Jimma University
Institute of Health
Department of Biomedical Sciences (Medical Physiology)

Electrocardiogram Abnormalities and Associated Factors Among Psychiatric Patients Attending Follow-up at Jimma Medical Center, Psychiatry Clinic, Jimma, South-West Ethiopia, 2021

By Betemariam Girma (BSc)

A thesis to be submitted to the Department of Biomedical Sciences, Institute of Health, Jimma University in partial fulfillment of the requirements for the degree of Master of Science (MSc) in Medical Physiology

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By Betemariam Girma (BSc)

Advisors:

1. Mr. Elias Mulat (MSc, Assistant professor)

2. Mr. Deriba Abera (MSc, Lecturer)

3. Dr. Elsah Tegene (MD, Associate professor of Medicine and Interventional cardiologist)

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Jimma, Ethiopia

ABSTRACT

Background: *Psychiatric patients have a higher risk of cardiovascular morbidity and mortality as compared to the general population. Intrinsic biological changes caused by the disease and the adverse effects of psychotropic medications explain the high risk of cardiovascular disease in these patients. Early detection of subclinical cardiovascular disease using an electrocardiogram can improve the clinical outcomes of these patients. However, no previous study was done on electrocardiogram abnormalities among psychiatric patients in Ethiopia.*

Objective: *The present study aimed to assess electrocardiogram abnormalities and associated factors among psychiatric patients attending follow-up at Jimma Medical Center, Psychiatry Clinic, South-west Ethiopia.*

Methods: *An institution-based cross-sectional study was carried out among psychiatric patients attending Jimma Medical Center Psychiatry Clinic from October 14 to December 10. A consecutive sampling technique was employed to recruit the study participants. An Interviewer-administered structured questionnaire was used to collect socio-demographic data, behavioral factors, disease-related and medication-related data. Anthropometry, blood pressure, and random blood sugar were measured following the World Health Organization's protocols. A resting 12 lead ECG was recorded according to the standard recording protocol of the Minnesota code. Data were entered into Epi data version 4.6 and exported to SPSS version 25. Descriptive statistics were carried out. Results of the descriptive analysis were summarized by frequencies, means, and proportions, and presented by using tables and figures. Bivariable and multivariable logistic regressions were performed to determine the association between dependent and independent variables. With a confidence interval of 95%, p-value ≤ 0.05 was considered statistically significant.*

Results: *A total of 315 psychiatric patients were included in the present study. The mean age (SD) of the respondents was 36.27 ± 10.85 years. 191 (60.6%) (95% C.I. 55.6-66.3) participants had ECG abnormalities. The most prevalent ECG abnormality was arrythmia (27.6%). Age older than 40 [AOR=3.31:95% C.I.1.58-6.89], diabetes mellitus [AOR=3.35:95% C.I.1.19-9.42], treatment with antipsychotics [AOR=4.16:95% C.I.1.25-13.79], polytherapy [AOR=3.13:95% C.I.1.15-8.62], having schizophrenia [AOR=3.11:95%C.I.1.20-8.11], and illness duration of >10 years [AOR=4.25:95% C.I.1.72-10.49] were significantly associated with ECG abnormalities.*

Conclusion and recommendation*: In the present study, six out of ten respondents had ECG abnormalities. Age of the respondents, diabetes mellitus, treatment with antipsychotics, having schizophrenia, polytherapy and illness duration of >10 years were significant predictors of ECG abnormalities. Routine ECG investigation should be performed in the JMC psychiatry treatment setup and further studies are recommended to delineate factors affecting ECG abnormalities.*

Keywords*: Psychiatric disorders, electrocardiogram, psychotropic drugs, Ethiopia*

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ABBREVIATIONS AND ACRONYMS

ACTH	Adrenocorticotropic hormone
AOR	Adjusted Odds Ratio
BMI	Body Mass Index
CATIE	Clinical Antipsychotic Trials of Intervention Effectiveness
CI	Confidence Interval
COR	Crude Odds Ratio
CRH	Corticotropin Releasing Hormone
CVD	Cardiovascular Disease
DDD	Defined Daily Dose
DALYs	Disability Adjusted Life Years
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
DSM V	Diagnostic and Statistical Manual of Mental Disorders fifth edition
ECG	Electrocardiogram
ETB	Ethiopian Birr
FGA	First Generation Antipsychotics
FRS	Framingham Risk Score
HERG	Human Ether-a-go-go Related Gene
HPA	Hypothalamic Pituitary Adrenal
JMC	Jimma Medical Center
Kg	Kilogram
MDD	Major Depressive Disorder
MMAS	Morisky Medication Adherence Scale
OR	Odds Ratio
PDD	Prescribed Daily Dose

QTc	Corrected QT
QTIP	QT Interval Prolongation
RBS	Random Blood Sugar
S2	Serotonin-2
SBP	Systolic Blood Pressure
SD	Standard Deviation
SGA	Second Generation Antipsychotic
SMI	Severe Mental Illness
SPSS	Statistical Package for Social Science Studies
TCAs	Tricyclic Antidepressants
WC	Waist Circumference
WHO	World Health Organization
YLD	Years Lived with Disability
YLL	Years of Life Lost

CHAPTER 1: INTRODUCTION

1.1 Background

According to the Diagnostic and Statistical Manual of Mental Disorders fifth edition (DSM-V), psychiatric disorder is defined as a major disturbance in an individual's thinking, feelings, or behavior that reflects a problem in mental function and causes distress or disability in social, work, or family activities (1). Psychiatric disorders are commonly occurring health problems in many countries throughout the world (2). According to the World Health Organization (WHO's) report, one in ten people meets the criteria for mental illness at some point during their life time (3).

Patients with psychiatric disorders have a two to three-fold mortality risk and a 15–20-years shorter life expectancy than the general population (4). One possible explanation for their shorter life expectancy could be a proclivity for unnatural deaths such as suicides and car accidents. Another cause of high mortality in these patients is a high rate of physical illness, the most common of which is cardiovascular disease (CVD) (5).

Intrinsic biological changes that occur during psychosis and an increased prevalence of modifiable cardiovascular risk factors, such as obesity, smoking, diabetes, and dyslipidemia, are some of the reasons for the high rate of CVD in psychiatric patients. Pathophysiological mechanisms such as activation of the hypothalamic-pituitary-adrenal (HPA) axis, autonomic nervous system imbalance, serotonergic dysfunction, and platelet activation explain the link between CVD and mental disorders (6). In response to stress, the hypothalamus releases corticotropin-releasing hormone (CRH), which stimulates the secretion of adrenocorticotropic hormone (ACTH) from the anterior pituitary and the release of cortisol from the adrenal gland. Higher cortisol level causes insulin resistance, glucose intolerance, and an increase in visceral fat mass, all of which contribute to the progression of atherosclerosis and subsequent CVD development (7).

Patients with psychiatric disorders also exhibit evidence of altered autonomic functioning, such as increased heart rate and sweating, which suggest an increased sympathetic output and decreased parasympathetic output. Excessive sympathetic activation has detrimental effects on the

cardiovascular system, contributing to the development of hypertension, arrhythmia, and cardiovascular hypertrophy (8,9).

Psychiatric patients have unhealthy lifestyle habits including smoking, obesity, poor diet and less physical activity which may contribute to the development of CVDs (10). In addition to this, treatment with psychotropic medications is also linked to the development of CVDs. Such medications have been widely used to treat a wide range of mental disorders, but they are associated with a risk of various side effects including weight gain and abnormalities in glucose and lipid metabolisms which further increase the risk of CVDs (11)

The cardiovascular disease that may occur in patients with psychiatric disorders can be easily diagnosed using noninvasive cardiac imaging tools like Electrocardiogram (ECG) (12). ECG is a graphical representation of the electrical activity of the heart recorded when electrodes are placed on the body surface (13). Various ECG changes such as arrhythmia, conduction block, ST-segment abnormalities, QT interval prolongation, and T-wave abnormalities have been reported in patients with psychiatric disorders (14,15).

Despite the high rate of cardiovascular disease among psychiatric patients, they are not being screened for subclinical CVDs as part of their comprehensive care, and ECG testing can be a convenient screening tool, especially in resource-limited settings.

1.2 Statement of the problem

Mental disorders are among the 20 leading causes of disability and mortality worldwide (2). Mental illness was responsible for 32.4% of years lived with disabilities (YLDs) and 13.0% of disability-adjusted life-years (DALYs) in 2016 (16). Around 8 million people die each year as a result of mental illnesses around the world (17).

In 2010, mental illnesses were the leading cause of YLDs in Sub-Saharan Africa and an estimated rise from approximately 20 million YLDs to 45 million YLDs could be experienced by 2050 (18). In Ethiopia, mental disorders account for 11% of the total disease burden, with schizophrenia and depression ranking among the top 10 most debilitating diseases (19). In 2015, mental disorders were the seventh leading cause of death in Ethiopia (20).

People with mental disorders are more likely to develop physical illnesses, the most prevalent of which is CVD (21). A large-scale meta-analysis undertaken by Christoph et al. reported that patients with mental disorders had a 78% higher risk for developing CVD and a 53% higher risk for harboring factors related to CVD (11). Globally, over 80% of patients with bipolar disorder have some degree of medical comorbidity with the vast majority suffering or dying from CVDs (22). Patients with schizophrenia have been reported to be three times more likely than the general population to die from a heart attack (23). Approximately, 25% of patients with schizophrenia and 33% of patients with bipolar disorder die from CVDs (24). When compared to age and sex-matched population norms, people with depression have a 36% increase in CVD mortality. Coronary artery disease is the leading cause of death in these patients, accounting for 50% of CVD-related mortality (25).

The high rate of CVD in psychiatric patients compromises the quality of life of both the affected and their caregivers, further affecting family finances and household productivity. Mental disorders and CVDs account for nearly 70% of global economic losses, owing to rising medical costs, increased healthcare utilization, and lost productivity (26).

Despite the high prevalence of CVD, about 80% of patients with mental disorders have limited access to general healthcare and fewer opportunities for CVD screening (27). Moreover, patients with mental disorders have reduced ability to verbalize concerns, poor insight into illness, and a tendency to ignore cardiovascular symptoms such as chest pain and palpitations, which may

contribute to the poor detection of CVDs (28). Thus, underrecognition of CVDs, coupled with limited access to healthcare facilities, raises the risk of sudden cardiac death in these patients. Therefore, early detection of subclinical CVDs using objective screening tools like ECG may improve patients' clinical outcomes and reduce further disabilities and mortality associated with comorbid CVDs (29). ECG abnormalities were found to be common psychiatric patients in several studies. It was reported that ECG abnormality was prevalent in 17.5% (15) to 54% (30) of psychiatric patients in some Asian countries. In a study done in Johannesburg the prevalenvce of ECG abnormality among psychiatry patients was 67.5% (31). Nevertheless, most of the previous studies presented an incomplete picture because they focused on solitary ECG abnormalities specifically QTc prolongation (32–35) and the factors associated with ECG abnormalities were not well studied. Currently, there is no available published data on the prevalence of ECG abnormalities and factors associated with having abnormal ECG among psychiatric patients in Ethiopia. Thus, this study aimed to assess ECG abnormalities and associated factors among psychiatric patients attending follow-up at Jimma Medical Center.

1.3 Significance of the study

This study will serve to provide an insight regarding the ECG findings of psychiatric patients in the scarce data situation of Ethiopia. The findings of this study might be helpful for policymakers and health planners for future planning to decide whether routine ECG evaluation should be indicated for specific circumstances or generally in psychiatric patients. Additionally, this study helps the study participants to know their ECG status and to prevent further complications that might happen in participants with abnormal ECG findings. Also, this study will add additional knowledge besides the existing literature for the scientific community and it will serve as baseline data for further studies.

CHAPTER 2: LITERATURE REVIEW

2.1 Magnitude of ECG abnormality among psychiatric patients

Different literatures had reported the prevalence of ECG abnormality among psychiatric patients. For instance, a retrospective study conducted in Minnesota (30) reported a 54% prevalence rate of ECG abnormality among psychiatric patients. Two retrospective studies conducted in Switzerland revealed 27.3% (32) and 17.9% (15) prevalence rates of ECG abnormality among psychiatric patients. A comparative cross-sectional study conducted in Denmark (28) reported a 28% prevalence of ECG abnormality among patients with Severe Mental Illness (SMI). According to a cross-sectional study conducted in Johannesburg (31), the prevalence of ECG abnormality among psychiatric patients was 67.5%.

2.2 Types of ECG abnormalities among psychiatric patients

Different types of ECG abnormalities have been reported among patients with psychiatric disorders. For example, according to the retrospective study done in Switzerland (15), arrhythmia (6.3%), conduction blocks (9.6%), and myocardial infarction (0.8%) were identified among the patients. The cross-sectional study done in Denmark (28) reported chamber enlargement and hypertrophy (8.5%), ST-T deviation (3.8%), conduction block (14.5%), and Q wave abnormality (5.4%). A retrospective study done in Minnesota (30) has found arrhythmia in 20% and T wave abnormalities in 10% of the respondents whereas a cross-sectional study done in Johannesburg (31) reported arrhythmia among 28.8% of the respondents, ST-segment abnormality in 20.5% and T wave abnormalities among 15.4% respondents. Several studies have also reported QTc prolongation among psychiatric patients. For instance, a retrospective study done in Atlanta (34) reported QTc prolongation among 16.5% of psychiatric patients. Similarly, cross-sectional studies conducted in Iran (33), Italy (36), Japan (35), and Nigeria (14) revealed 30%, 33.3%, 14%, and 5% prevalence of QTc prolongation among psychiatric patients respectively.

2.3 Factors associated with ECG abnormalities

2.3.1 Socio-demographic characteristics

A longitudinal study of psychiatric patients conducted in Sweden (37) showed that the age-standardized incidence rate of CVD was higher in males than in females. According to a cross-sectional study done in Italy (36), female sex and increasing age of psychiatric patients were significantly associated with QTc prolongation. Another cross-sectional studies conducted in

Atlanta (34), Nigeria (14), Switzerland (15), and Johannesburg (31) reported a high rate of ECG abnormalities among old aged psychiatric patients. A comparative study conducted in Canada (38) revealed that schizophrenia patients with comorbid CVDs were more likely to be unmarried than healthy controls (72% vs. 35%). This study also reported that individuals with schizophrenia when compared to controls, have an annual household income of less than $20,000 (40% vs. 10%).

2.3.2 Behavioural factors

2.3.2.1 Cigarette Smoking

Several studies have shown that cigarette smoking is highly prevalent in psychiatric patients and is associated with ECG abnormalities. A cross-sectional study conducted in Switzerland (39) reported that out of 62 psychiatric patients who had prolonged QTc, 32 (60.4%) of them were smokers. A comparative study conducted in six districts in North-East England (40) revealed that out of 40 patients who had prolonged QTC interval, 28 patients were ever smokers.

2.3.2.2 Khat chewing

Khat chewing is a common habit in psychiatric patients which has been associated with ECG abnormalities. Cathinone, which is the main active substance in khat leaves, has sympathomimetic effects which increase heart rate and blood pressure (41). A cross-sectional study conducted in Jimma town (42) reported that individuals who chewed khat were nearly two times more likely to have an ECG alteration than those who didn't chew khat.

2.3.2.3 Alcohol consumption

Psychiatric patients who consume alcohol are more likely to have ECG abnormalities than those who don't consume alcohol. A comparative study conducted in six districts in North-East England (40) revealed that out of 40 patients who had prolonged QTc interval, one patient had a history of excess alcohol intake. Acute alcohol intake may predispose to cardiac arrhythmias, whereas chronic heavy alcohol consumption can result in systolic and diastolic dysfunction, left ventricular dilatation, and cardiac conduction abnormalities (43).

2.3.2.4 Physical activity

People with mental disorders have been shown to be less physically active or less likely to meet international physical activity recommendations (44). For instance, a comparative study conducted in Canada (38) showed that individuals with schizophrenia were less likely to engage in regular or occasional physical activity than healthy controls (70% vs. 82%).

2.3.3 Disease-related factors

2.3.3.1 Type of psychiatric disorder

The risk of CVD may not be the same for the different psychiatric disorders. For instance, a retrospective cohort study of patients with SMI conducted in Netherland (45) reported that out of 116 patients with a comorbid CVD, 20.7%, 12.9%, and 9.5% of them were diagnosed with bipolar, schizophrenia, and unspecified psychiatric disorders respectively.

2.3.3.2 Duration of illness

A study done in Turkey (46) showed a positive correlation between the high risk of CVD and schizophrenia disease duration with the mean and Standard Deviation (SD) of the disease duration being 17.09 ± 9.6. According to a cross-sectional study done in Italy (36), the duration of psychiatric illness was significantly associated with QTc prolongation and the mean ± SD of the duration of illness was 12.2 ± 11.9. A retrospective study conducted in six Asian countries (47) reported that patients having a long illness were more likely to have QTc prolongation.

2.3.4 Medication-related factors

2.3.4.1 Number of psychotropic medications

Antipsychotic polypharmacy increases the severity of adverse effects and hence the risk of developing CVD (48). A comparative study done in Turkey (46) showed the mean ± SD of the 10-year cardiovascular risk measured by Framingham Risk Score (FRS) to be 7.09 ± 7.4 for patients who have been prescribed more than one antipsychotics, while the mean ± SD of FRS of patients prescribed with one antipsychotic was found to be 3.69 ± 5.1. According to a study done in Italy (36), the use of two or more antipsychotics was positively associated with QTc prolongation. A prospective study conducted in Pakistan (29) reported that out of the total patients with QTIP, 56.5% of them were taking more than one QT-prolonging drug concomitantly. A comparative study conducted in six districts in North-East England (40) revealed that 8 (15%) of 53 patients who were taking combinations of antipsychotics and tricyclic antidepressants (TCAs) had ECG abnormality.

2.3.4.2 Type of psychotropic medication

The risk of cardiovascular diseases varies across the different psychotropic medications. According to a comparative cross-sectional study conducted in Denmark (28), most psychotropic drugs, mainly antipsychotics were associated with abnormal ECGs. A multicentric observational study conducted among psychiatric patients (48) revealed that atypical antipsychotics were

significantly associated with QTc interval prolongation than other subclasses of antipsychotics. A retrospective study of six Asian countries (47) showed that thioridazine, clozapine, sulpiride, and chlorpromazine increased the risk of QTc prolongation. In this study, haloperidol was associated with a low risk of QTc prolongation. A population-based cohort study conducted in the United Kingdom among people with depression showed a significant increment in the rate of arrhythmia in the first 28 days after starting treatment with TCAs.

2.3.4.3 Dosage of psychotropic medication

The risk of cardiac toxicity is further increased by a high concentration of psychotropic drugs. For example, first-degree atrioventricular block increases with imipramine plasma concentrations above 350 ng/mL and increases more than 30-fold in patients with plasma concentrations above 450 ng/mL (49). A study conducted in Italy (50) found that the rate of ECG abnormality was significantly higher in patients treated with high-dose antipsychotics.

2.3.4.4 Treatment duration

A cross-sectional study done in New York (51) among depressive patients showed that depressive patients who were taking fluoxetine for 7 weeks showed a reduction in heart rate and a slight increment in ejection fraction. An observational study done in Holland (52) revealed that depressive patients who received sibutramine experienced a tolerable decrease in Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) and heart rate about 12 weeks of drug use.

2.3.4.5 Adherence to psychotropic medications

Psychiatric patients who adhere to psychotropic medications had less risk of mortality and hospital admission than those who do not adhere to the regular medications. This finding might be a result of the positive effects of psychotropic drug treatment in reducing the overall symptom load of the mental illness, perhaps resulting in patients seeking better help for behavioral or lifestyle choices (4). A retrospective study done to evaluate the association between adherence to antidepressant therapy and all-cause mortality in patients with ischemic heart disease revealed that adherence to antidepressant therapy is associated with a substantially decreased risk of death compared with the non-adherence group (17% and 14%) respectively (53). A 7-year follow-up study of patients with depression following myocardial infarction showed that patients with inadequately short duration of treatment for depression had a 3-fold higher mortality risk compared with those sufficiently treated (54).

2.3.5 Comorbidities

2.3.5.1 Diabetes Mellitus

People with psychiatric disorders are at an increased risk of Diabetes mellitus (DM). A cross-sectional study conducted in Hawassa (55) reported that the prevalence of undiagnosed type 2 DM among patients with SMI was 6.3%. A comparative study conducted in Holland (56) showed a higher prevalence of DM among schizophrenia patients (8.0%) than controls (1.7%). Antipsychotics, particularly second-generation antipsychotics (SGAs), may cause DM directly by promoting insulin resistance and indirectly by inducing weight gain (57). DM has been known to cause ECG alteration. A cross-sectional study of type 2 diabetic patients conducted in JMC showed a 61% prevalence of ECG abnormality among the patients (58).

2.3.5.2 Hypertension

Psychiatric patients are more likely to develop hypertension than members of the general population. A cross-sectional study conducted in Hawassa (55) reported that out of 237 psychiatric patients, 11 (4.6%) of them had stage-I hypertension. A prospective observational study conducted in Pakistan (29) reported that out of 23 patients who had QTIP, 3 patients (13%) were hypertensive.

2.3.6 Body composition

People with psychiatric disorders are at increased risk of being overweight and obese (57). A cross-sectional study of psychiatric patients conducted in Egypt (59) showed a 66.93% prevalence of obesity among the patients. According to the US Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) study among patients with schizophrenia (60), the mean baseline Body Mass Index (BMI) was 29.7 kg/m^2 with 37% of men and 73% of women having central obesity. Psychiatric patients are less likely to exercise and are more sedentary. Also, increased appetite and metabolic effects of some psychotropic medications can result in weight gain (61).

Many psychotropic medications antagonize histamine and serotonin receptors which lead to increased central appetite, increased food intake, and weight gain (62). Excess weight is a major risk factor for impaired glucose tolerance, atherogenic dyslipidemia, and arterial hypertension leading to increased risk for CVD (63). A cross-sectional study conducted in Switzerland (64) reported that out of 62 psychiatric patients who had a prolonged QTc, 16 (26.2%) of them had a BMI of ≥ 30 kg/m^2. A comparative study conducted in Holland (65) reported that compared to controls, schizophrenia patients with longer QT interval, had a higher BMI.

2.4 Conceptual framework

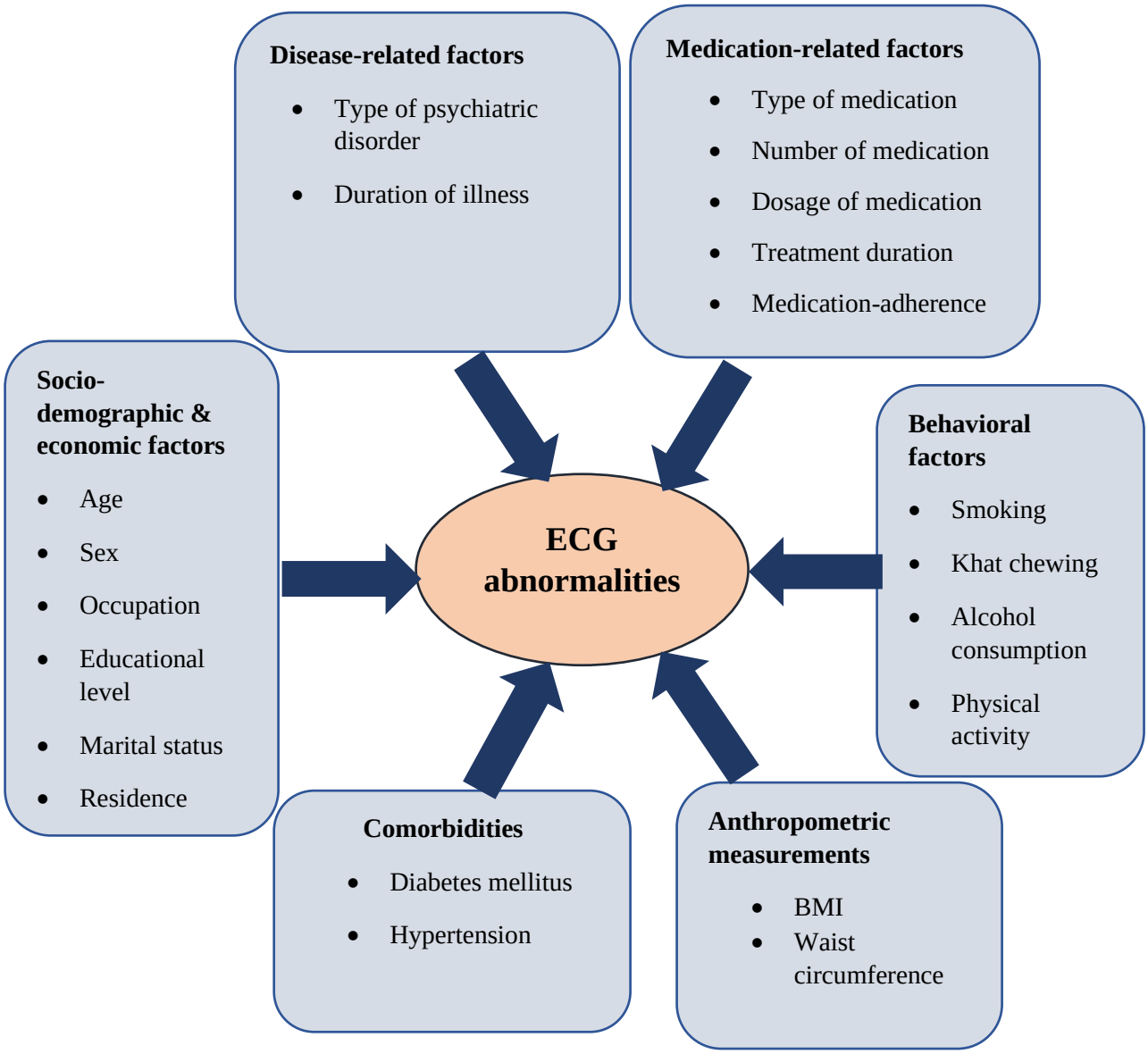

Figure 1. Conceptual framework developed after reviewing different literatures

CHAPTER 3: OBJECTIVES

3.1 General objective

The present study aimed to assess electrocardiogram abnormalities and associated factors among psychiatric patients attending follow-up at JMC Psychiatry Clinic, Jimma, Ethiopia, 2021.

3.2 Specific objectives

- To determine the magnitude of ECG abnormalities among psychiatric patients attending follow-up at JMC Psychiatry Clinic, Jimma, Ethiopia, 2021.
- To identify types of ECG abnormalities among psychiatric patients attending follow-up at JMC Psychiatry Clinic, Jimma, Ethiopia, 2021.
- To assess the factors associated with ECG abnormalities among psychiatric patients attending follow-up at JMC Psychiatry Clinic, Jimma, Ethiopia, 2021.

CHAPTER 4: MATERIALS AND METHODS

4.1 Study area and period

This study was conducted at Jimma Medical Center (JMC) Psychiatry Outpatient Clinic. JMC is located in Jimma town, Oromia regional state, South-west Ethiopia, at a distance of 352 km from the capital city, Addis Ababa. JMC is a teaching and referral center that was established in 1930 and provides services for approximately 15,000 inpatients, 160,000 outpatients, 11,000 emergency cases, and 4,500 deliveries in a year coming to the medical center from the catchment population of about 15 million people (66). Additionally, it serves as a training center for medical and health science students to create competent professionals.

JMC is one of the few hospitals in Ethiopia that provides psychiatric services in both inpatient and outpatient settings. JMC Psychiatry Clinic was established in 1996. There are three Psychiatry OPD clinics and 26 beds are available for the inpatient service. The psychiatry department has 3 Psychiatrists, 10 MSc Mental health specialists, 2 Clinical Psychologists and 12 Psychiatry Nurses Currently, 2380 patients are attending followup at JMC Psychiatry clinic.

The present study was carried out from October 14 to December 10, 2021.

4.2 Study design

An institution-based cross-sectional study was employed.

4.3 Population

4.3.1 Source population

All psychiatric patients attending follow-up at JMC Psychiatry Clinic.

4.3.2 Study population

All selected psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14 to December 10, 2021.

4.3.3 Study unit

Individuals with psychiatric disorder

4.3.4 Eligibility criteria

4.3.4.1 Inclusion criteria

All adult psychiatric patients who attended follow up treatment during the study period were included in the study

4.3.4.2 Exclusion criteria

- Patients with tardive dyskinesia
- Aggressive and acutely disturbed patients
- Pregnant women and
- Who were not willing to participate were excluded from the study

4.4 Sample size determination and sampling technique

4.4.1 Sample size determination

The sample size was determined using Epi info STAT CALC version 7.2.4.0 by considering the following assumption: prevalence of ECG abnormality among psychiatric patients 67.5% taken from a previous study done in Johannesburg (31), 95% confidence level and 5% margin of error. A sample size of 337 was obtained and the formula for finite population correction was applied since the source poplation was less than 10,000.

nf = $\frac{ni}{1+\frac{ni}{N}}$ where, nf = final sample size, ni = sample size from the formula, N = Size of the study population

nf = $\frac{337}{1+\frac{337}{2380}}$ = 296

By adding 10% non-response rate, the minimum sample size required for the study was 325.

4.4.2 Sampling technique

All adult psychiatric patients who fulfilled the inclusion criteria were included using consecutive sampling technique until the required sample size was achieved.

4.5 Data collection tools and procedures

Data were collected by trained BSc Nurse and Psychiatry Nurse who were employed from JMC Psychiatry Clinic. Two data collectors (one BSc Nurse and one BSc Psychiatry Nurse) and one supervisor (MSc psychiatry professional) were involved in the data collection. The data collectors

were trained for two days prior to the data collection regarding the purpose of the study, interview, measurement techniques, and ethical issues. An interviewer-administered structured questionnaire was used to assess sociodemographic variables, behavioral factors, and medication-adherence rate. The WHO standard total physical activity calculation guide (67) was used to assess the physical activity status and the respondents were accordingly categorized as physically active or inactive.

Medication-adherence status was assessed using the four-item Morisky Medication Adherence Scale (MMAS). The MMAS assesses patients' forgetfulness about taking medications, carelessness about taking medications, stopping medication when feeling better, and stopping medication when feeling worse. The questions were answered as "yes" and "no" with a scoring scheme of "Yes" = 1 and "No" = 0 and the scores were summed to give a total score, ranging from 0 to 4. Respondents who scored zero or one were considered adherent and those who scored two or more were considered non-adherent (68,69).

Clinical characteristics and medication history were extracted from the Participants' medical charts. Psychotropic medication doses were converted into multiples of the Defined Daily Dose (DDD) for each drug by dividing the prescribed daily dose (PDD) by the DDD. The DDD is the assumed average maintenance daily dose of a drug used for its main indication in adults. The DDD of the psychotropic medications was obtained from the WHO's Collaborative Center for Drug Statistics (70), whereas the PDD of the medications was obtained from the patients' medical charts. For patients who were taking more than one psychotropic medications, the multiples of DDD for each drug were summed up to give a cumulative dose. The medications were then classified as a low dose and a high dose.

Weight and height were measured using a combined height and weight scale (made in India, manufactured date-03/2017). Weight was measured to the nearest 0.1 kg with the participant not wearing shoes and heavy clothes, whereas height was measured to the nearest 0.1 cm with the participant standing upright with the heel, buttock, and upper back along the same vertical plane, arms at the side and looking straight forward. Body mass index (BMI) was computed by dividing the weight by the square of height and the participants were classified as normal weight, overweight and obese based on the WHO's anthropometric guideline (71).

Waist circumference (WC) was measured in cm using a stretch-resistant tape meter in the horizontal plane midway between the inferior margin of the ribs and the superior border of the iliac crest at the end of expiration. While measuring the WC, the participants were standing upright, with their feet together, arms at the side, and wearing light clothes. The respondents were then categorized into normal and increased risk based on the WHO's protocol (72).

Blood pressure was measured on the left arm in mmHg using a calibrated sphygmomanometer (Yton sphygmomanometer, Italy, model-10220060) whilst the participant was in a sitting position, with his/her back supported, legs uncrossed, arm supported, and cubital fossa at heart level after 5 minutes of rest. Three readings were taken with 3 min intervals and the average of the last two readings was recorded as the final blood pressure of the respondent (73). Random blood sugar (RBS) was measured using a digital glucometer (Care sens, Korea) from capillary blood obtained by finger prick following the WHO measurement protocol (71).

A resting 12 lead ECG calibrated at a paper speed of 25mm/s and amplitude of 10mv was obtained in a supine position using 'York' ECG machine (model-YSIPL-155). Patient preparation and lead attachments were made according to the standard manual for Minnesota code protocol (74). The electrocardiogram was interpreted by a cardiologist. QT interval was corrected for heart rate according to Bazett's ($QTc= QT/RR^{1/2}$) correction formula (75). QTc prolongation was defined according to the guideline of the American cardiologic society: > 450 ms in men, > 460 ms in women (76). The ECG findings were then coded and summarized according to the Minnesota code manual of electrocardiographic findings (74).

4.6 Study variable

4.6.1 Dependent variable

ECG abnormalities

4.6.2 Independent variables

- **Socio-demographic and economic characteristics**
    - Age, sex, monthly-income, occupation, place of residence, and marital status
- **Behavioral factors**
    - Smoking, khat chewing, alcohol consumption, and physical activity
- **Disease-related factors**
    - Type of psychiatric disorder and duration of illness

- **Medication-related factors**
    - Number of psychotropic medication, type of medication, dosage of medication, treatment duration, and medication-adherence status
- **Comorbidities**
    - Diabetes mellitus and Hypertension

4.7 Operational definition

ECG abnormalities - refers to any change deviated from normal sinus ECG based on Minnesota ECG coding criteria

Normal ECG finding - a regular heart rate between 60 and 100 beat per minute with normal P-wave, PR- interval, QRS complex, T- waves, and P-waves preceding each QRS complex

Psychotropic poly-therapy- is considered when respondents are treated with two psychotropic medications

Emotional disorders- include major depressive disorder, bipolar disorder, anxiety disorder, post-traumatic stress disorder, dysthymia, and schizoaffective disorder

Physically active- a respondent who performed more than than 150 minutes of moderate or 75 minutes of vigorous physical activity per week

Physically inactive- a respondent who performed less than 150 minutes of moderate or 75 minutes of vigorous physical activity per week

Current alcohol drinker: a respondent who was drinking alcohol within 30 days before the study

Former alcohol drinker- a respondent who used to drink alcohol but was not drinking alcohol within 30 days before the study

Non-alcohol drinker- a respondent who had never drunk alcohol in his/her lifetime

Current smoker-a respondent who were smoking cigarettes within 30 days before the study

Former smoker- a respondent who used to smoke cigarette but was not smoking cigarettes within 30 days before the study

Non-smoker – a respondent who never smoked any tobacco products

Current khat chewer- a respondent who was chewing khat within 30 days before the study

Former khat chewer- a respondent who used to chew khat previously but was not chewing khat within 30 days before the study

Nonkhat chewer- a respondent who had never chewed khat in his/ her lifetime

Low dose- if the ratio of PDD to DDD was less than one

High dose- if the ratio of PDD to DDD was greater than one

Increased waist circumference- is considered when a respondent had a waist circumference of > 94 cm (for males) and > 80 cm (for females)

Substantially increased waist circumference- is considered when a respondent had a waist circumference of > 102 cm (for males) and > 88 cm (for females)

Normal weight- BMI of 18.5-24.9 kg/m^2

Overweight- a BMI of 25-29.9 kg/m^2

Obesity - a BMI of $\geq$ 30 kg/m^2

4.8 Data analysis procedure

Data were entered into Epi data version 4.6 statistical software and exported to Statistical Package for Social Science (SPSS) version 25. Data cleaning and editing were done before the actual data analysis. Descriptive statistics for frequencies, mean and standard deviation were performed to summarize the dependent and independent variables. Bivariable and multivariable logistic regressions were performed to determine the association between dependent and independent variables. Firstly, each independent variable was entered into bivariable analysis one by one. Then, variables with p-value of less than 0.25 on bivariable analysis were entered to multiple logistic regression altogether to control confounders. Finally, variables with p-value of $\leq$ 0.05 on multivariable regression were considered as predictors of ECG abnormalities. Odds ratio with a 95% confidence interval was used to show the degree of association between dependent and independent variables.

4.9 Data quality management

The questionnaire was adapted from the WHO Stepwise approach to chronic disease risk factor surveillance (71) and some modification has been made. The necessary training was given to the data collectors before the data collection. Standard operating procedures were followed for each measurements. The questionnaire was translated from the English language to Amharic and Afan Oromo and retranslated back to the English language for its consistency. On each data collection day, all the collected data were reviewed by the principal investigator for completeness, accuracy, and clarity. The electrocardiogram was interpreted by a cardiologist.

4.10 Ethical consideration

Ethical clearance was obtained from the institutional review board of Jimma University, Institute of Health. An official permission letter was obtained from JMC Psychiatry Clinic. Written informed consent was obtained from each study participant before the interview. The informed consent form was translated into Amharic and Afan Oromo versions for simple understanding. Participation in the study was entirely voluntary and the right of the participants to withdraw at any time or not to participate was respected. Data confidentiality was kept at all stages of data processing. Covid-19 prevention measures were taken while approaching the study participants. Participants with abnormal findings were referred for further evaluation and possible intervention.

4.11 Dissemination plan of results

The findings of this study will be submitted to Jimma University Postgraduate School. Copies of the paper will be submitted to the Psychiatry Department, JMC. The results of the study will be communicated with stakeholders through presentations on meetings, workshops, and scientific panels. Finally, attempts will be made to publish the work in peer-reviewed journal to make it accessible to all individuals.

CHAPTER FIVE: RESULTS

5.1. Socio-demographic and economic characteristics of the respondents

A total of 325 psychiatric patients were enrolled in the present study. Ten of the 325 respondents were excluded from the analysis, mainly because of ECGs of poor quality and artifacts. The remaining 315 respondents were included in the analysis giving a completeness rate of 97%.

From the total of 315 respondents included in the analysis, 187 (59.4%) were men. The mean age of the respondents was 36.27 ± 10.85 years with a minimum of 18 and a maximum of 65 years. One hundred twenty-one (38.4%) respondents had attended primary education and 194 (61.6%) were rural dwellers. Nearly half (159, 50.5%) were married, one-fourth (25.1%) were farmers and one-third (33.3%) had an average monthly income of more than 3000 ETB as shown in Table 1.

Table 1. Socio-demographic and economic characteristics of psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

Variables	Category	Frequency	Percentage
Sex	Male	187	59.4
	Female	128	40.6
Age (years)	18-30	119	37.8
	31-45	124	39.4
	46-59	67	21.2
	≥ 60	5	1.6
Mean ± SD	36.27 ± 10.85 years		
Educational status	No formal education	77	24.4
	Primary education	121	38.4
	Secondary education	72	22.9
	tertiary education	45	14.3
Marital status	Single	110	34.9
	Married	159	50.5
	Divorced	39	12.4
	Widowed	7	2.2
Average monthly income	≤ 2000 ETB	210	66.6
	>2000 ETB	105	33.4
Mean ± SD	2887.78 ± 1530.40 ETB		
Occupation	Government employee	49	15.5
	Non-governmental employee	61	19.4
	Farmer	79	25.1
	Housewife	63	20.0
	Merchant	48	15.2
	Others*	15	4.8
Place of residence	Urban	121	38.4
	Rural	194	61.6
Total		315	100

Key*: daily laborer, student, and unemployed; ETB: Ethiopian birr; SD: Standard deviation

5.2 Behavioral characteristics of the respondents

Twenty-six (8.2%) respondents were current alcohol drinkers. Fifty-four (17.1%) were current cigarette smokers whereas 131 (41.6%) were current khat chewers. Regarding their physical activity status, 187 (59.4%) respondents reported to perform a moderate physical activity of less than 150 minutes or a vigorous physical activity of 75 minutes per week (Table 2).

Table 2. Behavioral factors of psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

Variables	Category	Frequency	Percentage
Alcohol use	Never	228	72.4
	Former	61	19.4
	Current	26	8.2
Cigarette smoking	Never	217	68.9
	Former	44	14.0
	Current	54	17.1
Khat use	Never	114	36.2
	Former	70	22.2
	Current	131	41.6
Physical activity status	< 150 min of moderate or 75 min of vigorous exercise/week	187	59.4
	≥ 150 min of moderate or 75 min of vigorous exercise/week	128	40.6

5.3 Disease and Medication-related factors

Out of the total respondents, 134 (42.5%) were diagnosed with schizophrenia, 91 (28.9%) were diagnosed with Major Depressive Disorder (MDD), and 75 (23.8%) had bipolar disorder. Other psychiatric disorders like anxiety disorder (6, 1.9%), post-traumatic stress disorder (6, 1.9%), dysthymia (2, 0.6%) and schizoaffective disorders (1, 0.3%) totally accounted for 15 (4.8%) (figure 2).

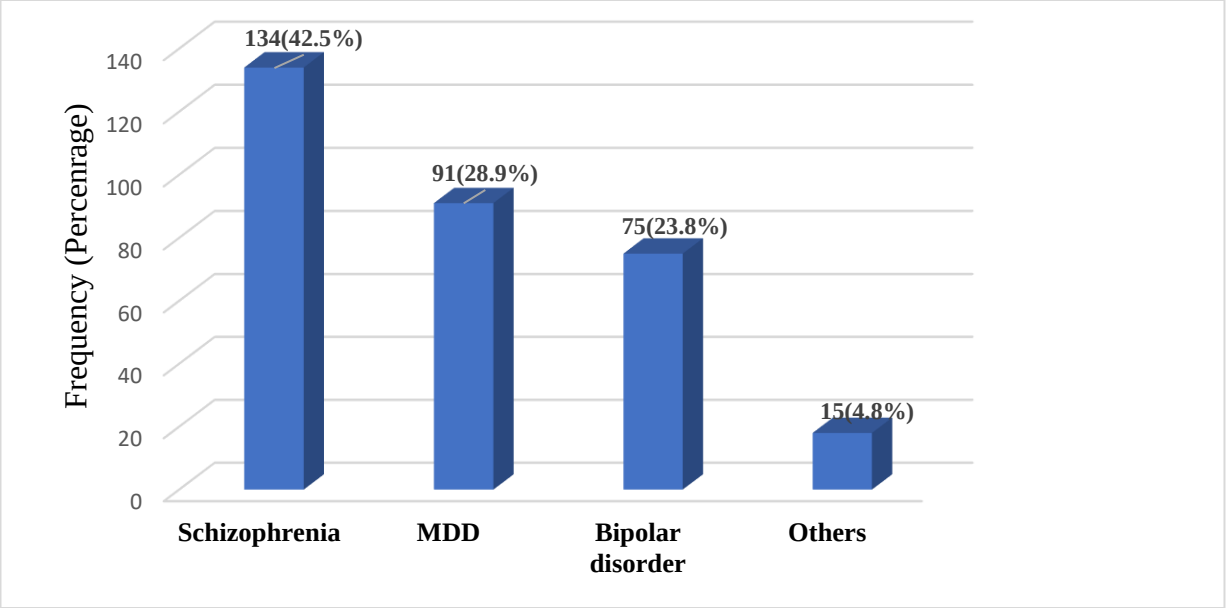

Figure 2. A graph showing the diagnostic category of psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

The most frequently prescribed class of psychotropic medications was antipsychotic (197, 62.5%). Antidepressants were prescribed for 110 (34.9%) and mood stabilizer was prescribed for 70 (22.2%) respondents. Two hundred thirty-two (73.7%) respondents were treated with a single psychotropic medication. The rest 83 (26.3%) were treated with a combination of two psychotropic medications. Sodium valproate was the most frequently prescribed monotherapy (67, 21.3%) whereas the combination of risperidone and amitriptyline was the most common combination therapy (50, 15.8%). According to the classification made using the multiples of DDD of the drugs, 270 (85.7%) respondents were treated with low-dose psychotropic medications. Regarding the medication-adherence status, 218 (69.2%) were adherent to the prescribed medications whereas the rest 97 (30.8%) were non-adherent (Table 3).

Table 3. Medication-related factors of psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

Variable	Category	Frequency	Percentage
Monotherapy with psychotropic drug	**Antipsychotics only**	114	36.2
	Risperidone	56	17.8
	Chlorpromazine	18	5.7
	Haloperidol	40	12.7
	Antidepressants only	51	16.2
	Amitriptyline	35	11.1
	Fluoxetine	16	5.1
	Mood stabilizer only	67	21.3
	Sodium valproate	67	21.3
	Total	232	73.7
Polytherapy with psychotropic drugs	**Antipsychotics with antidepressants**	59	18.7
	Risperidone with amitriptyline	50	15.8
	Chlorpromazine with amitriptyline	9	2.9
	Antipsychotics with a mood stabilizer	3	1.0
	Risperidone with sodium valproate	3	1.0
	Two antipsychotics together	21	6.7
	Risperidone with chlorpromazine	21	6.7
	Total	83	26.3
Medication adherence status	Adherent	218	69.2
	Non-adherent	97	30.8
Dosage of medication	Low dose	270	85.7
	High dose	45	14.3

Concerning the duration of illness and treatment, the mean duration of illness was 7.16 ± 5.49 years with a minimum of 6 months duration and a maximum of 25 years, whereas the mean treatment duration was 6.18 ± 4.89 years while ranging from 2 months to 24 years. One hundred thirty-four (42.5%) had illness duration of less than than five years and 143 (45.4%) were treated for less than 5 years as presented in figure 3.

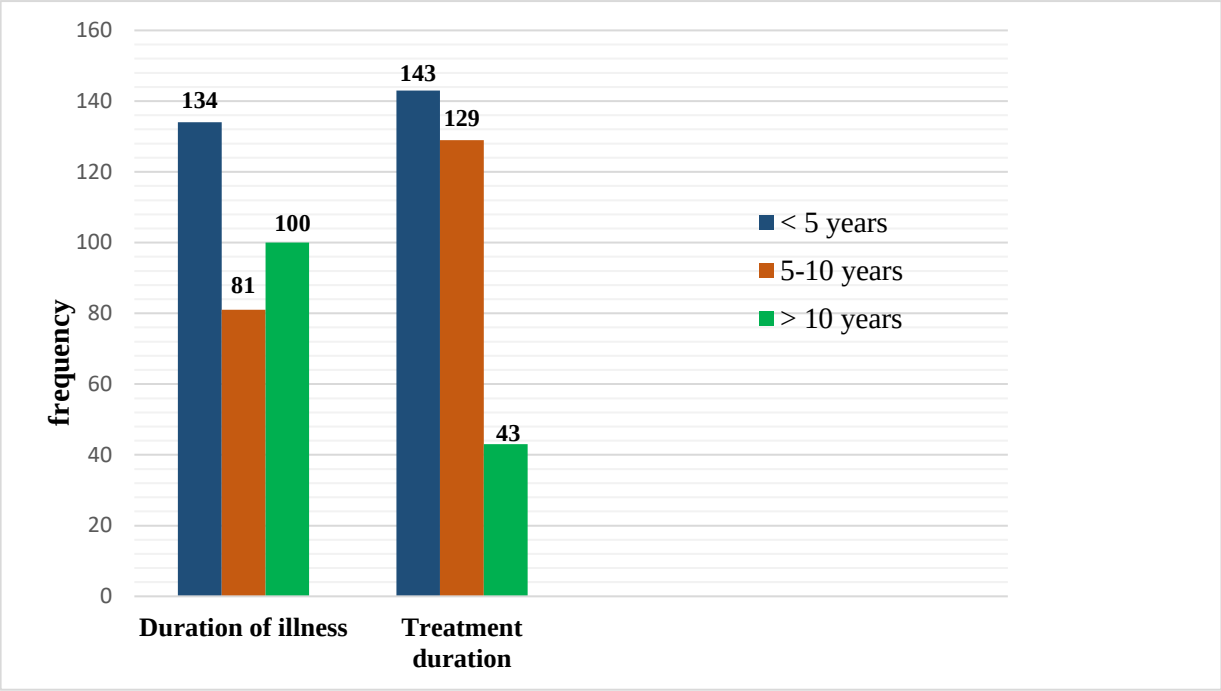

Figure 3. A graph showing duration of illness and treatment duration of psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

5.4 Medical conditions and anthropometric measurement of the respondents

The most common comorbid disease was hypertension (76, 24.1%). The mean systolic blood pressure was 118.01 ± 12.83 mmHg and the mean diastolic blood pressure was 79.27 ± 8.08 mmHg. Forty-one (13.0%) respondents had comorbid DM. The mean RBS was 126.92 ± 40.06 mg/dl with a minimum of 70 mg/dl and a maximum of 236 mg/dl. Regarding the anthropometric measurements, the mean weight was 66.55 ± 7.67 kg and 239 (75.8%) respondents had a BMI in the range between 18.5-24.9 kg/m^2. As per the WHO's classification, 19 (6.0%) respondents had a waist circumference of > 102 for male/ > 88 for female (Table 4).

Table 4. Medical conditions and anthropometric measurement of psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

Variables	Category	Frequency	Percentage
Comorbidities	Hypertension	76	24.1
	Diabetes Mellitus	41	13.0
BMI (kg/m^2)	18.5-24.9	239	75.8
	25-29.9	67	21.3
	≥ 30	9	2.9
Mean ± SD (kg/m^2)	23.19 ± 2.64		
Waist Circumference (cm)	< 94 for male/ < 88 for female	245	77.8
	> 94 for male/ > 88 for female	51	16.2
	>102 for male/ > 88 for female	19	6.0
Mean ± SD (cm)	81.40 ± 9.43		

5.5. ECG status of the study participants

Out of the total 315 participants, 191 (60.6%) had at least one ECG abnormality (Figure 4).

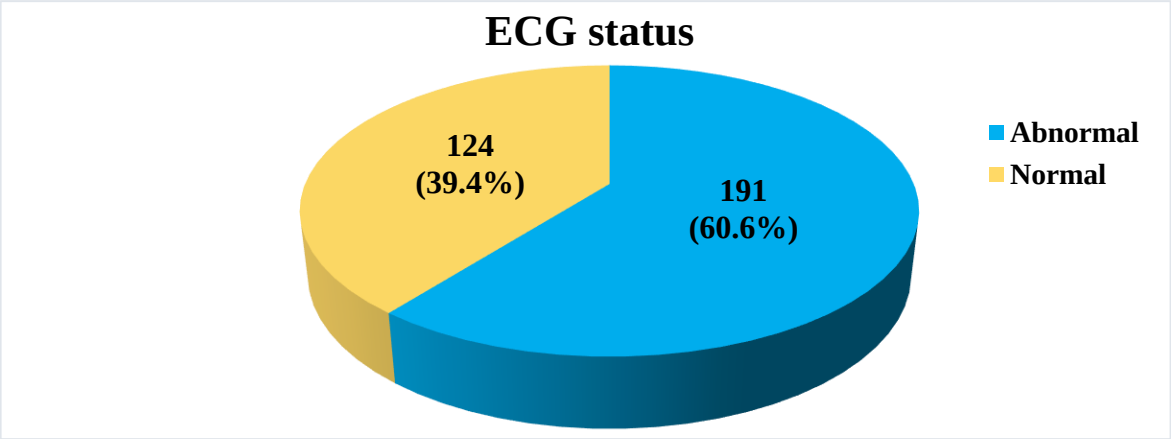

Figure 4. A pie chart showing ECG status of psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

As presented in figure 5, ECG abnormalities were 35.2% among patients with schizophrenia, 16.2% among MDD, 7.6% among bipolar disorder and 1.6% among patients with other psychiatric disorders.

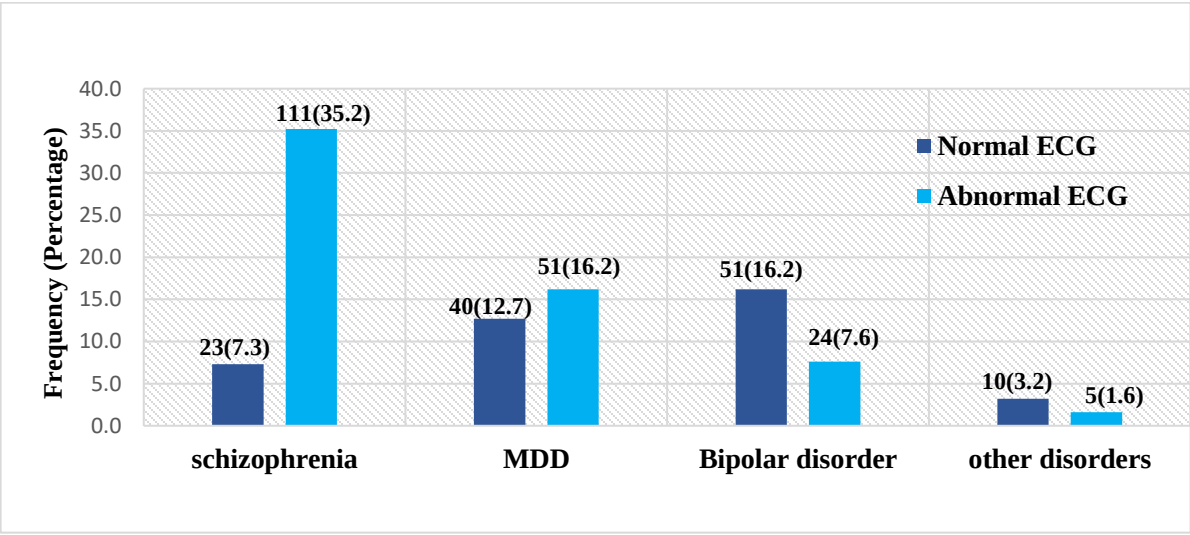

Figure 5. A graph showing ECG status of the different diagnostic categories of psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

As per the medications prescribed, ECG abnormalities were 48.3% among patients treated with antipsychotic medication, 20.0% among antidepressants, and 8.6% among those treated with a mood stabilizer. Ninety-seven (30.8%) respondents who were taking risperidone had ECG abnormalities. Similarly, ECG abnormalities were 19% among respondents treated with amitriptyline and 12.4% among those treated with chlorpromazine (Figure 6).

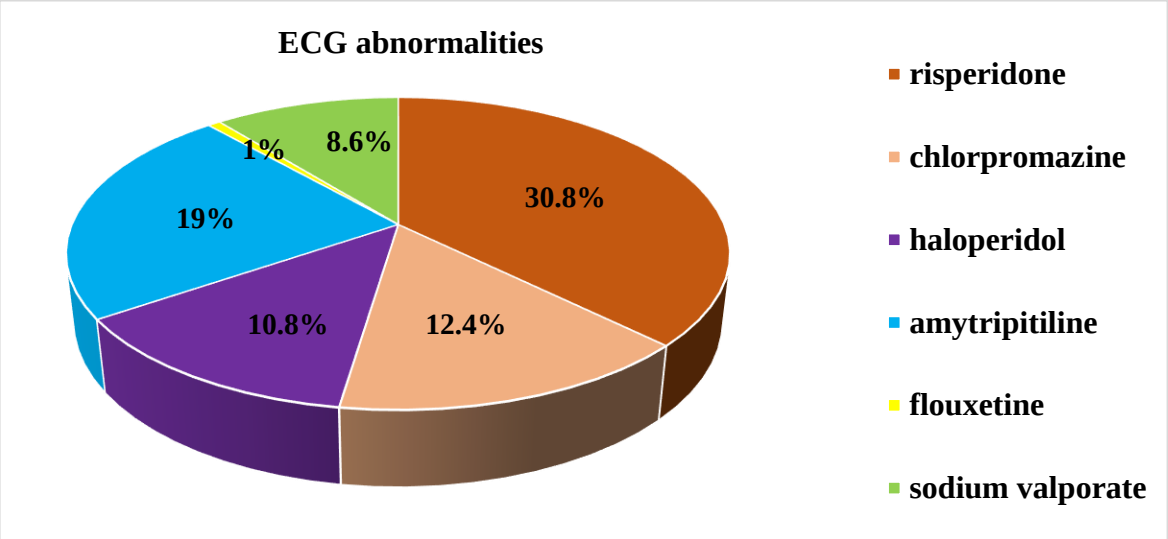

Figure 6. A pie chart showing the proportion of ECG abnormalities across different psychotropic medications prescribed to psychiatric patients attending follow-up at JMC Psychiatry Clinic, from October 14-December 10, 2021 (n = 315)

5.6 Types of ECG abnormalities

From the different categories of ECG abnormalities identified according to the Minnesota code, arrhythmia was the most frequently observed abnormality (87, 27.6%). QTc prolongation was identified in 61 (19.4%) and conduction block in 58 (18.4%) respondents. Fifty-three (16.8%) respondents had ST-segment abnormalities, 37 (11.7%) had axis deviation and 31 (9.8%) had chamber enlargement and hypertrophy. T wave abnormalities and Q wave abnormality were observed in 24 (7.6%) and 18 (5.7%) respondents respectively (Table 5).

Table 5. Types of ECG abnormalities identified among psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

ECG abnormalities	Category	Frequency	Percentage
Arrhythmia	Sinus arrhythmia	13	4.1
	Sinus tachycardia	43	13.7
	Sinus bradycardia	19	6.0
	Atrial fibrillation	5	1.6
	Premature ventricular contraction	7	2.2
	Total	**87**	**27.6**
QTc prolongation		**61**	**19.4**
Conduction block	First degree AV block	9	2.9
	Ventricular preexcitation pattern (WPW)	15	4.8
	Incomplete LBBB	7	2.2
	Incomplete RBBB	13	4.1
	Left anterior fascicular block	9	2.8
	Left posterior fascicular block	5	1.6
	Total	**58**	**18.4**
ST-segment abnormalities	ST elevation	39	12.3
	Anterior	20	6.2
	Inferior	10	3.2
	Lateral	9	2.9
	ST depression	14	4.5
	Anterior	10	3.2
	Inferior	4	1.3
	Total	**53**	**16.8**
Axis deviation	Right axis deviation	12	3.8
	Left axis deviation	25	7.9
	Total	**37**	**11.7**
Chamber enlargement and hypertrophy	Left ventricular hypertrophy	12	3.7
	Right ventricular hypertrophy	10	3.2
	left atrial enlargement	6	1.9
	right atrial enlargement	3	1.0
	Total	**31**	**9.8**
T wave abnormalities	T wave flattening	20	6.3
	Inverted T wave	4	1.3
	Total	**24**	**7.6**
Q wave abnormality		**18**	**5.7**

From the total 87 (27.6%) cases of arrhythmia, 41 (13.0%) were observed among schizophrenia patients, 29 (9.2%) among MDD, 14 (4.4%) among patients with bipolar disorder and 3 (1%) among patients with other psychiatric disorders. Similarly, QTc prolongation was 35 (11.1%) among schizophrenia patients, 16 (5.1%) among MDD, 9 (2.8%) among bipolar and 1 (0.3%) among patients with other psychiatric disorders (Figure 7).

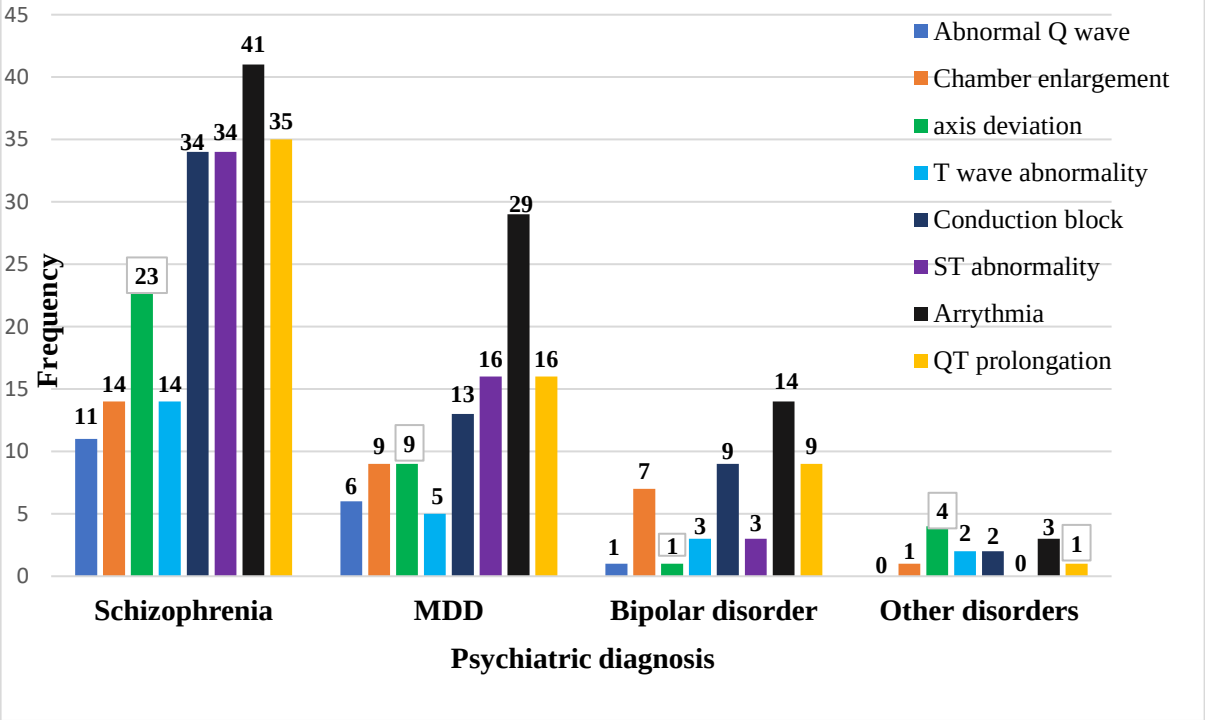

Figure 7. A graph showing types of ECG abnormalities across the different disease categories of psychiatric patients attending follow-up at JMC Psychiatry Clinic from October 14-December 10, 2021 (n = 315)

5.7 Factors associated with ECG Abnormalities

To determine factors associated with ECG abnormalities binary logistic regression was performed by putting the dependent variable (ECG abnormalities) as dichotomous variable i.e. patients having at least one ECG abnormality as 1 and patients with no ECG abnormality as 0. Among twenty-three variables entered into SPSS for binary logistic regression, forteen variables (age, place of residence, treatment duration, duration of illness, treatment with antipsychotics, treatment

with mood stabilizer, dosage of medication, treatment type, type of psychiatric disorder, physical activity, diabetes mellitus, cigarette smoking, khat chewing, and BMI were candidate variables for multiple logistic regression (p-value < 0.25). Finally, multiple logistic regression analysis was performed using SPSS enter method and variables whose p-value was ≤ 0.05 were fitted in the final model. Model fitness was tested with Hosmer-Lemeshow test and the assumption was fulfilled as the p-value of the Hosmer-Lemeshow was not significant (p = 0.530).

Among the fifteen variables entered into multiple logistic regression, six variables i.e age, diabetes mellitus, duration of illness, treatment with antipsychotics, type of psychiatric disorder, and treatment type) showed statistically significant association with ECG abnormalities (Table 6).

Accordingly, by putting all other variables constant, the odds of ECG abnormalities were three times higher in patients older than 40 years than younger age group (AOR = 3.31: 95% C.I 1.58-6.89: p-value = 0.002). Similarly, psychiatric patients with comorbid DM were three times more likely to have ECG abnormalities than non-diabetic psychiatric patients (AOR = 3.35: 95% C.I 1.19-9.42: p-value = 0.021). Psychiatric patients who were treated with antipsychotics were four times more likely to have ECG abnormalities than those who were treated with other psychotropic medications (AOR = 4.16:95% C.I. 1.25-13.79: p-value = 0.019). Patients with schizophrenia had a three-fold risk of ECG abnormalities as compared to patients with emotional disorders (AOR = 3.11: 95% C.I 1.20-8.11: p-value = 0.02). In the same way, patients treated with polytherapy had a three-fold risk of ECG abnormalities as compared to those treated with monotherapy (AOR = 3.13:95% C.I. 1.15-8.62: p-value = 0.027). Patients who were ill for more than 10 years were four times more likely to have ECG abnormalities than patients with lower illness duration (AOR = 4.25: 95% C.I. 1.72-10.49: p-value = 0.002).

Table 6. Bivariable and multivariable analysis of factors associated with ECG abnormalities among psychiatric patients attending follow-up at JMC Psychiatry Clinic, from October 14-December 10, 2021 (n = 315)

Variable	Category	ECG abnormalities		COR (95%)	P-value	AOR (95%)	P-value
		No Freq (%)	Yes Freq (%)				
Sex	Male	70(22.2)	117(37.1)	1.22[0.77-1.93]	0.397		
	Female	54(17.1)	74(23.5)	1			
Age	> 40 years	18(5.7)	96(30.5)	5.95[3.35-10.57]	<0.001*	**3.31[1.58-6.89]**	**0.002****
	≤ 40 years	106(33.7)	95(30.2)	1			
Educational status	No formal education	30(9.5)	47(14.9)	0.78[0.36-1.67]	0.535		
	Primary	49(15.6)	72(22.9)	0.73[0.36-1.51]	0.400		
	Secondary	30(9.5)	42(13.3)	0.70[0.32-1.52]	0.368		
	Tertiary	15(4.8)	30(9.5)	1			
Residence	Urban	41(13.0)	80(25.4)	1.46[0.91-2.34]	0.117*	1.40[0.75-2.57]	0.293
	Rural	83(26.3)	111(35.5)	1			
Occupation	Non-governmental	22(7.0)	39(12.4)	0.94[0.43-2.06]	0.881		
	Farmer	33(10.5)	46(14.6)	0.74[0.35-1.55]	0.426		
	Housewife	27(8.6)	36(11.4)	0.71[0.33-1.53]	0.381		
	Merchant	18(5.7)	30(9.5)	0.88[0.38-2.02]	0.774		
	Others	7(2.2)	8(2.5)	0.61[0.18-1.96]	0.607		
	Gov't employee	17(5.4)	32(10.2)	1			
Monthly income	≤ 2000 ETB	82(26.0)	128(40.6)	1.04[0.65-1.68]	0.870		
	> 2000 ETB	42(13.3)	63(20.0)	1			
Alcohol drinking	Current	9(2.9)	17(5.4)	1.26[0.54-2.94]	0.601		
	Former	24(7.6)	37(11.7)	1.02[0.58-1.83]	0.936		
	Never	91(28.9)	137(43.5)	1			
Cigarette smoking	Current	9(2.9)	45(14.3)	4.43[2.07-9.52]	<0.001*	1.70 [0.61-4.69]	0.309
	Former	13(4.1)	31(9.8)	2.12[1.05-4.26]	0.036*	1.23 [0.46-3.29]	0.678
	Never	102(32.4)	115(36.5)	1			
Khat chewing	Current user	48(15.2)	95(30.2)	1.38[0.82-2.34]	0.224*	0.88 [0.42-1.85]	0.866
	Former user	34(10.8)	36(11.4)	0.74[0.40-1.37]	0.338	1.05 [0.45-2.43]	0.904
	Never	42(13.3)	60(19.0)	1			
Medication adherence	Non-adherent	38(12.1)	59(18.7)	1.01[0.62-1.65]	0.963		
	Adherent	86(27.3)	132(41.9)	1			
Treatment with mood stabilizer	Yes	43(13.7)	27(8.6)	0.30[0.18-.52]	<0.001*	1.707[0.64-4.53]	0.283
	No	81(25.7)	164(52.1)	1			

Treatment with antipsychotics	Yes	45(14.3)	152(48.3)	6.40[3.87-10.60]	<0.001*	**4.16[1.25-13.79]**	**0.019****
	No	79(25.1)	39(12.4)	1			
Treatment with antidepressants	Yes	47(14.9)	63(20.0)	0.81[0.50-1.29]	0.371		
	No	77(24.4)	128(40.6)	1			
Type of psychiatric Disorder	Schizophrenia	23(7.3)	111(35.2)	6.10[3.57-10.42]	<0.001*	**3.11 [1.20-8.11]**	**0.020****
	Emotional disorders	101(32.1)	80(25.4)	1			
Duration of illness	>10 years	17(5.4)	83(26.3)	4.84[2.70-8.70]	<0.001*	**4.25 [1.72-10.49]**	**0.002****
	≤10 years	107 (34.0)	108(34.3)	1			
Treatment duration	>10 years	5(1.6)	38(12.1)	5.91[2.26-15.48]	<0.001*	0.69 [0.17-2.81]	0.610
	≤10 years	119(37.8)	153(48.6)	1			
Treatment type	Polytherapy	14(4.4)	69(21.9)	4.44[2.37-8.34]	<0.001*	**3.13[1.15-8.62]**	**0.027****
	Monotherapy	110(34.9)	122(38.7)	1			
BMI	Overweight	18(5.7)	49(15.6)	1.99[1.09-3.62]	0.024*	1.17 [0.54-2.54]	0.678
	Obese	5(1.6)	4(1.3)	0.59[0.15-2.23]	0.434	0.27 [0.05-1.47]	0.132
	Normal	101(33.3)	138(43.8)	1			
WC	Increased	17(5.4)	34(10.8)	1.40[0.74-2.64]	0.296		
	Substantially increased	6(1.9)	13(4.1)	1.52[0.55-4.11]	0.412		
	Normal	101(32.1)	144(45.7)	1			
Diabetes mellitus	Yes	9(2.9)	32(10.2)	2.58[1.19-5.60]	0.017*	**3.35[1.19-9.42]**	**0.021****
	No	115(36.5)	159(50.5)	1			
Hypertension	Yes	30(9.5)	46(14.6)	0.94[0.58-1.68]	0.982		
	No	94(29.8)	145(46.0)	1			
Physical activity status	Inactive	62(19.7)	126(40.0)	1.94[1.22-3.08]	0.05*	1.79 [0.93-3.46]	0.078
	Active	62(19.7)	65(20.6)	1			
Dosage of medication	High dose	12(3.8)	33(10.5)	1.95[0.96-3.94]	0.063*	0.75[0.28-2.01]	0.57
	Low dose	112(35.6)	158(50.2)	1			

key *Candidate variables for multiple logistic regression: ** Statistically significant: COR: Crude Odds Ratio AOR-Adjusted Odds Ratio: CI: Confidence Interval 1: reference category.

CHAPTER SIX: DISCUSSION

People with psychiatric disorders have increased risk of cardiovascular morbidity and mortality as compared with the general population (5). Early detection of ECG abnormalities may offer a simple way to identify psychiatric patients who are at higher risk of CVDs. With the objective of assessing ECG abnormalities and associated factors, an institution-based cross-sectional study was conducted among psychiatric patients attending follow-up at JMC. The mean age of the respondents was 36.27 ± 10.85 years and 59.4% were males.

The prevalence of ECG abnormalities among psychiatric patients was 60.6%. This finding is higher than the previous studies conducted in Denmark (28%) (28), Minnesota (54%) (30), and two studies conducted in Switzerland (17.9%, 27.3%) (15,32). The present finding is however lower than the study done in Johannesburg (67.5%) (31). These inconsistencies in the prevalence rate of ECG abnormalities could be attributed to the differences in socioeconomic status, sample size, study design, inclusion criteria, drug prescribing pattern, and criteria for ECG abnormalities.

According to the present study, arrhythmia was the most common ECG abnormality which was observed in 27.6% of the respondents. In contrast to the present finding, a lower prevalence of arrhythmia was reported in the studies conducted in Minnesota (20%) (30) and Switzerland (6.3%) (15). The lower percentage reported in Minnesota might be due to the small sample size involved in the study (37 respondents). By the same token, the study done in Switzerland (15) defined sinus tachycardia at a cut value of > 120 beats per minute which probably contributed to the lower rate of arrhythmia reported in the study. The possible explanation for the occurrence of arrhythmia may be the fact that psychiatric patients have episodes of highly sympathomimetic arousal during restraint, which may trigger potentially fatal arrhythmias. In addition, psychotropic medications also have an arrhythmogenic effect through blockage of peripheral cholinergic and adrenergic receptors (77,78).

In the present study, the prevalence of QTc prolongation was 19.4%. In agreement with this finding, the studies conducted in Atlanta (34) and Minnesota (30) reported 16.8% and 16% prevalence of QTc prolongation respectively. On the contrary, the finding of the present study is higher as compared to the studies conducted in Nigeria (5%) (14), Japan (14%) (35), and Switzerland (7.6%) (15) and lower as compared to the studies conducted in Italy (33.3%) (36) and

Iran (30%) (33). These discrepancies might be due to heterogeneity in QTc cutoff value and patient characteristics. Unlike the present study, the studies conducted in Nigeria (14), Switzerland (15), and Japan (35) used 470 ms QTc cut-off value for women whereas, in the present study, QTc value of more than 460 ms for women was considered prolonged. Likewise, in the Iran study (33) the proportion of female patients was relatively high (67.1%). Being female is known to be one of the risk factors for QT prolongation (79) and this might explain the higher percentage of QTc prolongation reported in the study. The potential mechanism for QT prolongation can be explained by the effect of psychotropic drugs on cardiac ion channels. Most antipsychotics and TCAs, in particular, cause blockage of delayed rectifier potassium current (IKr), which is encoded by the Human ether-a-go-go-related gene (HERG). This blockade can prolong cardiac repolarization, seen as QTc prolongation on the ECG (80).

The current study revealed that 18.4% of the respondents had conduction block. This finding is in accordance with the studies conducted in Denmark (14.5%) (28). Blockade of high-voltage L-type calcium channels that are responsible for conduction via the atrioventricular node may explain the mechanism of conduction abnormalities in psychiatric patients. Psychotropic medications, specifically antipsychotics and TCAs, cause sodium ion channel blockage. This reduces the inward Na^+ depolarising current leading to conduction delay, atrioventricular block, and bundle-branch block (78).

In the present study, ST-segment abnormalities were identified in 16.8% of the respondents. In agreement with this finding, the study done in Johannesburg (31) reported 20.5% ST-segment abnormalities. On the other side, the study done in Nigeria (14) reported 5% prevalence of ST-segment abnormalities. The study done in Nigeria (14) has excluded patients with chronic illnesses like DM and this could explain the lower rate of ST-segment abnormalities reported in the study. Treatment with psychotropic medications has been associated with blockade of the fast sodium current encoded by the sodium channel, voltage-gated type V α-subunit. This blockade reduces peak sodium influx causing altered voltage gradients which manifest as ST-segment elevation on the ECG (78).

According to the present study, 9.8% of the participants were found to have chamber enlargement or hypertrophy. This report is consistent with the study done in Denmark (28) which reported an 8.5% prevalence of chamber enlargement among the respondents. Autonomic nervous system imbalance characterized by sympathetic hyperactivity might explain the mechanism of cardiac hypertrophy in these patients (81).

In the current study, T wave abnormalities were found in 7.6% of the respondents. This finding is consistent with the findings reported from the studies done in Nigeria (7.4%) (14) and Minnesota (10%) (30). Sympathetic overactivity and the effect of antipsychotics on serum potassium level may explain the T wave abnormality that occur in psychiatric patients. Antipsychotics are believed to cause hypokalemia by changes in adrenergic activity. It was postulated that a hyperadrenergic state might drive beta-2-receptor stimulation, causing an influx of potassium into skeletal muscle, resulting in a hypokalemic trend (82).

According to this study, Q wave abnormality was found in 5.7% of the respondents. Similar to the present finding, the study done in Denmark (28) reported 5.4% Q wave abnormality among the respondents. Q wave abnormality may occur due to undetected or silent myocardial infarction that may present in the psychiatric patients (83).

According to the present finding, age older than 40 years was one of the predictors of ECG abnormalities. This finding is supported by the previous studies conducted in Atlanta (34), Nigeria (14), Minnesota (30), and Switzerland (15) which showed significant association between old age and ECG abnormalities. The possible explanation for this could be the structural and physiological changes in the heart observed with age advancement, which include, among others, loss of the elasticity, increased left ventricular wall thickness, cardiac hypertrophy, fibrosis and alterations in the sympatho-vagal balance (84).

In this study, having comorbid diabetes mellitus was found to be another predictor of ECG abnormality. In accordance with the present finding, the study done in Atlanta (34) showed a significant association between QTc prolongation and comorbid DM. The possible explanation is that DM is associated with endothelial vasomotor dysfunction, vascular effects of advanced

glycation products, adverse effects of circulating free fatty acids, and increased systemic inflammation which leads to atherosclerosis and subsequent CVD (85).

In the current study having schizophrenia was significantly associated with ECG abnormalities. In agreement with this finding, the study done in Denmark (28) reported that schizophrenia patients had a high rate of ECG abnormality in comparison with other psychiatric disorders. The possible explanation is that schizophrenia is associated with physiologic changes, including sympathetic nervous system activation, cardiac rhythm disturbances, systemic and localized inflammation, and hypercoagulability that negatively influence the cardiovascular system. The cardiac adverse effects of the medications used to treat this disorder might be another possible explanation for the high rate of ECG abnormalities in these patients (4).

In this study, treatment with antipsychotic medication has shown a significant association with ECG abnormalities. In accordance with this finding, previous studies done in Switzerland (32), Italy (36), and Atlanta (34) showed a significant association between ECG abnormalities and treatment with antipsychotics. This could be due to the effect of antipsychotics on cardiac ion channels. In addition, antipsychotics are known to cause autonomic nervous system dysfunction through blockade of peripheral dopamine receptors, thus increasing sympathetic activity (4). Some antipsychotic medications, particularly second-generation antipsychotics, cause immunoglobin E-mediated hypersensitivity reaction, hyper-eosinophilic syndrome with direct cardiotoxic effects of eosinophils. This in turn leads to the development of drug-induced cardiomyopathy (77).

According to this study, taking polytherapy was a significant predictor of ECG abnormalities. This is consistent with two studies done in Italy (36,86) which revealed a significant association between ECG abnormalities and polytherapy. The possible explanation could be that many psychotropic drugs share the capacity to inhibit cardiac ion channels, particularly, HERG potassium channels, therefore those agents may have synergic effects when used in combination (87).

In the current study, psychiatric illness duration of more than 10 years was significantly associated with ECG abnormalities. This finding is in agreement with the study in Norway (88) which revealed a high cardiometabolic risk among psychiatric patients with long duration of illness. The possible explanation for this might be the long-term effects of biological changes caused by

psychiatric illness including inflammation, hyperglycemia, and dyslipidemia. In addition, the long duration of psychiatric illness is a proxy for the duration of exposure to psychotropic medications. The long-term exposure to antipsychotic drugs places a patient with a longer illness duration at a greater risk of cardiometabolic disorders (88,89).

Limitation of the study

Although the present study provides helpful information in the scarce data situation of Ethiopia, it has some flaws that should be addressed in future researches. One of the study's potential drawbacks was the cross-sectional nature of the study which is not suitable to establish a causal inference. Additionally, due to financial constraints, biochemical measures such as lipid profile and serum electrolytes were not performed.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

7.1 Conclusion

In the present study, six out of ten respondents had ECG abnormalities. Age older than 40 years, having diabetes mellitus, treatment with antipsychotics, having schizophrenia, polytherapy and longer duration of psychiatric illness (> 10 years) were significant predictors of ECG abnormalities.

7.2 Recommendation

Based on the finding of this study, the following recommendations are forwarded:

- **JMC** should plan a better way of treatment service by taking into consideration the high risk of cardiovascular diseases. An integrated care that involves a multi-professional approach, paying attention to the early detection of coexisting cardiac disease is recommended.
- **Mental Health Practitioners** should pay attention to assessing cardiovascular risk factors and monitoring the cardiac status of psychiatric patients. Clinicians should also consider the risk of ECG abnormalities while selecting psychotropic medications. Patients need to be assessed for their cardiovascular risk before antipsychotic therapy is initiated and should be routinely monitored thereafter. A pretreatment ECG should be performed for the elderly and for those with comorbid diseases. Early detection and effective management of comorbidities such as diabetes mellitus are recommended to mitigate the risk of cardiovascular disease. Clinicians should also take into account that adding a second psychotropic medication may increase the risk of ECG abnormalities when compared to monotherapy. Health education, focusing on the prevention of modifiable cardiovascular risk factors should be given as a part of the psychiatry follow-up treatment to improve the cardiovascular health of the patients.
- **For researchers-** further researches with better study designs and large-scale studies are recommended to delineate factors affecting ECG abnormalities and to formulate policies and programs for the prevention and control of cardiovascular diseases that may occur in psychiatric patients.

REFERENCES

1. Malachowski M. Understanding Mental Disorders: Your Guide to DSM-5 by the American Psychiatric Association. *Med Ref Serv Q*. 2016 Dec;**35(4):467–8.**

2. Whiteford HA, Degenhardt L, Rehm J, Baxter AJ, Ferrari AJ, Erskine HE, et al. Global burden of disease attributable to mental and substance use disorders: findings from the Global Burden of Disease Study 2010. *The Lancet*. 2013 Nov 9;**382(9904):1575–86.**

3. WHO. mhGAP intervention guide for mental, neurological and substance use disorders in non-specialized health settings: mental health Gap Action Programme (mhGAP). *World Health Organ*. 2016;**1–174.**

4. Nielsen RE, Banner J, Jensen SE. Cardiovascular disease in patients with severe mental illness. *Nat Rev Cardiol*. 2021 Feb;**18(2):136–45.**

5. Walker ER, McGee RE, Druss BG. Mortality in mental disorders and global disease burden implications: a systematic review and meta-analysis. *JAMA Psychiatry*. 2015 Apr;**72(4):334–41.**

6. Holt RIG. Cardiovascular Disease and Severe Mental Illness. *Ment Phys Disord.* 2015;**179:54–65.**

7. Whooley MA, Wong JM. Depression and cardiovascular disorders. *Annu Rev Clin Psychol*. 2013;**9:327–54.**

8. Brown ADH, Barton DA, Lambert GW. Cardiovascular abnormalities in patients with major depressive disorder: Autonomic mechanisms and implications for treatment. *CNS Drugs.* 2009;**23(7):583–602.**

9. Stogios N, Gdanski A, Gerretsen P, Chintoh AF, Graff-Guerrero A, Rajji TK, et al. Autonomic nervous system dysfunction in schizophrenia: impact on cognitive and metabolic health. *NPJ Schizophr*. 2021 Apr 26;**7:22.**

10. Woodhead C, Ashworth M, Broadbent M, Callard F, Hotopf M, Schofield P, et al. Cardiovascular disease treatment among patients with severe mental illness: a data linkage study between primary and secondary care. *Br J Gen Pract.* 2016 Jun 1;**66(647):e374–81.**

11. Correll CU, Solmi M, Veronese N, Bortolato B, Rosson S, Santonastaso P, et al. Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: a large-scale meta-analysis of 3,211,768 patients and 113,383,368 controls. World Psychiatry Off J *World Psychiatr Assoc WPA*. 2017 Jun;**16(2):163–80.**

12. Pillinger T, Osimo EF, de Marvao A, Berry MA, Whitehurst T, Statton B, et al. Cardiac structure and function in patients with schizophrenia taking antipsychotic drugs: an MRI study. *Transl Psychiatry*. 2019 Jun 7;**9(1):1–10.**

13. Harris PRE. The Normal Electrocardiogram: Resting 12-Lead and Electrocardiogram Monitoring in the Hospital. *Crit Care Nurs Clin North Am*. 2016 Sep;**28(3):281–96.**

14. Yakasai, Mukhtar IG, Salisu AI. Electrocardiographic recordings of psychiatric patients attending Dawanau Psychiatric hospital, Kano-Nigera. *Bayero J Pure Appl Sci*. 2018;**11(2):205–9.**

15. Ansermot N, Bochatay M, Schläpfer J, Gholam M, Gonthier A, Conus P, et al. Prevalence of ECG abnormalities and risk factors for QTc interval prolongation in hospitalized psychiatric patients. *Ther Adv Psychopharmacol.* 2019 Jan 1;**9:2045125319891386.**

16. Vigo D, Thornicroft G, Atun R. Estimating the true global burden of mental illness. *Lancet Psychiatry*. 2018;**3(2):171–8.**

17. Walker ER, McGee RE, Druss BG. Mortality in Mental Disorders and Global Disease Burden Implications. *JAMA Psychiatry*. 2015 Apr;**72(4):334–41.**

18. Charlson FJ, Diminic S, Lund C, Degenhardt L, Whiteford HA. Mental and Substance Use Disorders in Sub-Saharan Africa: Predictions of Epidemiological Changes and Mental Health Workforce Requirements for the Next 40 Years. *PLOS ONE.* 2014 Oct 13;**9(10):e110208.**

19. Misganaw A, Melaku YA, Tessema GA, Deribew A, Deribe K, Abera SF, et al. National disability-adjusted life years (DALYs) for 257 diseases and injuries in Ethiopia, 1990–2015. *Popul Health Metr*. 2017 Jul 21;**15(1):2–28.**

20. Shiferaw F, Letebo M, Misganaw A, Feleke Y, Gelibo T, Getachew T, et al. Non-communicable Diseases in Ethiopia: Disease burden, gaps in health care delivery and strategic directions. *Ethiop J Health Dev*. 2018;**32(3).**

21. Heiberg IH, Jacobsen BK, Balteskard L, Bramness JG, Naess Ø, Ystrom E, et al. Undiagnosed cardiovascular disease prior to cardiovascular death in individuals with severe mental illness. *Acta Psychiatr Scand*. 2019 Jun;**139(6):558–71.**

22. Soreca I, Kupfer DJ. Cardiovascular risk in bipolar disorder: beyond medication effects and lifestyle factors. *Braz J Psychiatry*. 2014 Mar;**36(1):100.**

23. Kozumplik O, Uzun S, Jakovljević M. Psychotic disorders and comorbidity: Somatic illness vs. side effect. *Psychiatr Danub*. 2009;**21(3):361–7.**

24. Mariano A, Di Lorenzo G, Jannini TB, Santini R, Bertinelli E, Siracusano A, et al. Medical Comorbidities in 181 Patients With Bipolar Disorder vs. Schizophrenia and Related

Psychotic Disorders: Findings From a Single-Center, Retrospective Study From an Acute Inpatients Psychiatric Unit. *Front Psychiatry*. 2021;**12:702789.**

25. Khawaja IS, Westermeyer JJ, Gajwani P, Feinstein RE. Depression and Coronary Artery Disease. *Psychiatry Edgmont.* 2009 Jan;**6(1):38–51.**

26. Bloom, D.E., Cafiero, E.T., Jané-Llopis, E., Abrahams-Gessel, S., Bloom LR, Fathima, S., Feigl, A.B., Gaziano, T., Mowafi, M., Pandya, A., Prettner K, Rosenberg, L., Seligman, B., Stein, A.Z., & Weinstein C. The global economic burden of Non-communicable Diseases. *World Cancer Rep* 2014. 2014;**(87):1–8.**

27. Mensah GA, Collins PY. Understanding Mental Health for the Prevention and Control of Cardiovascular Diseases. *Glob Heart.* 2015 Sep;**10(3):221–4.**

28. Polcwiartek C, Atwater BD, Kragholm K, Friedman DJ, Barcella CA, Attar R, et al. Association Between ECG Abnormalities and Fatal Cardiovascular Disease Among Patients With and Without Severe Mental Illness. *J Am Heart Assoc*. 2021 Jan 19;**10(2):e019416.**

29. Ali Z, Ismail M, Nazar Z, Khan F, Khan Q, Noor S. Prevalence of QTc interval prolongation and its associated risk factors among psychiatric patients: a prospective observational study. *BMC Psychiatry.* 2020 Dec;**20(1):1–7.**

30. Linzer M, Baker KC, Poplau S, Coffey E, Shroff G, Baum I, et al. Electrocardiographic abnormalities as potential contributors to premature mortality in patients with mental illness in a psychiatric day treatment program. *Prim Care Companion CNS Disord.* 2013;**15(3).12m01484.**

31. Moosa MYH, Jeenah FY, Mouton C. ECG changes in patients on chronic psychotropic medication. *South Afr J Psychiatry.* 2006 Sep **1;12(3):5.**

32. Girardin F, Gex-Fabry M, Berney P, Shah D, Gaspoz J-M, Dayer P. Drug-Induced Long QT in Adult Psychiatric Inpatients: The 5-Year Cross-Sectional ECG Screening Outcome in Psychiatry Study. *Am J Psychiatry.* 2013 Dec **1;170:1468–76.**

33. Beyraghi N, Rajabi F, Hajsheikholeslami F. Prevalence of QTc interval changes in acute psychiatric care: a cross-sectional study. *Int J Psychiatry Clin Pract.* 2013 Aug;**17(3):227–31.**

34. Shao W, Ayub S, Drutel R, Heise WC, Gerkin R. QTc Prolongation Associated With Psychiatric Medications: A Retrospective Cross-Sectional Study of Adult Inpatients. *J Clin Psychopharmacol*. 2019 Feb;**39(1):72–7.**

35. Sadanaga T, Sadanaga F, Yao H, Fujishima M. Abnormal QT prolongation and psychotropic drug therapy in psychiatric patients: significance of bradycardia-dependent QT prolongation. *J Electrocardiol*. 2004 Oct;**37(4):267–73.**

36. Nose M, Bighelli I, Castellazzi M, Martinotti G, Carrà G, Lucii C, et al. Prevalence and correlates of QTc prolongation in Italian psychiatric care: cross-sectional multicentre study. *Epidemiol Psychiatr Sci.* 2016 Dec;**25(6):532–40.**

37. Bent-ennakhil N, Périer MC, Sobocki P, Gothefors D, Johansson G, Milea D, et al. Incidence of cardiovascular diseases and type-2- diabetes mellitus in patients with psychiatric disorders. *Nord J Psychiatry.* 2018;**0(0):1–7.**

38. Bresee LC, Majumdar SR, Patten SB, Johnson JA. Diabetes, cardiovascular disease, and health care use in people with and without schizophrenia. *Eur Psychiatry.* 2011 Aug;**26(5):327–32.**

39. Poncet A, Gencer B, Blondon M, Gex-Fabry M, Combescure C, Shah D, et al. Electrocardiographic Screening for Prolonged QT Interval to Reduce Sudden Cardiac Death in Psychiatric Patients: A Cost-Effectiveness Analysis. *PloS One.* 2015;**10(6):10–5.**

40. Reilly JG, Ayis SA, Ferrier IN, Jones SJ, Thomas SHL. QTc-interval abnormalities and psychotropic drug therapy in psychiatric patients. *Lancet.* 2000;**355(9209):1048–52.**

41. Al-Motarreb A, Briancon S, Al-Jaber N, Al-Adhi B, Al-Jailani F, Salek MS, et al. Khat chewing is a risk factor for acute myocardial infarction: a case-control study. *Br J Clin Pharmacol*. 2005 May;**59(5):574–81.**

42. Almaz A, Andualem M, Amare D ST. Electrocardiogram Alteration and its Association with Khat Chewing : A study Anatomy & Physiology : Current Electrocardiogram Alteration and its Association with Khat Chewing : A study in Jimma Town , Ethiopia. 2020:**6–12.**

43. Raheja H, Namana V, Chopra K, Sinha A, Gupta SS, Kamholz S, et al. Electrocardiogram Changes with Acute Alcohol Intoxication: A Systematic Review. *Open Cardiovasc Med J.* 2018;**12:1.**

44. Rosenbaum S, Morell R, Abdel-Baki A, Ahmadpanah M, Anilkumar TV, Baie L, et al. Assessing physical activity in people with mental illness: 23-country reliability and validity of the simple physical activity questionnaire (SIMPAQ). *BMC Psychiatry*. 2020 Mar 6;**20(1):1–12.**

45. Jakobs KM, Posthuma A, de Grauw WJC, Schalk BWM, Akkermans RP, Lucassen P, et al. Cardiovascular risk screening of patients with serious mental illness or use of antipsychotics in family practice. *BMC Fam Pract*. 2020 Jul 29;**21(1):1–8.**

46. Kilicaslan EE, Karakilic M, Erol A. The Relationship between 10 Years Risk of Cardiovascular Disease and Schizophrenia Symptoms: Preliminary Results. *Psychiatry Investig.* 2019 Dec;**16(12):933–9.**

47. Xiang Y-T, Chiu HFK, Ungvari GS, Correll CU, Lai KYC, Wang C-Y, et al. QTc prolongation in schizophrenia patients in Asia: clinical correlates and trends between 2004 and 2008/2009. *Hum Psychopharmacol*. 2015 Mar;**30(2):94–9.**

48. Friedrich M-E, Winkler D, Konstantinidis A, Huf W, Engel R, Toto S, et al. Cardiovascular Adverse Reactions During Antipsychotic Treatment: Results of AMSP, A Drug Surveillance Program Between 1993 and 2013. *Int J Neuropsychopharmacol*. 2020 Feb 1;**23(2):67–75.**

49. Maleki J, Akhondzadeh S. Cardiovascular Effects of Antidepressants and Mood Stabilizers. *J Tehran Univ Heart Cent.* 2007;**2(3):133–6.**

50. Barbui C, Bighelli I, Carrà G, Castellazzi M, Lucii C, Martinotti G, et al. Antipsychotic Dose Mediates the Association between Polypharmacy and Corrected QT Interval. *PLoS ONE.* 2016 Feb 3;**11(2):e0148212.**

51. Roose SP, Glassman AH, Attia E, Woodring S, Giardina EG V., Bigger JT. Cardiovascular effects of fluoxetine in depressed patients. *Am J Psychiatry*. 2008;**155(5):660–5.**

52. Gaciong Z, Placha G. Efficacy and safety of sibutramine in 2225 subjects with cardiovascular risk factors. *J Hum Hypertens*. 2005;**19(9):737–43.**

53. Krivoy A, Balicer RD, Feldman B, Hoshen M, Zalsman G, Weizman A, et al. Adherence to antidepressant therapy and mortality rates in ischaemic heart disease: Cohort study. *Br J Psychiatry*. 2015;**206(4):297–301.**

54. Scherrer JF, Chrusciel T, Garfield LD, Freedland KE, Carney RM, Hauptman PJ, et al. Treatment-resistant and insufficiently treated depression and all-cause mortality following myocardial infarction. *Br J Psychiatry.* 2012;**200(2):137–42.**

55. Hirigo AT, Teshome T. The magnitude of undiagnosed diabetes and Hypertension among adult psychiatric patients receiving antipsychotic treatment. *Diabetol Metab Syndr.* 2020 Sep 7;**12(1):79.**

56. De Hert M, Dekker JM, Wood D, Kahl KG, Holt RIG, Moller H-J. Cardiovascular disease and diabetes in people with severe mental illness position statement from the European Psychiatric Association (EPA), supported by the European Association for the Study of Diabetes (EASD) and the European Society of Cardiology (ESC). *Eur Psychiatry J Assoc Eur Psychiatr.* 2009 Sep;**24(6):412–24.**

57. Correll CU, Detraux J, De Lepeleire J, De Hert M. Effects of antipsychotics, antidepressants and mood stabilizers on risk for physical diseases in people with schizophrenia, depression and bipolar disorder. *World Psychiatry.* 2015 Jun 1;**14(2):119–36.**

58. Bedane DA, Tadesse S, Bariso M, Reta W, Desu G. Assessment of electrocardiogram abnormality and associated factors among apparently healthy adult type 2 diabetic patients on follow - up at Jimma Medical Center , Southwest Ethiopia : Cross - sectional study. *BMC Cardiovasc Disord.* 2021;**1–8.**

59. Kamel A, Abuhegazy H, Ismaila A, Sherra K, Ramadan M, Mekky A, et al. The prevalence of obesity in a sample of Egyptian psychiatric patients. *Egypt J Psychiatry.* 2016;**37(3):157.**

60. Stroup TS, McEvoy JP, Swartz MS, Byerly MJ, Glick ID, Canive JM, et al. The National Institute of Mental Health Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) project: schizophrenia trial design and protocol development. *Schizophr Bull.* 2003;**29(1):15–31.**

61. Shrivastava A, Johnston ME. Weight-Gain in Psychiatric Treatment: Risks, Implications, and Strategies for Prevention and Management. *Mens Sana Monogr*. 2010;**8(1):53–68.**

62. Abosi O, Lopes S, Schmitz S, Fiedorowicz JG. Cardiometabolic effects of psychotropic medications. *Horm Mol Biol Clin Investig*. 2018 Jan 10;**36(1):1–15.**

63. Correll CU, Kane JM, Manu P. Obesity and coronary risk in patients treated with second-generation antipsychotics. *Eur Arch Psychiatry Clin Neurosci.* 2011 Sep;**261(6):417–23.**

64. Poncet A, Gencer B, Blondon M, Gex-Fabry M, Combescure C, Shah D, et al. Electrocardiographic Screening for Prolonged QT Interval to Reduce Sudden Cardiac Death in Psychiatric Patients: A Cost-Effectiveness Analysis. *PLOS ONE*. 2015 Jun 12;**10(6):e0127213.**

65. Blom MT, Bardai A, van Munster BC, Nieuwland M-I, de Jong H, van Hoeijen DA, et al. Differential changes in QTc duration during in-hospital haloperidol use. *PloS One.* 2011;**6(9):e23728.**

66. Scrolls. Jimma University Specialized Hospital. Ugfacts.net/et.

67. World Health Organization (2008). Global Physical Activity Questionnaire (GPAQ). Geneva. World Health Organization.

68. Bates JA, Whitehead R, Bolge SC, Kim E. Correlates of medication adherence among patients with bipolar disorder: results of the bipolar evaluation of satisfaction and tolerability (BEST) study: a nationwide cross-sectional survey. Prim Care Companion. *J Clin Psychiatry.* 2010;**12(5): 09m00883.**

69. Tesfay K, Girma E, Negash A, Tesfaye M, Dehning S. Medication Non-Adherence among Adult Psychiatric Out-patients in Jimma University Specialized Hospital, Southwest Ethiopia. *Ethiop J Health Sci.* 2013 Nov 11;**23(3):227–36.**

70. World Health Organization (2022). WHOCC - ATC/DDD Index.

71. World Health organization (2005). WHO STEPS Surveillance Manual: The WHO STEPwise approach to chronic disease risk factor surveillance. Geneva, World Health Organization.

72. World Health Organization (2011). Waist circumference and waist-hip ratio: report of a WHO expert consultation.Geneva. World Health Organization.

73. World Health Organization (2020). WHO technical specifications for automated non-invasive blood pressure measuring devices with cuff. Geneva.World Health Organization.

74. Prineas RJ, Crow RS, Zhang Z-M, editors. The Minnesota Code Manual of Electrocardiographic Findings. In London: *Springer*; 2010. p. **206–25.**

75. Salvi V, Karnad DR, Panicker GK, Kothari S. Update on the evaluation of a new drug for effects on cardiac repolarization in humans: issues in early drug development. *Br J Pharmacol.* 2010 Jan;**159(1):34–48.**

76. Rautaharju PM, Surawicz B, Gettes LS. AHA/ACCF/HRS Recommendations for the Standardization and Interpretation of the Electrocardiogram. *Circulation*. 2009;**119(10):e241–50.**

77. Kovacs D, Arora R. Cardiovascular effects of psychotropic drugs. *Am J Ther.* 2008 Oct;**15(5):474–83.**

78. Polcwiartek C, Kragholm K, Schjerning O, Graff C, Nielsen J. Cardiovascular safety of antipsychotics: a clinical overview. *Expert Opin Drug Saf*. 2016 May;**15(5):679–88.**

79. Khatib R, Sabir FRN, Omari C, Pepper C, Tayebjee MH. Managing drug-induced QT prolongation in clinical practice. *Postgrad Med J*. 2021 Jul;**97(1149):452–8.**

80. Acciavatti T, Martinotti G, Corbo M, Cinosi E, Lupi M, Ricci F, et al. Psychotropic drugs and ventricular repolarisation: The effects on QT interval, T-peak to T-end interval and QT dispersion. *J Psychopharmacol Oxf Engl*. 2017 Apr;**31(4):453–60.**

81. Andersen S, Andersen A, Man FS de, Nielsen-Kudsk JE. Sympathetic nervous system activation and β-adrenoceptor blockade in right heart failure. *Eur J Heart Fail.* 2015 Apr 1;**17(4):358–66.**

82. Hong E. Hypokalemia and Psychosis: A Forgotten Association. *Am J Psychiatry Resid J*. 2016;**11(11):6–7.**

83. Brien P, Oyebode F. Psychotropic medication and the heart. *Adv Psychiatr Treat.* 2003 Nov;**9(6):414–23.**

84. Fajemiroye JO, Cunha LC da, Saavedra-Rodríguez R, Rodrigues KL, Naves LM, Mourão AA, et al. Aging-Induced Biological Changes and Cardiovascular Diseases. *BioMed Res Int.* 2018 Jun 10;2018:**e7156435.**

85. De Rosa S, Arcidiacono B, Chiefari E, Brunetti A, Indolfi C, Foti DP. Type 2 Diabetes Mellitus and Cardiovascular Disease: Genetic and Epigenetic Links. *Front Endocrinol.* 2018;**9:2.**

86. Sala M, Vicentini A, Brambilla P, Montomoli C, Jogia JR, Caverzasi E, et al. QT interval prolongation related to psychoactive drug treatment: a comparison of monotherapy versus polytherapy. *Ann Gen Psychiatry*. 2005 Dec;**4(1):1–6.**

87. Tiihonen J, Taipale H, Mehtälä J, Vattulainen P, Correll CU, Tanskanen A. Association of Antipsychotic Polypharmacy vs Monotherapy With Psychiatric Rehospitalization Among Adults With Schizophrenia. *JAMA Psychiatry*. 2019 May 1;**76(5):499–507.**

88. Ringen PA, Faerden A, Antonsen B, Falk RS, Mamen A, Rognli EB, et al. Cardiometabolic risk factors, physical activity and psychiatric status in patients in long-term psychiatric inpatient departments. *Nord J Psychiatry*. 2018 May;**72(4):296–302.**

89. Mitchell AJ, Vancampfort D, Sweers K, van Winkel R, Yu W, De Hert M. Prevalence of Metabolic Syndrome and Metabolic Abnormalities in Schizophrenia and Related Disorders—A Systematic Review and Meta-Analysis. *Schizophr Bull.* 2013 Mar;**39(2):306–18.**

ANNEXES

JIMMA UNIVERSITY

INSTITUTE OF HEALTH

DEPARTMENT OF BIOMEDICAL SCIENCES (MEDICAL PHYSIOLOGY)

ANNEX I: Information sheet and consent form (English version)

Information sheet

Greetings!

My name is_____. I am a data collector for the study to be conducted on electrocardiogram abnormalities and associated factors among psychiatric patients attending Jimma Medical Center Psychiatry Clinic.

Dear respondent, you are kindly requested to participate in this study. Here is some important information that helps you to decide whether to participate in this study or not.

Purpose of the study: This study aims to assess electrocardiogram abnormalities and associated factors among psychiatric patients attending follow-up at Jimma Medical Center Psychiatry Clinic.

Procedures to be carried out: If you are willing to participate, you will be asked some questions. Weight, height, blood pressure, and blood glucose measurement will be taken. You will also undergo an electrocardiogram examination.

Benefit: There is no payment or any incentives provided for your participation in this study. But, this study will help you to know your electrocardiogram status and if any ECG abnormality is identified during the examination, you will be referred for further investigation and necessary intervention.

Risk: It may cause minimal discomfort but will not cause any physiological or financial harm.

Confidentialities: Any information you give will be kept confidential and won't be accessible to anyone except by the investigator and the information you are going to give is used only for the research purpose.

Voluntary Participation: Your participation is voluntary and you are not obliged to answer any questions you do not wish to answer. You also have the right not to participate in the study and to stop at any time you want and this will not affect the regular service you get from the Hospital.

Whom to contact: If you have any questions about this study, you may contact the principal investigator: Betemariam Girma: **Phone number**: 0914970162, **Email**: girmabetty10@gmail.com

Consent form

I confirm that I understood the information about this study. I understood that the objective of this study is to assess electrocardiogram abnormalities and associated factors among psychiatric patients attending Jimma Medical Center. I also understood that my participation is completely voluntary and I have the right to withdraw at any time and this will not affect the regular service I get from the Hospital. I also understood that I will undergo blood sugar and electrocardiographic examination. I agree to take part in this study and I hereby approve my agreement with my signature.

Signature of the participant _____ Date_____

Name of the data collector: _____ Signature: _____ date_____

Thank you for your participation and cooperation!!

ANNEX II: Questionnaire (English version)

Questionnaire for assessing electrocardiogram abnormalities and associated factors among psychiatric patients attending follow-up at Jimma Medical Center Psychiatry Clinic.

Part I: Sociodemographic and economic characteristics		**Participant's MRN_____**
S/N	**Variables**	**Response**
101	Age	_____ years
102	Sex	1.Male 2. Female
103	Educational status	1.No formal education 2. Primary education (1-8 grade) 3. Secondary education (9-12 grade) 4. Tertiary education (diploma and above)
104	Marital status	1. Single 1. Married 2. Divorced 3. Widowed
105	Occupation	1.Government employee 2. Non government employee 3. Farmer 4. Merchant 5. House wife 6. Daily laborer 7. Others (specify)_____
106	Average monthly income	_____Ethiopian birr
107	Place of Residence	1. Urban 2. Rural

Part II: Behavioural factors related questions			
Tobacco use			
S. N	**Question**	**Response**	**Remark**
201	In the past, did you ever smoke tobacco products such as cigarette or pipe?	1.Yes 2.No	If no, skip to Q.205
202	On average, how many cigarettes did you used to smoke each day?	_____cigarettes	
203	Did you smoke tobacco products in the past 30 days?	1.Yes 2.No	
204	If yes, how frequently do you smoke?	1.Daily 2. 5-6 days per week 3.1-4 days per week 4.1-3 days per month 5.Less than once a month	
Alcohol consumption			

205	Have you ever consumed an alcoholic drink such as beer, wine, whisky, tej or areke?	1.Yes 2.No	If no, skip to Q. 209
206	If yes to, for how long have you been drinking alcohol? (years.)	_____	
207	Have you consumed an alcoholic drink within the past 30 days?	1.Yes 2.No	
208	If yes, how frequently have you had drink alcohol?	1.Daily 2. 5-6 days/week 3.1-4 days/week 4.1-3 days/month 5. Less than once a month	
Khat chewing			
209	Have you ever chewed khat in your life time?	1.Yes 2.No	If no, skip to Q. 213
210	If yes, for how long have you chewed khat?	_____years	
211	Have you chewed khat within the last 30 days?	1.Yes 2.No	
212	If yes, how often you chew khat?	1.Daily 2. 5-6 days/week 3.1-4 days/week 4.1-3 days/month 5. Less than once a month	
Physical activity			
213	Do you do vigorous-intensity activity that causes large increases in breathing or heart rate like (e.g., carrying or lifting heavy loads, digging or construction work, recreational activities, running or playing football) for at least 10 minutes continuously?	1.Yes 2.No	If no, skip to Q. 216
214	If yes, in a typical week, on how many days do you do these activities?	_____days	
215	How much time do you spend doing vigorous-intensity activities at work on a typical day?	____hrs.: ____min.	
216	Do you do moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads], cycling or swimming for at least 10 minutes continuously?	1.Yes 2.No	If no, skip to the next section
217	In a typical week, on how many days do you do moderate intensity activities?	_____days	
218	How much time do you spend doing moderate-intensity activities at work on a typical day?	____hrs.: ____min.	

Part III: Assessment of drug-adherence rate		
S.N	**Question**	**Response**
301	Did you ever forget to take your medicine?	1.Yes 2.No
302	Did you ever have problems remembering to take your medication?	1.Yes 2.No
303	When you feel better, do you sometimes stop taking your medicine?	1.Yes 2.No
304	Sometimes if you feel worse when you take your medicine, do you stop taking it?	1.Yes 2.No

Part IV: Diabetes symptom check list		
S.N	**Question**	**Response**
401	Do you frequently feel thirsty?	1.Yes 2.No
402	Do you have frequent urge to urinate?	1.Yes 2.No
403	Do you have an increased appetite?	1.Yes 2.No

Part V: Disease and Medication-related data		
501	Type of psychiatric disorder	_____
502	Duration of illness	_____
503	Number of psychotropic medication prescribed	1.Single medication 2. Two medications 3. Three or more medications _____
504	Type of psychotropic drug the client is taking	1.Antipsychotic (specify)_____ 2.Antidepressant (specify)_____ 3.Mood stabilizer (specify)_____ 4.Others_____
505	Dosage of the drug (in mg/day)	1st drug _____ 2nd drug _____ 3rd drug _____
506	Duration of treatment	_____
507	Is there any comorbid condition?	1.Yes 2.No
508	If yes, what type of comorbidity(ies)?	1._____ 2._____ 3._____

Part VI: Physical measurements	
Anthropometric measurement	
Weight (in kg)	_____
Height (in cm)	_____

West circumference (in cm)	**_____**		
Hip circumference (in cm)	**_____**		
Blood pressure measurement			
	Reading I	**Reading II**	**Reading III**
Systolic blood pressure (mmHg)			
Diastolic blood pressure (mmHg)			
Random blood sugar measurement	**_____ mg/dl**		

ANNEX III: Information sheet and consent form (Afan Oromo Version)

Akkam jirtu!

Maqaan koo_____jedhama. Ani qorannoo saayinsawaa rakkoo elektrookardiyograami fi sababoota isaa yaalamtoota dhukkuba sammuu giddu-gala Medikaala Jimmaatti hordoffi qaban irratti taassifamuf odeeffanno sassaaban jira.

Isinis, qorannoo kana irratti akka hirmaattan kabajaan isin gaafanna. Odeeffannoon armaan gadi qorannoo kana irratti hirmaachuf yookaan dhisuu murtessuf isin gargaara.

Kaayyoo qorannoo kanaa; rakkoo elektrookaardiyoograamii fi sababoota isaa yaalamtoota dhukkuba sammuu giddu-gala Medikaala Jimmaatti hordoffi qaban irratti mula'atu adda baasu

Adeemsa qorannicha; Qorannoo kana irratti hirmaachuf yoo waligaltan, gaaffii tokko tokko isin gaafanna. Dheerina fi ulfaatina qaama kessan ni madaalla. Akkasumas, qoranno dhibee sukkaara fi qoranno elektrokaardiyogrami isini taassisna.

Faayidaa qorannoo kanaa; qoranno kana keessatti hirmaachu kessanif badhaasni addaa isini kennamu hin jiraatu. Qorannoon kun haala onnee kessani baruf isin fayyada akkasumas rakkoon onnee keessan irratti mul'atu yoo jiraate, yaala barbaachisoo yeroodhaan argachuf isin danddeessisa

Iccitii eegu; odeeffannon isin kennitan kamiyyuu iccitidhaan ni qabama. Nama qoranno kana gaggeessun alattis dabarfame hin kennamu. Odeeffannon isin kennitan sababa qorannoo kanaaf qofa kan oolu ta'a

Hirmaanaa fedhiini; qorannoo kana iratti hirmaachu dhisu akkasumas giddu irratti adda kutuu ni dandeessu. Gaaffi deebisu hin barbaannes irra darbu ni dandeessu kunis tajaajila isin hospitaala kana irraa argachaa jirtanu irratti dhibbaa hin qabu

Qorannoo kana ilaalchisee gaaffi yoo qabaattan gaggeessitu qorannoo kanaa kan taate Betamaariyam Girmaa lakk bilbilaa; 0914970162, e mail; girmabetty10@gmail.com irratti argachu ni dandessu.

Consent form (Afaan Oromo version)

Unka fedhii

Qorannoo kana ilaalchisee odeeffanno naaf kenname hubachu koo nan mirkaneessa. Kaaayyon qorannoo kanaa rakkoo elektrookaardiyograami fi rakkoole walqabatan yaalamtoota dhibee sammuu irra mudachuu danda'u adda baasu akka ta'e hubadheera. Hirmaannaan koo fedhii irratti kan hundaa'e ta'u isaa fi yeroo barbaadametti adda kutun akka danda'amu kunis yaala tajaajila hospitaala irraa argachan jiru irratti midhaa kan hin qabne ta'u hubadheera. Akkasumas Odeeffanon ani kennu qorannoo kanaaf qofa kan oolu fi kaayyo biraatif kan hin olle ta'u isaa hubadheera. Qoranno kana irratti hirmaachuf waligaleera. waligaltee koos mallotoo koo kanaan nin mirkaneessa.

Mallattoo_____ Guyyaa_____

Maqaa-sassaabaa-ragaa_____ Mallattoo_____ Guyyaa_____

ANNEX IV: Questionnaire (Afan oromo version)

Kutaa 1ffaa: Gaaffilee Haala Hawaasummaa			
Lakk.	**Gaaffii**	**Deebii**	
101	Umrii	Waggaa_____	
102	Saala	1.Dhiira 2.Dubara	
103	Sadarkaan Barumassa	1.Sadarkaa barumsa idilee kan hin qabne 2. Barumsa sadarkaa 1ffaa (1-8) 3. Barumsa sadarkaa 2ffaa (9-12) 4. Barumsa olaanaa (dipilomaa fi isa ol)	
104	Akkaataa fuudhaaf heeruma	1. Kan hin fune/herumne 2. Kan fudhe/herumte 3. Kan walhiike/hiikte 4. Abbaa manaa/ haati manaa kan irraadu‘e (duute)	
105	Hojii/dalagaa	1. Hojjataa motummaa 2. Hojjataa dhunfaa 3. Qonnaan bulaa 4.Haadha warraa 5. Daldaalaa 6. Dafqaan bulaa 7. Kanbiroo (caqasii)_____	
106	Bakka jireenya	1.Baadiyya 2. Magaala	
107	Galii maatii ji’aan	Qarshii _____	

Kutaa 2ffaa: Safartuu amala dhunfaa			
	Shaakala tamboo xuuxuu		
201	Seenaa tamboo xuuxuu qabduu?	1.Eeyyee 2. Lakkii	
202	Eeyyee yoo ta’e giddugalessaan guyyaatti sigaaraa meeqa xuxaa turtani?	Sigaaraa _____	
203	Guyyoota 30 darban keessa tamboo xuxxani beektu?	1.Eeyyee 2. Lakkii	
204	Eeyyee yoo ta’e si’a meeqa tamboo xuxxan?	1.Guyyaa guyyatti 2. Torbanitti guyaa 5-6 3. Torbetti guyyaa 1-4 4. Ji’aan guyyaa 1-3 5. Ji’an guyyaa 1 gaditti	
Shaakala alkoolii dhuguu			
205	Seenaa alkoolii kan akka biraa, wayinii, wuskii, daadhii fi areqee dhuguu qabduu?	1.Eeyyee 2. Lakkii	
206	Eeyyee yoo ta’e, waggoota meeqaaf alkoolii dhugdani	Waggoota_____	
207	Guyyoota 30 darban keessa dhugaatii alkooli dhugdannittu?	1.Eeyyee 2. Lakkii	
208	Eeyyee yoo ta’e, si’a meeqa dhugaati alkoolii qabu dhugdan?	1.Guyyaa guyyaatti 2.Torbeetti guyyaa 5-6 3. Torbeetti guyyaa 1-4 4. Ji’aan guyyaa 1-3 5. Ji’an guyyaa 1 gaditti	
Fayyadama caatii			
208	Caatii qamaatani beektu?	1.Eeyyee 2. Lakkii	
209	Eeyyee yoo ta’e waggoota hangamif qamaatan?	waggaa_____	
210	Guyyoota 30n darban keessa caatii qamaatanittu?	1.Eeyyee 2. Lakkii	

211	Eeyyee yoo ta'e si'a meeqa qamaatu?	1.Guyyaa guyyaatti 2.Torbeetti guyyaa 5-6 3. Torbeetti guyyaa 1-4 4. Ji'aan guyyaa 1-3 5. Ji'an guyyaa 1 gaditti	
Sosochii qaamaa			
212	Sochii qaamaa kan hargansuu fi rukuttaa onnee baayye dabalu kan akka ba'aa ulfaataaa baachu, boolla qotuu, kubbaa mila taphachu fi hojiilee ijaarsaa, walitti fufiinsaan daqiiqaa 10f hojjetamu ni gootu?	1.Eeyyee 2. Lakkii	
213	Eeyyee yoo ta'e torbetti guyyaa meqaaf sochii qaamaa ulfaataa gootu?	Guyyoota_____	
214	Guyyaatti sa'aati meeqa sochilee kana irratti dabarsitu?	Sa'ati_____; daqiqaa_____	
215	Sochii qaamaa kan hargansu fi rukkuttaa onne muraasa dabalu kan akka adeemsa daddaffi ykn ba'aa salphaa baachu, saayikilii ofuu fi bishaan daaku walitti fufiinsaan daqiiqaa 10f ni gootu?	1.Eeyyee 2. Lakkii	
216	Eeyyee yoo ta'e torbetti guyyaa meqaaf sochiilee qaamaa kana gootu?	Guyyoota_____	
217	Guyyaatti sa'aati meeqa sochilee kana irratti dabarsitu?	Sa'ati_____; daqiqaa_____	

Kutaa 3ffaa: Haala hordoffii qorichaa		
301	Qoricha fudhachu irraanfattani beektu?	1.Eeyyee 2. Lakkii
302	Qoricha keessan fudhachu yaadachu irratti rakkinni isin mudatee beeka?	1.Eeyyee 2. Lakkii
303	Yeroo isinitti foyya'u qoricha fudhachu kessan ni dhistu?	1.Eeyyee 2. Lakkii
304	Yeroo qoricha liqimsitanu yoo dhukkubbin isinitti dhagahame qoricha kessan ni dhaabdu?	1.Eeyyee 2. Lakkii

Kutaa 4ffaa: gaaffilee mallattoo dukkuba sukkaaran wal qabatan		
401	Bishaan amma amma isin dheebossa?	1.Eeyyee 2. Lakkii
402	Fedhiin nyaata kessani dabaleera?	1.Eeyyee 2. Lakkii
403	Boolii bishaanii isin sarda?	1.Eeyyee 2. Lakkii

ANNEX V: Information sheet and consent (Amharic version)

የታካሚ መረጃ ወረቀት

ጤና ይስጥልኝ

ስሜ _____ ይባላል። በጅማ የሕክምና ማዕከል የአዕምሮ ህክምና ክሊኒክ በሚከታተሉ የአእምሮ ሕሙማን መካከል በኤሌክትሮክካዮግራም መዛባት እና ተጓዳኝ ሁኔታዎች ላይ ለሚካሄድ ጥናት መረጃ ሰብሳቢ ነኝ።

እርሶም፣ በዚህ ጥናት ውስጥ እንዲሳተፉ በትህትና ይጠየቃሉ። ለመሳተፍ ወይም ላለመሳተፍ ለመወሰን የሚረዳዎ አንዳንድ አስፈላጊ መረጃዎች እዚህ አሉ።

የጥናቱ ዓላማ- በጅማ የሕክምና ማዕከል የአዕምሮ ህክምና ክሊኒክ በሚከታተሉ የአእምሮ ሕሙማን መካከል የኤሌክትሮክካዮግራም አለመመጣጠን እና ተጓዳኝ ሁኔታዎችን ለመገምገም።

የሚከናወኑ ሂደቶች - በዚህ ጥናት ውስጥ ለመሳተፍ ፈቃደኛ ከሆኑ ከ**ማህበራዊ መረጃ** እና ከአኗኗር ዘይቤ ጋር የተያያዙ ጉዳዮችን በተመለከተ ቃለ መጠይቅ እናርደግሎታለን። ክብደት ፣ ቁመት ፣ የደም ግፊት እና የደም ግሉኮስ ልኬት ከደንበኛው ይከናወናል። የኤሌክትሮክካዮግራፍ ምርመራም ይደረግልዎታል።

የጥናቱ ጥቅም- በዚህ ጥናት ውስጥ ለመሳተፍዎ የተለየ ጥቅም ሆነ ማበረታቻ አይሰጥም። ነገር ግን ጥናቱ የኤሌክትሮክካሮግራም ሁኔታዎን ለማወቅ ይጠቅማል እናም በምርመራው ወቅት ማንኛውም የኢ.ሲ.ጂ ያልተለመደ ሁኔታ ከታየ ለአስፈላጊ ምርመራ እና ሕክምና ይላካሉ።

የጎንዮሽ ጉዳት- ምርመራ ወቅት ጊዜ አነስተኛ ምቾት አለመሰማት በስተቀር ምንም አይነት አካላዊ ወይም ኢኮኖሚያዊ ጉዳት አይኖረዉም።

በፍቃደኝነት ላይ የተመሰረተ ተሳትፎ - በዚህ ጥናት ውስጥ የእርስዎ ተሳትፎ ሙሉ በሙሉ በፈቃኝነትዎ ላይ የተመሰረተ ነዉ። ቃለመጠይቁን በማንኛውም ጊዜ የማቆም መብት ወይም መመለስ የማይፈልጉትን ያለመመለስ መብት አለዎት። ይህም ከሆስፒታሉ የሚያገኙትን አገልግሎት ላይ ተጽእኖ አይኖረዉም።

ምስጢራዊነት - የእርስዎ ማንኛዉም መረጃ ምስጢራዊነቱ የተጠበቀ ይሆናል እና ከአጥኚው በስተቀር ለማንም ተደራሽ አይሆንም። እርስዎ የሚሰጡት መረጃ ለምርምር አላማዎች ብቻ ጥቅም ላይ ይዉላል።

በዚህ ጥናት ላይ ማንኛውም ጥያቄ ካለዎት ዋናውን መርማሪ ቤተ ማርያም ግርማ በስልክ ቁጥር 0914970162 ፣ በኢሜል girmabetty10@gmail.com ማግኘት ይችላሉ።

Consent (Amharic version)

የፈቃድ ቅጽ

ስለ ጥናቱ የተሰጠኝ መረጃ እንደተረዳሁ አረጋግጣለሁ። የዚህ ጥናት ዓላማ የኤሌክትሮካርዲዮግራም መዛባቶችን እና ተዛማጅ ምክንያቶችን በጅማ ሜዲካል ማዕከል በሚከታተሉ የአእምሮ ሕመማን መገምገም እንደሆነ ገብቶኛል። እንዲሁም ተሳትፎየ ሙሉ በሙሉ በፈቃደኝነት ላይ የተመሠረተ መሆኑን እና በማንኛውም ሰአት ጥናቱን የማቋርት መብት እንዳለኝ እና ይህም ከሆስፒታሉ የማገኘዉ መደበኛ አገልግሎት ላይ ተጽዕኖ እንደማይኖረው ተረድቻለዉ። የምሰጠው መረጃ ለዚህ ጥናት ብቻ ያሚያገለግል መሆኑን እናም ለሌላ ዓላማ እንደማይዉል ተረድቻለዉ። በዚህ ጥናት ውስጥ ለመሳተፍ እስማማለሁ እናም በዚህ ስምምነቴን በፊርማዬ አረጋግጣለሁ።

ፊርማ _____ ቀን _____

የመረጃ ሰብሳቢው ስም _____ ፊርማ _____ ቀን_____

ANNEX VI: Questionnaire (Amharic version)

ክፍል I: የማህበራዊ- ኢኮኖሚያዊ ና ስነ-ህዝብ መረጃ

ተራ ቁጥር	ጥያቄ	መልስ	ማስታወሻ
101	እድሜ	_____	
102	ጾታ	1.ወንድ 2. ሴት	
103	ሃይማኖት	1. ኦርቶዶክስ 2. ሙስሊም 3. ፕሮቴስታንት 4. ካቶሊክ 5. ሌሎች (ይግለጹ) _____	
104	ብሄር	1.ኦሮሞ 2. አማራ 3. ትግሬ 4. ከፋ 5. ሌሎች (ይግለጹ) _____	
105	የትምህርት ደረጃ	1. መደበኛ ትምህርት ያልተማሩ 2. የመጀመሪያ ደረጃ ትምህርት (1-8 ክፍል) 3. የሁለተኛ ደረጃ ትምህርት (9-12 ክፍል) 4. የከፍተኛ ትምህርት (ዲፕሎማ እና ከዚያ በላይ)	
106	የጋብቻ ሁኔታ	1. ያላገባ/ች 2. ያገባ/ች 3. የፈታ/ች 4. መበለት	
107	ሥራ	1. የመንግስት ሰራተኛ 2. የግል / መንግስታዊ ያልሆነ ድርጅት ሰራተኛ 3. ገበሬ 4. የቤት እመቤት 5. የቀን ስራተኛ 6. ሌላ (ይግለጹ)_____	
108	አማካይ ወርሃዊ ገቢ	_____ብር	
109	መኖሪያ	1. ገጠር 2. የከተማ	

ክፍል II: የአኗኗር ዘይቤ

የአልኮል አጠቃቀም ልምድን በተመለከተ			
201	በሕይወት ዘመንዎ አልኮሆል ያለበት መጠጥ እንደ ቢራ ፣ ወይን ፣ ውስኪ ፣ ጠጅ ወይም አሬኬ ጠጥተው ያውቃሉ?	1. አዎ 2. አይደለም	
202	ለ ጥያቄ ቁጥር 201 መልሶ አዎ ከሆነ፣ የአልኮል መጠጥ ለምን ያክል ጊዜ ጠጥተዋል?	_____	
203	ባለፉት 30 ቀናት ውስጥ የአልኮል መጠጥ ጠጥተዋል?	ነ. አዎ 2. አይደለም	
204	መልሶ አዎ ከሆነ፣ ምን አይነት አልኮሆል ጠጥተዋል?	ነ. ቢራ 2. ወይን 3. ጠላ 4. ጠጅ 5. ሌላ ካለ ይጠቀሰ_____	
205	ለ ጥያቄ ቁጥር 203 መልሶ አዎ ከሆነ፣ ስንት ጊዜ የአልኮሆል መጠጥ ጠጥተዋል?	ነ.በየቀኑ 2. በሳምንት 5-6 ቀናት 3. በሳምንት ነ-4 ቀናት 4. በወር ነ-3 ቀናት 5. በወር ከ ነ ጊዘ በታች	
የትንባሆ አጠቃቀምን በተመለከተ			
206	በሕይወት ዘመንዎ እንደ ሲጋራ ያሉ የትንባሆ ምርቶችን አጭሰው ያቃሉ?	1. አዎ 2. አይደለም	
207	ለ ጥያቄ ቁጥር 206 መልሶ አዎ ከሆነ ለምን ያህል ጊዜ አጨስክ/ሽ?	_____	
208	ባለፉት 30 ቀናት ውስጥ የትንባሆ ምርቶችን አጭሰው ያቃሉ?	1. አዎ 2. አይደለም	

209	አዎ ከሆነ ፣ ስንት ጊዜ ያጨሱ ነበር	ነበየቀኑ 2. በሳምንት 5-6 ቀናት 3. በሳምንት ነ-4 ቀናት 4. በወር ነ-3 ቀናት 5. በወር ከ ነ ጊዘ በታች	
የጫት አጠቃቀም በተመለከተ			
210	በሕይወት ዘመንዎ ጫት ቅመው ያውቃሉ?	1. አዎ 2. አይደለም	
211	ለ ጥያቄ ቁጥር 210 መልሶ አዎ ለምን ያህል ጊዜ ጫት ቅመዋል?	_____	
212	ባለፉት 30 ቀናት ውስጥ ጫት ቅመዋል?	1. አዎ 2. አይደለም	
213	አዎ ከሆነ ስንት ጊዜ ጊዜ ጫት ቅመዋል?	ነበየቀኑ 2. በሳምንት 5-6 ቀናት 3. በሳምንት ነ-4 ቀናት 4. በወር ነ-3 ቀናት 5. በወር ከ ነ ጊዘ በታች	
አካላዊ እንቅስቃሴ በተመለከተ			
214	ትንፋሽ ወይም የልብ ምትን በታም የሚጨምር ሥራ እንደ [ከባድ ሸክሞችን መሸከም ወይም ማንሳት ፣ መቆፈር ወይም የግንባታ ሥራ] ፣ማንኛውንም ጠንካራ- ስፖርቶች ፣ የአካል ብቃት ወይም የመዝናኛ እንቅስቃሴዎችን [ሩጫ ወይም እግር ኳስ] ያለማቋረጥ ቢያንስ ለ 10 ደቂቃዎች ያደርጋሉ?	1. አዎ 2. አይደለም	
215	መልስዎ አዎ ከሆነ በሳምንት ውስጥ ምን ያህል ቀናት ጠንካራ-አካላዊ እንቅስቃሴዎችን ያደርጋሉ?	_____ ቀናት	
216	ለጥያቄ ቁጥር 217 መልስዎ አዎ ከሆነ በተለመደው ቀን በሥራ ላይ ጠንካራ-አካላዊ እንቅስቃሴዎችን ለመሥራት ምን ያህል ጊዜ ያሳልፋሉ?	_____ ሰዓታት :- _____ ደቂቃ	
217	ትንፋሽ ወይም የልብ ምትን የሚጨምሩ መጠነኛ እንቅስቃሴዎች እንደ ፈጣን የእግር ጉዞ ፣ ቀላል ሸክሞችን መሸከም፣ ብስክሌት መንዳት ፣ መዋኘት ፣ መረብ ኳስ) ለማቋረጥ ቢያንስ ለ 10 ደቂቃዎች ያደርጋሉ?	1. አዎ 2. አይደለም	
218	መልስዎ አዎ ከሆነ በሳምንት ውስጥ ምን ያህል ቀናት መጠነኛ-አካላዊ እንቅስቃሴዎችን ያደርጋሉ?	_____ ቀናት	
219	በተለመደው ቀን መጠነኛ-አካላዊ እንቅስቃሴዎችን ለማድረግ ምን ያህል ጊዜ ያጠፋሉ?	_____ ሰዓታት :- __ ደቂቃ።	

ክፍል III: የመድኃኒት - የክትትል መጠን ግምገማ			
301	መድሃኒትዎን መውሰድዎን ረስተው ያውቃሉ?	1. አዎ 2. አይደለም	
302	መድሃኒትዎን ለመውሰድ የማስታወስ ችግሮች አጋጥመውዎት ያውቃሉ?	1. አዎ 2. አይደለም	
303	ጥሩ ስሜት ሲሰማዎት አንዳንድ ጊዜ መድሃኒት መውሰድዎን ያቆማሉ?	1. አዎ 2. አይደለም	
304	አንዳንድ ጊዜ መድሃኒትዎን ሲወስዱ የከፋ ስሜት ከተሰማዎት መውሰድዎን ያቆማሉ?	1. አዎ 2. አይደለም	
ክፍል IV: የሰኳር ህመም ምልክቶች			
401	የውሃ ጥም በጣም ይሰማዎታል?	1. አዎ 2. አይደለም	
403	በተደጋጋሚ ሽንት ዩሸናሉ?	1. አዎ 2. አይደለም	
404	የምግብ ፍላጎትዎ ጨምሯል?	1. አዎ 2. አይደለም	

ANNEX VII: ECG assessment tool

ECG assessment tool	
1.Does the ECG show any arrythmia?	1.Yes 2.No
2. If yes, what is the origin of arrhythmia?	1.Sinus origin 2.Supra ventricular 3.Ventricular origin 4.Other origin arrythmia
3.If sinus origin, which type?	1.Sinus tachycardia 2.Sinus bradycardia 3. Sinoatrial arrest 4. Sinoatrial block 5. Sinus arrythmia
4. If supra ventricular, which type?	1.Atrial premature beat 2.Junctional premature beat 3. Paroxysmal supraventricular tachycardia 4. Atrial fibrillation 5. Atrial flutter 6. Multifocal atrial tachycardial 7. Paroxysmal atrial tachycardia
5. If ventricular, which type?	1.Premature ventricular contraction 2.Ventricular tachycardia 3.Ventricular fibrillation 4. Accelerated idioventricular rhythm 5.Torsade de pointes 6. Other type of ventricular arrythmias (specify)_____
6. Does the ECG show conduction block?	1.Yes 2.No
7. If yes, which type of conduction block	1.Atrioventricular 2. Ventricular
8. If atrio ventricular, which type?	1. First degree AV block 2. Second degree AV block 3. Third degree AV block 4. Ventricular preexcitation pattern (WPW) 5. Mobitz Type II 6. Wenckebach's phenomena 7. Intermittent aberrant atrioventricular conduction
9. If ventricular, whih type?	1.Complete left bundle branch block (LBBB) 2. Intermittent LBBB 3. Incomplete LBBB 4. Complete right bundle branch block (RBBB) 5. Intermittent RBBB 6. Incomplete RBBB 7. Left anterior fascicular block 8. Left posterior fascicular block 9. Intraventricular block 10. Type I brugada pattern 11. Type II brugada pattern

	12. Type III brugada pattern 13. Other types of block _____
10. Does ECG show any chamber enlargement or hypertrophy?	1.Yes 2.No
11. If yes, which type?	1.Left ventricular hypertrophy 2.Right ventricular hypertrophy 3.Left atrial hypertrophy 4.Right atrial hypertrophy
12. Does ECG show any ST segment changes?	1.Yes 2.No
13. If yes, which type?	1.ST depression 2. ST elevation
14. If ST depression, which type?	1. Anterior 2. Lateral 3. Inferior
15. If ST elevation, which type?	1. Anterior 2. Lateral 3. Inferior
16. Does ECG show T wave abnormality?	1.Yes 2.No
17. If yes, which type?	1.T wave inversion 2.T wave flattening 3.Biphasic T wave abnormality 4. Other T wave abnormalities (_____)
18. Does ECG show any QTc abnormality?	1.Yes 2.No
19. If yes, which type?	1.Shortening 2.Prolongation
20. QTc interval in milliseconds	_____
21.Does the ECG show any axis deviation (AD)	1.Right AD 2.Left AD 3.Extreme AD 4.Indeterminate axis
22. Does the ECG show any Q wave abnormality	1.Yes 2.No
23. Other ECG abnormalities (specify)	_____

ANNEX VIII: ECG Examination Procedure

A 12 lead ECG calibrated at paper speed of 25mm/s and voltage at 10mm/mv was used. Equipment and supplies needed for ECG acquisition (ECG machine, ECG electrodes, Cardiac gel, Surgical blade, Gauze pads and Alcohol swabs) were assembled.

- Before starting the procedure, an ECG recorder had introduced himself to the participant and gave a brief explanation of the ECG procedure to be undertaken
- The participant was told to remove any metallic ornaments and clothing from the waist up by ensuring privacy and told to lie in a supine position .
- Skin preparation was made by shaving excessive chest hair, rubbing the lower legs, lower forearms, and chest area with an alcohols swab and the areas were dried with gauze pads
- The cardiac gel was then applied to electrode placement areas
- Limb electrodes were placed on their appropriate sites (Right arm limb lead (RA) was placed on right forearm (proximal to wrist); Left arm limb lead (LA) was placed on left forearm (proximal to wrist); Left leg limb lead (LL) was placed on left lower leg (proximal to ankle) and Right leg limb lead (RL) was placed on right lower leg (proximal to ankle)
- Chest leads were placed on their appropriate sites (V1-on the fourth intercostal space to the right of sternum; V2-on the fourth intercostal space just to the left of the sternum; V3- midway between V2 and V4; V4- on the fifth intercostal space in the mid-clavicular line; V5- on the fifth intercostal space in the anterior axillary line horizontal to V4); V6- On the fifth intercostal space in the mid-axillary line horizontal to V4 & V5)
- The ECG machine was turned on and the participant's identification was entered
- The participant was instructed to relax, be comfortable, close his/her eyes, breath normally and to remain still during the examination.
- When a satisfactory ECG is acquired, it was saved and printed out.
- After the tracing is completed, the electrodes were removed from the participant and the electrode placement areas were dried
- The recorded electrocardiogram was kept for reading and interpreted by a cardiologist

DECLARATION

- I, the undersigned, declare that this thesis is my original work, has not been presented for a degree in this or any other university and that all sources of materials used for the thesis have been fully acknowledged.
- Name: _____
- Signature: _____
- Name of the institution: _____
- Date of submission: _____
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