 38% respectively. Additionally, more than half of the participants were able to correctly identify the appropriate management for Asystole (64.7%) and Myocardial infarction (59.6%).

Table 4- Correct and incorrect responses of ECG wave and management questions (n = 255) of participants working at and public hospital of Addis Ababa, Ethiopia

| practice assessment question | Correct N (%) | Incorrect N (%) |
|---|---|---|
| Sinus Bradycardia | 194(76.1) | 61(23.9) |
| Sinus Bradycardia management | 174(68.2) | 81(31.8) |
| Ventricular tachycardia | 102(40) | 153(60) |
| Ventricular tachycardia management | 125(49.0) | 130(51) |
| Atrial flutter | 85(33.3) | 170(66.7) |
| Atrial flutter management | 133(52.2) | 122(47.8) |
| Asystole | 195(76.5) | 60(23.5) |
| Asystole management | 165(64.7) | 90(35.3) |
| Myocardial infraction | 146(57.3) | 109(42.7) |
| Myocardial infarction management | 152(59.6) | 103(40.4) |
| Second-Degree Heart block | 115(45.1) | 140(54.9) |
| Second-Degree Heart block management | 155(60.8) | 100(39.2) |
| Atrial fibrillation | 103(40.4) | 152(59.6) |
| Atrial fibrillation management | 127(49.8) | 128(50.2) |
| SVT (supraventricular tachycardia) | 97(38) | 158(62.6) |
| SVT (supraventricular tachycardia) management | 126(49.4) | 129(50.6) |
| Ventricular fibrillation | 97(38) | 158(62) |
| Ventricular fibrillation management | 96(37.6) | 156(62.4) |
| Sinus Tachycardia | 106(41.6) | 149(58.4) |
| Sinus Tachycardia management | 79(31) | 176(69) |

## 5.4. Factors associated with knowledge, practice of ECG interpretation for nurses

The bivariable logistic regression analysis of level of education, area of practice, training, last-time training time, training of ECG, BLS, and ACLS, and frequency of ECG interpretation were

candidates for multivariable regression of ECG interpretation knowledge and practice of nurses scored p-value less than 0.25.

In final regression model nurses who work in intensive care units had three times more ECG interpretation knowledge [AOR = 2.7 CI; 1.3-5.9] and practice [AOR = 2.8 CI; 1.3-5.7]. Nurses who had a professional qualification of master's degree ha six times more likely good knowledge [AOR = 6.23; CI: 1.7–22.3] and practice [AOR = 5.64; CI: 1.5–20.65] than those who were bachelor degree nurses and bachelor degree holders in ECCN and BSC. Those nurses who had training had three times more good knowledge [AOR = 3.29; CI: 1.3.–8.3] and four times more practice [AOR = 4.41; CI: 1.7–10.94] than those who didn't take training.

Table 5; - Factors associated with knowledge, practice of ECG interpretation for nurses

| knowledge | Category | Knowledge | | COR(95%CI) | AOR(95%CL) | P value |
|---|---|---|---|---|---|---|
| | | Good | Poor | | | |
| Level of education | Msc | 30 | 10 | 8.4(2.65-25.1)* | 6.2(1.7-22.3) | 0.005** |
| | Bsc in nursing | 31 | 184 | 1.0 | 1.0 | |
| Area of practice | ICU | 45 | 76 | 4.37(2.3-8.28)* | 2.8(1.3-5.9) | 0.009** |
| | ED | 16 | 118 | 1.0 | 1.0 | |
| ECG training | Yes | 49 | 88 | 4.9(2.5-9.82)* | 3.3(1.33-8.3) | 0.012** |
| | No | 12 | 106 | 1.0 | 1.0 | |
| Last training time | Above 5 year | 10 | 25 | 4.8(2.27-10.04)* | 2.26(0.69-7.4) | 0.18 |
| | <5 years | 38 | 78 | 1.0 | 1.0 | |
| BLS training | Yes | 29 | 65 | 1.8(1.01-3.8)* | 0.67(0.25-1.8) | 0.42 |
| | No | 32 | 129 | 1.0 | 1.0 | |
| ACLS training | Yes | 18 | 34 | 1.97(1.01-3.8)* | 1.16(0.47-2.9) | 0.75 |
| | No | 43 | 160 | 1.0 | 1.0 | |
| **practice** | **Category** | **practice** | | **COR(95%CI)** | **AOR(95%CL)** | **P value** |
| | | **Good** | **Poor** | | | |
| Level of education | Msc | 32 | 8 | 6.4(2.1-19.4)* | 5.6(1.5-20.7) | 0.010** |
| | Bsc in nursing | 37 | 178 | 1.0 | 1.0 | |
| Area of practice | ICU | 49 | 72 | 3.9(2.1-7.05)* | 2.7(1.3-5.7) | 0.010** |
| | ED | 20 | 114 | 1.0 | 1.0 | |
| ECG training | Yes | 56 | 81 | 5.6(2.9-10.9)* | 4.4(1.8-10.9) | 0.001** |
| | No | 13 | 105 | 1.0 | 1.0 | |
| Last training time | Above 5 year | 9 | 26 | 2.7(1.4-5.3)* | 0.75(0.20-2.6) | 0.65 |
| | <5 years | 40 | 76 | 1.0 | 1.0 | |
| ACLS training | Yes | 21 | 31 | 2.19(1.15-4.15)* | 1.77(0.7-4.4) | 0.022 |
| | No | 48 | 155 | 1.0 | 1.0 | |
| Frequency of ECG interpretation | 1-3times/day | 23 | 29 | 3.35(1.35-8.31)* | 1.38(0.41-4.7) | 0.61 |
| | >3 times /day | 46 | 157 | 1.0 | 1.0 | |

Note: * = significant at p<0.25, **= significant at p<0.05, AOR=Adjusted odd ratio, COR=Crude odd ratio, CI=Confidence interval,

## 6. Discussion

I this study majority of the nurses had a mean age of 30.02 ± 4.7 years, was male, held a B.Sc. degree, and was employed in emergency department. This study assessed the ECG interpretation knowledge and practice of nurses, with only 23.5% demonstrating adequate knowledge and 27.1% showing good practice. Specific ECG interpretation questions showed varying levels of accuracy among participants, with some questions having high correct response rates, such as identifying the QRS complex and recognizing myocardial infarction, while others, like ventricular tachycardia and atrial flutter, had lower accuracy. Education level, practice area, and training were identified as significant factors influencing ECG interpretation knowledge and practice among nurses. These findings emphasize the importance of continuous education and cardiac related training.

This study result showed that the knowledge and practice of nurses on ECG interpretation among ED and ICU nurses was vey poor, with only 60 (23.5%) and 53 (27.1%) demonstrating adequate knowledge and practice respectively. Interestingly, these results align with a similar study conducted in China, where the almost 70.0% of the study participants lack knowledge on ECG interpretation (12), this finding were supported by study in Saudi Arabia's (14).). Another study conducted at Kenyatta National Hospital revealed that 61% of nurses lacked the ability to accurately interpret 12-lead ECG rhythms (9). Likewise, Indonesia study revealed majority (70. %) of the participant had poor knowledge (25). The study in Addis Ababa also show very low level of competency (90.9%) (15). The slight variance in these results could potentially be attributed to the inclusion of intensive care unit staff, who exhibited slightly higher levels of knowledge compared to emergency department nurses.

However, in contrast to these findings, another study conducted in Spain on emergency nurse competence found that an impressive 93% of the study participant had competency to interpret ECGs (23). The decrease in the prevalence of knowledge and practice may be due to the fact that many nurses who underwent cardiac-related training didn't receive recent training. Many of the study participants had training 2–5 years ago. These results emphasize the necessity of consistently updated training.

In this study, 130 (51% of the nurses) were not familiar correct order of ECG waves and intervales while over half of the participants in Pakistan answered correctly. The question about whether "atrial fibrillation could have a regular rhythm" was answered incorrectly by 131 (51.4%) participants, which contrasts with the study in Turkey, where 61.5% answered correctly (2). The majority of correct answers in this study were for questions such as “P wave representing left and right ventricular depolarization” (152, 59.6%), “QRS complex representing right and left ventricular depolarization” (207, 81.2%), and "ST depression in the ECG indicates myocardial ischemia" (155, 60.8%). Additionally, 180 (70.6%) answered correctly about the “conduction problem between the atriums if the P wave does not appear in an ECG." These results are similar to the study in Turkey (2). Furthermore, a study in China also showed that 89.9% correctly identified the QRS complex representing ventricular depolarization, and 86.3% recognized that the absence of a P wave indicates a problem with atrial conduction (12).

The ECG interpretation practice in this study revealed that the most prevalent irregular heartbeats were systole at 195 (76.5%), sinus bradycardia at 76.1%, and myocardial infarction at 146 (57.3%). A study in Turkey similarly indicated that systole was correctly identified in 94.1% of cases (2). Additionally, a study at Dow University Hospital in Pakistan concluded that 61.7% successfully traced an acute myocardial infarction (9).

The most inaccurately answered question was ventricular tachycardia at 102 (40%), followed by atrial flutter at 85 (33.3%), atrial fibrillation at 103 (40.4%), and ventricular fibrillation at 38%. Conversely, findings from a Turkish study showed that the most commonly recognized aspects were the interpretation and identification of ventricular tachycardia (87.7%) and atrial flutter (84.6%), with approximately half correctly identifying ventricular fibrillation and atrial fibrillation (2). Another study at Dow University Hospital revealed that 72.5% accurately identified atrial flutter, 60.0% ventricular fibrillation, and 53.33% successfully traced atrial fibrillation (9).

This study revealed significant differences in nurses' ECG interpretation knowledge based on their working areas within the hospital. Nurses in the intensive care unit demonstrated higher knowledge levels at 16 (6.3%) compared to those in the emergency department at 45 (17.6%). This variation could be attributed to the fact that ICU nurses primarily care for patients with

heart conditions, and the lack of cardiac care units in many Ethiopian public hospitals leads to cardiac patients being admitted to the ICU. This exposes ICU nurses to more ECG cases. In contrast, a study at Dow University Hospital in Pakistan found similar ECG competence scores between nurses in the CCU and ED at 20.0% and 19.5%, respectively. ICU nurses scored lower at 15.6%, indicating a discrepancy in ECG knowledge levels among different hospital units (9).

The results of this study show a substantial correlation (P = 0.012 for knowledge and P = 0.001 for practice) between the degree of ECG interpretation knowledge and cardiac-related training. These results have been validated by numerous research studies. In Spain, for example, research on ECG interpretation revealed that nurses with recent training performed better than those without (23). In a similar vein, a Turkish study also found a strong correlation between nurses' prior ECG training and their knowledge of ECG (2). A study done in Malaysia on the practice of ECG interpretation by nurses found that those who had not completed an ECG course in the ED (U = 128.5, p = 0.003) or ICU (U = 302, p = 0.003) had much lower practice levels. In a similar vein, an Addis Ababa study found a strong link between nurses' training and their ability to interpret ECGs (15).

In this study, nurses with an M.Sc. degree had a higher percentage of right responses than nurses with a BSC or ECCN certificate (P = 0.005 for knowledge and P = 0.010 for practice). A Malaysian investigation provides support for this conclusion (25). According to a recent Addis Ababa study, participants' interpretations of their ECGs did not significantly differ based on their age, gender, or level of job experience. This study's outcome is comparable to this one and in line with research done in Saudi Arabia (14, 15).

# 7. Strength and limitation

## 7.1. Strength

- Use of a self-administered survey facilitated the effective gathering of data from a broad spectrum of nurses working in various healthcare environments.
- The varied demographics of the participants in the research, encompassing nurses with different levels of expertise, working in diverse hospital settings, offered a holistic perspective on ECG interpretation knowledge and application.
- Enrolling nurses both with and without prior training in ECG interpretation enabled the pinpointing of crucial elements linked to the enhancement of skills in this area.

## 7.2. Limitations

- Self-administered questionnaires pose a potential risk of response bias, as participants may be inclined to provide answers that are socially desirable rather than accurately reflecting their true knowledge and practices.
- The diversity among study participants, including variations in professional qualifications, work settings, and exposure to ECG training, may have introduced confounding factors that were not adequately addressed in the analysis.
- The cross-sectional design of the study limits the ability to establish causal relationships between factors and nurses' ECG interpretation knowledge and practice.
- It is important to note that the study was conducted in a specific hospital, and therefore, the findings may not be fully applicable to other healthcare settings or nursing populations in different contexts.

# 8. conclusion and recommendation

## 8.1. Conclusion

This study has revealed a lack of good knowledge and practice among emergency and intensive care unit nurses on electrocardiography. Having electrocardiograph interpretation training, being an MSC degree holder, and working in an intensive care unit have associations. This study underscores the need for a multi-faceted approach to fill this gap.

## 8.2. Recommendation

- The results of this research highlight the importance of implementing a comprehensive strategy to tackle the significant skill gap within the nursing profession. Key suggestions include:
- Incorporating thorough ECG interpretation training into nursing education programs and ongoing professional development initiatives. This will ensure that all nurses possess the necessary knowledge and abilities to accurately interpret ECG results.
- Offering specialized, hands-on ECG interpretation training for nurses in acute and critical care settings. Furthermore, organizing regular skill enhancement workshops to maintain their proficiency.
- Promoting the establishment of knowledge-sharing initiatives, where nurses proficient in ECG interpretation can mentor and exchange best practices with their peers. This peer-to-peer learning approach can effectively spread expertise throughout the nursing community.

## 9. -REFERENCE

1. Wen H, Hong M, Chen F, Jiang X, Zhang R, Zeng J, et al. CRISP method with flipped classroom approach in ECG teaching of arrhythmia for trainee nurses: a randomized controlled study. BMC Med Educ. 2022.

2.Obaydah Yaser HT, Ümran Dal Yılmaz ,. Nurses' Knowledge and Practices of Electrocardiogram Interpretation,Turkish. Int Cardiovasc Res J. 2019.

3.TahboubIn OYH. Knowledge and Practices of Electrocardiogram Interpretation of Nurses.near east unversity institution of health science. 2018.

4. Sabaan S . Effect of Application of Training Program about Electrocardiogram on Nurses Competency Level and Expected Clinical Outcome of Cardiac Patients Egyptian Journal of Health Care, 2016.

5. World Heart Report, Confronting, The World's Number One Killer, Geneva, Switzerland. World Heart Federation. . 2023.

6. Ho JK, Yau CH, Wong CY, Tsui JS. Capability of emergency nurses for electrocardiogram interpretation. International emergency nursing. 2021.

7. Amini K, Mirzaei A, Hosseini M, Zandian H, Azizpour I, Haghi Y. Assessment of electrocardiogram interpretation competency among healthcare professionals and students of Ardabil University of Medical Sciences: a multidisciplinary study. BMC Med Educ. 2022.

8. K N. Knowledge of Student Nurses Regarding Interpretation of Electrocardiogram: A Pre-Experimental Study. Nursing & Healthcare International Journal. 2019.

9. Yaqoob M, Ali A, Siddiqui F, Rehan M. 12-Leads Electrocardiogram Interpretation Competency among Nurses working in Critical Care Areas at Dow University Hospital, Karachi. Journal of Liaquat University of Medical & Health Sciences. 2023.

10. Anthony Kashou AM, Christopher DeSimone,, Noseworthy P. The essential skill of ECG interpretation:How do we define and improve competency? Postgrad Med J. 2020.

11. Ibraheem NK. Nurses' Knowledge toward Electrocardiogram Interpretation at Al-Basrah Teaching Hospitals. University of Basrah College of Nursing. 2022.

12. Buluba SE, He J, Li H. ICU nurses' knowledge and attitude towards electrocardiogram interpretation in Fujian province, China: a cross-sectional study. Front Med (Lausanne). 2023.

13. Supriadi D, Kurniawan R, Esa HF, Kusumawaty J, Farihatun A, Rosmiati. Record Results Analysis Electrocardiogram (ECG) at Pangandaran Health Center. Journal of Physics: Conference Series. 2019.

14. Aljohani MS. Competency in ECG Interpretation and Arrhythmias Management among Critical Care Nurses in Saudi Arabia: A Cross Sectional Study. Healthcare. 2022.

15.Belay YH, Gezahegn D, Melaku B, Tegegne oa. Nurses' Competency on ElectrocardiographyInterpretation in Adult Emergency Room: Addis Ababa, Ethiopia,. 2023.

16. Obaydah Yaser Hamed Tahboub 1, Ümran Dal Yılmaz 2. Nurses' Knowledge and Practices of Electrocardiogram Interpretation. Int Cardiovasc Res J. 2019.

17. Israa Mohammed Ali OAE-AA, Mona Nadr Ebraheim. Nurses' Performance Regarding Electrocardiography Application and Its Interpretation: Suggested nursing Guideline. Egyptian Journal of Health Care. 2022.

18. Alanezi F. A systematized review aimed to identify the impact of basic electrocardiogram training courses on qualified nurses. Saudi Critical Care Journal. 2018.

19. Anthony Kashou , Adam May, Christopher DeSimone, Noseworthy2 P. The essential skill of ECG interpretation: How do we define and improve competency? . 2020.

20. Ahmed1 RA, SAA. Basic Research Efficiency of Competency Training Program on Intensive Care Nurses Performance Regarding the Electrocardiogram Interpretation. Egyptian Journal of Nursing & Health Sciences. 2023.

21. Tanrewali RHMS. nurses competencies of electrocardiogram interpritation in emergency setting: A litrature review. Jurnal Keperawatan. 2021.

22. Coll-Badell M, Jiménez-Herrera MF, Llaurado-Serra M. Emergency Nurse Competence in Electrocardiographic Interpretation in Spain: A Cross-Sectional Study. Journal of Emergency Nursing. 2017.

23. Rasha Nabil Malk HEH. Evaluation of Nurses Practice Regarding Electrocardiogram Procedure. Sumerianz Journal of Medical and Healthcare. 2018.

24. Haristiani R, Tanrewali MS. Nurses Competencies of Electrocardiogram Interpretation in Emergency Settings: A Literature Review. Jurnal Keperawatan. 2021.

25. Ros1 SC, RI, RF, SNI, WAWM. Critical Care Nurses' Competency in Electrocardiogram Interpretation: A Cross-Sectional Study. Malaysian Journal of Medicine and Health Sciences. 2022.

26. Khadija Mohammed Jassim AKSK, Zainab Salman Dawood, Tiryag AM. Nurses' knowledge about electrocardiogram interpretation: A cross-sectional study. 2023.

27. Chen Y, Kunst E, Nasrawi D, Massey D, Johnston ANB, Keller K, et al. Nurses' competency in electrocardiogram interpretation in acute care settings: A systematic review. Journal of advanced nursing. 2022.

28. Gediwon Negash YK, Segewkal Hawaze1. Medication errors in the adult emergency unit of a tertiary care teaching hospital in Addis Ababa. 2013.

29. Tsegaye G/Ananya1 MS, Biruktawit Zemede2, Ayalew Zewdie2. Pre-hospital Care to Trauma Patients in Addis Ababa, Ethiopia: Hospital-based Cross-sectional Study. 2021.

30. Tola K, Abebe H, Gebremariam Y, Jikamo B. Improving Completeness of Inpatient Medical Records in Menelik II Referral Hospital, Addis Ababa, Ethiopia. Advances in Public Health. 2017.

31. Ali M, Alemu T, Sada O. Medication adherence and its associated factors among diabetic patients at Zewditu Memorial Hospital, Addis Ababa, Ethiopia. BMC Res Notes. 2017.

32. Shararo FL, Asebe DS, Teshome HT, Jabo SA. Prevalence and Determinant of Adverse Drug Reactions Among MDR-TB Patients Attending St. Peter's TB Specialized Hospital, Addis Ababa, Ethiopia. 2022.

33. Aljohani MS. Competency in ECG Interpretation and Arrhythmias Management among Critical Care Nurses in Saudi Arabia: A Cross Sectional Study. Healthcare (Basel). 2022.

34.Rawshani DA. <Pocket-guide-ECG-interpretation.pdf>. ECGWAVESCOM. 2017.

# 10. ANNEX

Information sheet for participants and informed voluntary consent in the English version of the consent form

**Greeting**: Good afternoon/morning!

my name is ----------. I am employed as a data collector, For the study on nurses' knowledge, practice, and related factors on ECG interpretation among nurses working in emergency and intensive care units at particular public hospitals in Addis Ababa, Ethiopia, in 2024,

**The purpose of this study**; - is to evaluate the knowledge, skills, and related variables of nurses about the interpretation of electrocardiograms among those employed in emergency and critical care units of particular public hospitals in Addis Ababa, Ethiopia, in 2024. Risk/Discomfort: There is no risk associated with taking part in this study.

**Benefits:** Your participation in this study may not directly benefit you, and there won't be any fin ancial compensation for it. However, it will probably aid in our evaluation of the skills and know ledge of intensive care unit nurses, which will assist the relevant organizations in creating effecti ve interventions.

**Privacy:** The data gathered for this research project will be kept private. The information about y ou that is being gathered will be kept in a file with a code number instead of your name, and it w on't be shared with anyone outside of the lead researcher.

**Refusal or withdrawal rights:** You are entitled to decline participation in this research. You may opt out of answering certain or all questions if you prefer not to provide a response. You also have the complete freedom to withdraw from the study whenever you choose.

**Process and timeframe**: The questionnaires primarily consist of inquiries regarding knowledge, practices, and barriers. Some questions may offer multiple answers as options.

Will you participate?

Yes No,

## Individual consent form

Thank you for your participation in our study on "assessment Competency in electrocardiogram interpretation among nurses working at emergency rooms and intensive care units of selected public hospitals in Addis Ababa, Ethiopia." Your signature below confirms that you are participating voluntarily and after being informed about the study's purpose.

Contact Information:

Data collector name: ---------- Signature ----------

Date ----------

For further inquiries regarding the project, please reach out to the following individual:

Principal Investigator Name and Address:

Name: Marta Teklemariam  Phone number: +251953452931

Email—martateklemariam16@gmail.com

Feel free to ask any questions you may have about the study.

Annex 2: English version Questionnaires

**PART I - socio-demographic characteristics of respondent**

| |
|---|
| 1. Age? ---------- |
| 2. What is your gender?<br>A. Male B. Female |
| 3. Where do you work?<br>A. Tikur Anbessa SH<br>B. Aabet H<br>C. Menelik II CH<br>D. Zewditu MH<br>E. St Peter H |
| 4. What is your level of education?<br>A. BSc. Nursing<br>B. BSc in ECCN<br>C. MSc |
| 5. What is your area of practice?<br>A. Intensive Care Units<br>B. Emergency Department |
| 6. Year of experience? ---------- |
| 7. If yes, then: When was the last course? ---------- |
| 8. Do you attend ECG interpretation training?<br>A. Yes<br>B. No |
| 9. Do you attend Basic life support (BLS)?<br>A. Yes<br>B. No |

10. Do you attend Advance cardiac life support?
   A. Yes
   B. No

11. Is there an ECG machine in your hospital?

A. Yes

B. No

12. Frequency of ECG interpretation?
A. 1-3times/day
B. 1-3times/week
C. 1-3times/month
D. 1-3times/year 11
E. None

**PART II: Knowledge assessing questions**

13. The proper sequence of ECG waves and intervals is "P wave, QRS complex, T wave, PR interval, ST interval, U wave".
   A. True
   B. False

14. The P wave represents right and left atrial repolarization?
   A. True
   B. False

15. QRS complex represents right and left ventricular depolarization?
   A. True
   B. False

16. T wave represents ventricular repolarization?
   A. True
   B. False

17. Pathologic Q waves are a sign of previous myocardial infarction?
   A. True
   B. False

18. Atrial fibrillation could have a regular rhythm?

A. True

B. False

19. If in an ECG the P wave does not appear, there is conduction problem between the atriums?

A. True

B. False

20. Atrial flutter is characterized by a regular ventricular rhythm with a consistent R-R?

A. True

B. False

21. Ventricular fibrillation is characterized by no identifiable P waves and T waves, but the QRS complex is identifiable?

A. True

B. False

22. ST depression in ECG indicated ischemia myocardial?

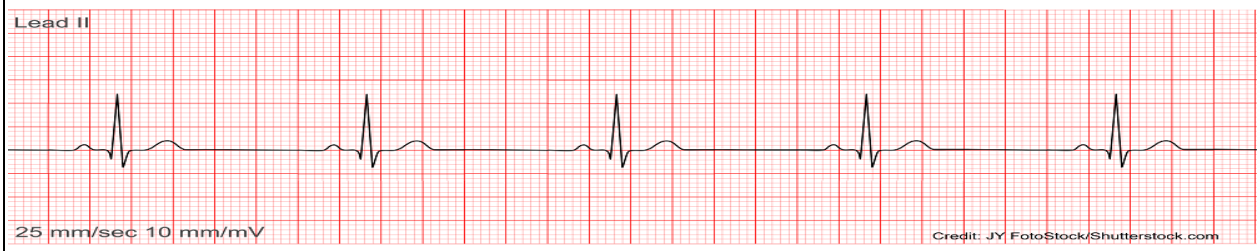
A. True

B. False

**PART II: practice assessing questions**

23. Select the options above that describe the rhythm below?

A. Sinus Bradycardia
B. Normal Sinus Rhythm
C. Sinus Tachycardia
D. SVT (supraventricular tachycardia




24. The above patient has hypotension and dizziness what is initial management

A. Administer Atropine up to 3 mg while awaiting pacer
B. No intervention is required
C. Start CPR
D. Administer Lidocaine 10 mg IV

25. Select the options above that describe the below rhythm?

A. Ventricular fibrillation
B. Ventricular tachycardia
C. Atrial flutter
D. Atrial fibrillation with bundle branch block


26. You checked the above patient and you did not find a pulse, what is initial management?

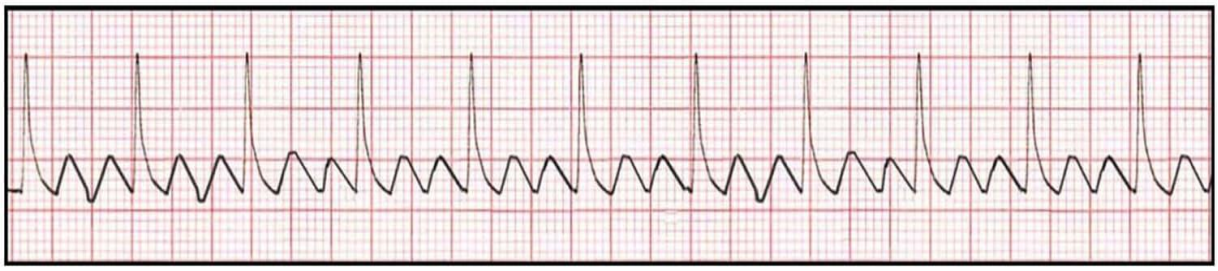
A. Immediate CPR with rapid defibrillation
B. Immediate synchronized cardio version
C. Administer Lidocaine 10 mg IV

D. Atropine up to 3 mg IV while awaiting pacer

27. Select the options below that describe the rhythm below?

E. Ventricular fibrillation
F. Ventricular tachycardia
G. Atrial flutter
H. Atrial fibrillation with bundle branch block

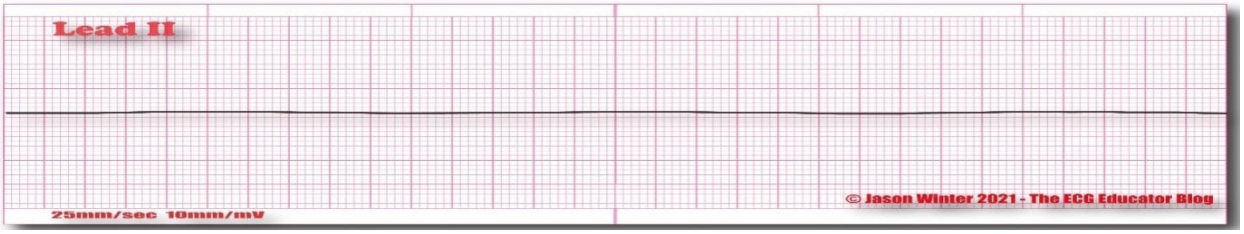
28. The above patient has palpitation, shortness of breath, or hypotension



A. Immediate CPR with rapid defibrillation
B. Immediate synchronized cardio version
C. Administer Atropine up to 3 mg IV
D. Reassure the patient

29. Select the options below that describe the rhythm below?

A. Pulseless electrical activity (PEA)




B. Asystole
C. Ventricular fibrillation
D. Third –Degree hearth block

30. What is the appropriate treatment for the above ECG strip

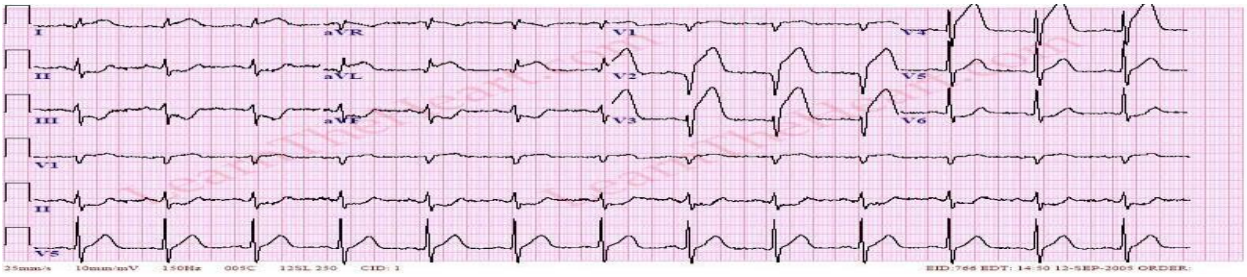
A. Immediate CPR with rapid defibrillation
B. Immediate CPR with epinephrine 1 mg IV bolus every 3–5 min
A. Immediate synchronized cardio version
B. Atropine up to 3 mg IV while awaiting pacer

31. Select the options below that describe the rhythm below?

A. Myocardial infraction
B. Ventricular fibrillation
C. Second-Degree Heart block
D. Normal ECG

32. You got the above ECG for a patient, who had not symptom, He is 52 years old and hypertensive and he was diagnosed with type II diabetes mellitus a few months ago. What is the appropriate treatment for

A. Immediate CPR with rapid defibrillation



B. Immediate CPR with epinephrine 1 mg IV bolus every 3–5 min

C. reperfusion therapy

D. no treatment is needed

33. Select the options below that describe the rhythm below?

A. SVT (supraventricular tachycardia)
B. Ventricular fibrillation
C. Second-Degree Heart block
D. Sinus Bradycardia

34. What is the appropriate treatment for the above ECG strip


A. Immediate CPR with rapid defibrillation

B. Immediate synchronized cardio version

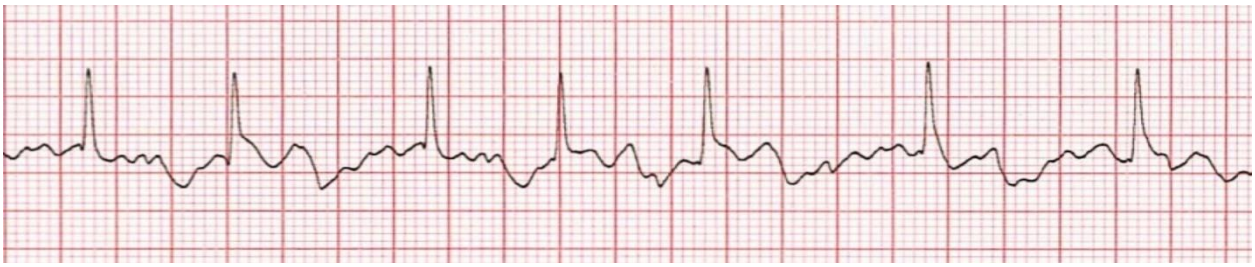
C. Stabilize the patient and Consider Permanent pacing

D. Vagal maneuvers

35. Select the options below that describe the rhythm below?

A. Ventricular fibrillation
B. Ventricular tachycardia
C. Atrial flutter
D. Atrial fibrillation with bundle branch block

36. You checked the above patient and you did find cause palpitation, shortness of breath, or

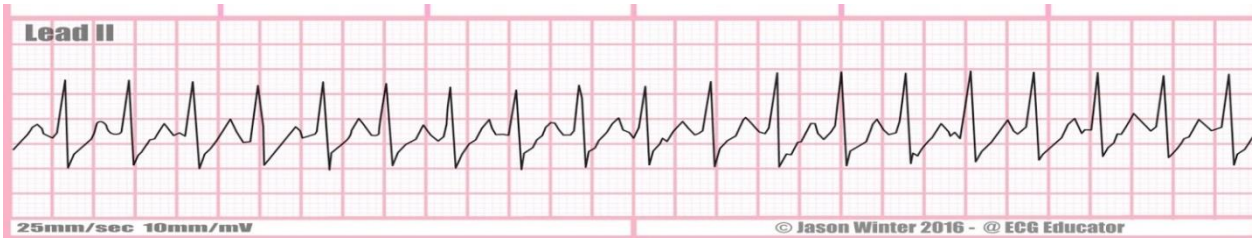


hypotension

A. Immediate CPR with rapid defibrillation
B. Immediate synchronized cardio version
C. Administer Lidocaine 10 mg IV
D. Reassure the patient

37. Select the options above that describe the below rhythm?

A. Sinus Bradycardia
B. Normal Sinus Rhythm
C. Sinus Tachycardia
D. SVT (supraventricular tachycardia)

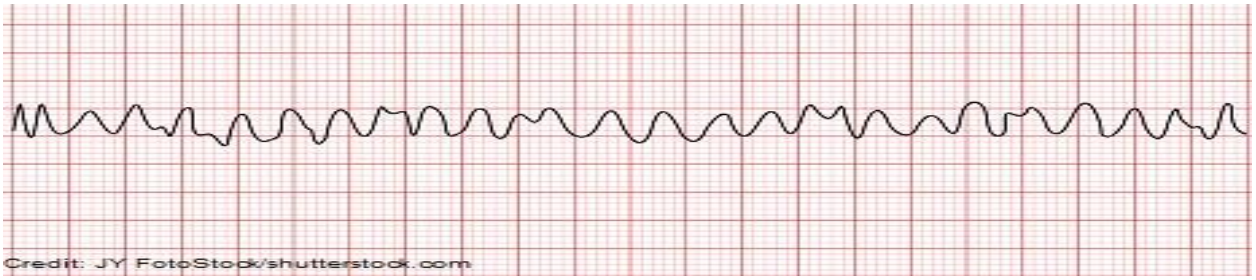



38. You checked the above patient and you did find Palpitation, shortness of breath, or syncope

A. No intervention is required
B. Start CPR
C. Immediate synchronized cardio version
D. Atropine up to 3 mg IV while awaiting pacer

39. Select the options that describe the below rhythm?

A. Ventricular fibrillation




B. B. Ventricular tachycardia C
C. . Atrial flutter
D. D. Atrial fibrillation with bundle branch block

40. What is the appropriate treatment for the above ECG strip

A. Immediate CPR with rapid defibrillation
B. Only CPR
C. Immediate synchronized cardio version
D. Atropine up to 3 mg IV while awaiting pacer

41. Select the options below that describe the rhythm?

A. Sinus Bradycardia
B. Normal Sinus Rhythm
C. Sinus Tachycardia
D. SVT (supraventricular tachycardia


42. You checked the above patient and what is the immediate and appropriate management

A. Vagal maneuvers
B. Immediate synchronized cardio version
C. Atropine up to 3 mg IV while awaiting pacer
D. Atropine up to 3 mg IV while awaiting pacer