“An observational survey on the recent prescribing patterns in cardiac disease management in Dhaka North City”

B. Pharm (Honors) Project Report

[In the partial fulfillment of the requirements for the degree of Bachelor of Pharmacy]

Submitted To

Department of Pharmacy

Faculty of Allied Health Science

Daffodil International University

Submitted By

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Batch: 20th, Section: A

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A P P R O V A L

This is to certify that this project titled **"An observational survey on the recent prescribing patterns in cardiac disease management in Dhaka North City"** submitted to the Department of Pharmacy, Faculty of Allied Health Science, Daffodil International University for the partial fulfillment of the requirements for the degree of Bachelor of Pharmacy and approved as to its styles and contents.

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DECLARATION

I, **Md. Yamin**, hereby declare that this project work entitled **"An observational survey on the recent prescribing patterns in cardiac disease management in Dhaka North City"** has been carried out through my efforts and facts arrived at my observation under the supervision of **Mr. Md. A.K. Azad**, Assistant Professor & Coordinator M. Pharm, Department of Pharmacy, Daffodil International University, for the partial fulfillment of the requirements for the degree of Bachelor of Pharmacy. I also declare that this work has not been previously submitted, in whole or in part, to any other university or institute for the award of any other degree or professional qualification except as specified.

Supervised By

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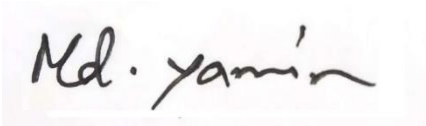

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ABSTRACT

Background: Effective evaluation, monitoring, and modifications in prescribing diverse classes of medicines for managing various cardiac conditions are very essential to make cardiac care more rational.

Aim of this study: The study mainly aims to evaluate the recent prescribing patterns in cardiac disease management in Dhaka North City, Bangladesh.

Method: It was a questionnaire-based observational study conducted by direct interviewing patients who visited two renowned cardiac hospitals in Dhaka North City from 11 September 2022 to 13 October 2022. The sample collected for this study was 107.

Findings: The majority of the respondents were male (72%) than the female cardiac patients (28%). Most of the respondents were 31-60 years (73%) old, followed by ages above 60 years (28%). Most prominently overserved cardiac conditions were Hypertension (96.26%), followed by Coronary Heart Disease (86.91%), Angina Pectoris (65.42%), Myocardial Infarction (13.08%), Stroke (6.54%), Valvular Heart Disease (4.67%), Heart Arrhythmias (4.67%), Heart Attack (5.6%), Cardiomyopathy (1.86%), Carditis (0.93%). Individual respondents were advised to take various therapeutic classes. Advised therapeutic classes were antithrombotics/anti-platelets/anti-coagulants (91.58%), lipid-lowering agents (88.78%), beta-blockers (82.24%), calcium channel blockers (CCBs) (9.34%), nitrates (68.22%), angiotensin-II receptor blockers (ARBs) (44.85%), angiotensin-converting enzyme (ACE) inhibitors (27.1%), diuretics (32.71%), fatty acid oxidation inhibitors (58.87%), potassium channel activators (6.54%), soluble guanylate cyclase (sGC) stimulators (1.86%), hyperpolarization-activated cyclic nucleotide-gated (HCN) channel blockers (1.86%), other anti-anginal & anti-ischaemic agents (4.67%), and anxiolytics (49.53%). Prescribed combination drugs were aspirin + clopidogrel (68.22%), furosemide + spironolactone (28.03%), CCBs + ARBs (3.73%), and ARNIs (6.54%). Combination of beta-blocker + CCBs, diuretics + beta-blocker, and ARBs + diuretics were found 0.93%. Prescribed newly approved drugs such as Vericiguat (sGC stimulator), and combination drugs such as ARNIs were also found. The positive findings from this study are that respondents were maintaining non-pharmacological management (86%), and prescriptions guidelines properly (97%) though they were worried (78%) about their disease. The negative outcome is that most of them (80%) were unconcerned about polypharmacy. Even though the majority of respondents had a variety of health problems and were taking various medications for those problems.

Conclusion: Though the sample size was small to generalize the prescribing pattern in the whole of Dhaka city in Bangladesh. But it may conclude that new drugs are currently available and prescribed to cardiac patients. The availability of newly approved drugs will expand the thinking capability as well as reduce cardiac death and hospitalization in the future. Moreover, it is important to educate cardiac patients on the negative consequences of improper medication use as well as the significance of 'appropriate polypharmacy'.

Keywords: Cardiac, Drugs, Disease, Hypertension, Heart, Pattern, Prescription, Management

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CHAPTER ONE

INTRODUCTION

1.1. Introduction

Cardiovascular disease (CVD) is a major public health concern at present. Additionally, it is the main cause of death globally. It directly involves more than 17 million deaths each year. A variety of cardiac conditions are Coronary Heart Disease (CHD), Angina, Heart Arrhythmias, Rheumatic Heart Disease (RHD), Stroke, Heart Attack, Carditis, Cardiomyopathy, Congenital Heart Disease, Heart Failure, Valvular Heart Disease, Ischaemic Heart Disease (IHD), etc. [1,2]. Among them, Heart attacks and strokes account for more than four out of every five CVD deaths, and one-third of these deaths happen before the age of 70 [2].

Similar to other countries, Bangladesh is seeing an increase in the prevalence of cardiovascular disease as a cause of morbidity and mortality. Due to epidemiological change over the past few decades, this country's major illness pattern has shifted from primarily communicable to non-communicable, with cardiovascular disease playing a significant role in the latter [3]. In our country, it has been observed that Coronary Heart Disease (CHD), and hypertensive illness are becoming more and more widespread [3]. The main risk factors for the cardiac disease include elevated blood pressure, high sugar, and lipid levels [4,5]. A significant direct risk factor for CVDs, obesity [defined as a high Body Mass Index (BMI)] also serves as a contributor to other intermittent risk factors including diabetes mellitus and hypertension. The reasons for higher CVD rates in developing nations are mostly fast urbanization, altered food patterns, increased tobacco use, and insufficient physical activity. Bangladesh has the greatest prevalence of CVD risk factors among South Asian nations, according to the INTERHEART study [6]. In Bangladesh, 99.6% of men and 97.9% of women are exposed to one or more known risk factors for CVD. However, in Bangladesh, there is a relatively low degree of public awareness of the risk factors for CVD. Additionally, there were also poor identification and control rates, which may have been brought on by low literacy rates, limited access to healthcare, or different priorities [5,7].

The management of cardiovascular disease emphasizes prevention over treatment. However, it became clear from various population-based studies that cardiac medicines can also significantly prolong life as well as reduce the incidence of hospitalization. Common medicines for managing the diversity of cardiac conditions are Vasodilators, beta-blockers, lipid-lowering medications, calcium channel blockers, ACE inhibitors, diuretics, etc. [8].

The assessment of trends in prescribing patterns is an effective exploratory technique to evaluate current medication use habits and the appropriateness of prescriptions. This kind of research is essential for identifying trends and setting objectives since it has enormous socioeconomic and medical significance [9]. The current study aims to understand the recent prescribing patterns in cardiac management in Dhaka North City. This study also aims to evaluate the patient’s non-pharmacological responsiveness, knowledge about polypharmacy, and overall satisfaction and cost-effectiveness of cardiac treatment.

1.2. Diversity in Cardiac Disease

The cardiac disease comes in a variety of forms, and each one has unique signs, causes, and treatments. Some people's cardiac disease can be significantly improved by making lifestyle modifications and taking medications. Others could require surgery to restore the functionality of their heart. Common cardiac conditions are mentioned in (**Figure 1**).

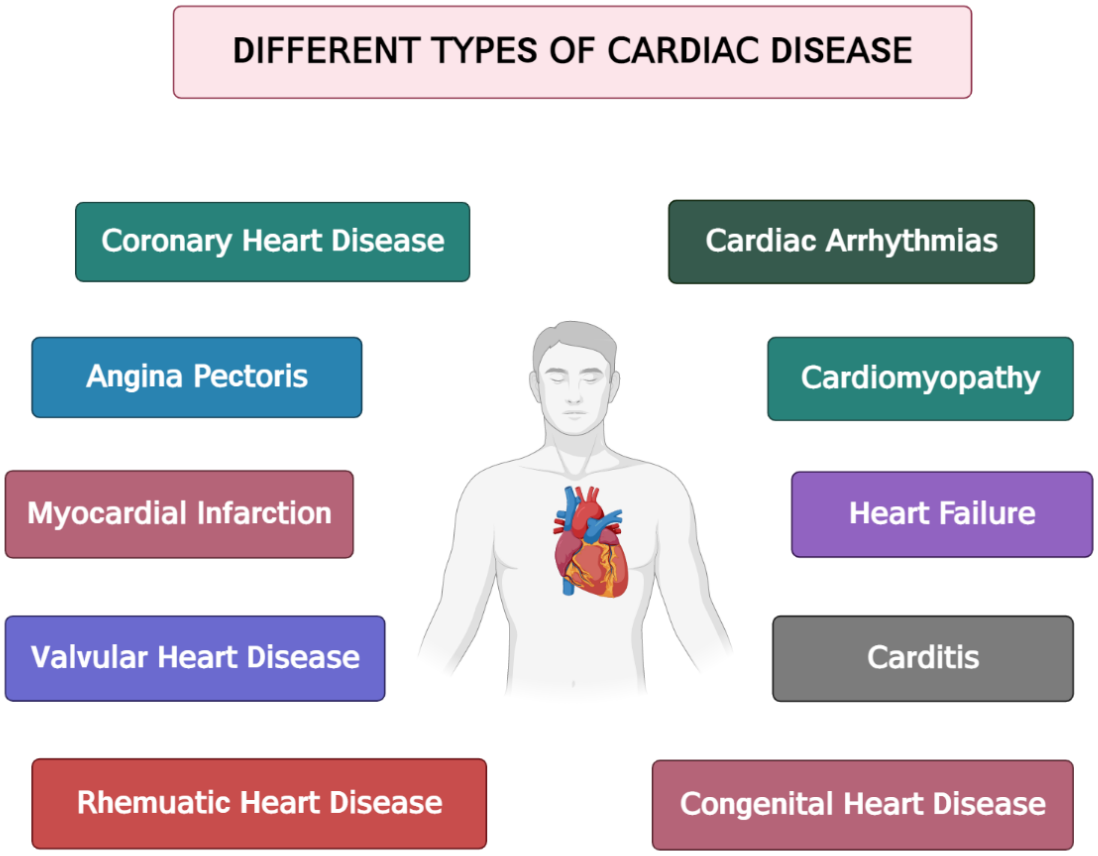


Figure 1: Illustration showing different types of cardiac diseases.

1.2.1. Coronary Heart Disease

Atherosclerotic plaque buildup as shown in (**Figure 2**) in the cardiac arteries causes **coronary artery disease (CAD)**, also known as **coronary heart disease (CHD)**, **ischemic heart disease (IHD)**, **myocardial ischemia** [10], or simply heart disease [11–13]. The majority of cardiac conditions or illnesses are caused by Coronary Heart Disease [14]. These types include myocardial infarction, angina, and sudden cardiac death [15]. Chest pain or discomfort, which may radiate to the shoulder, arm, back, neck, or jaw, is a major symptom [16]. Sometimes it could feel like heartburn. Typically, symptoms are triggered by physical activity or stress, last

for a short period, and become better with rest. Shortness of breath may occur. There may be no symptoms at all. The first indication is frequently a heart attack. Heart failure or an irregular heartbeat are examples of additional complications [13].

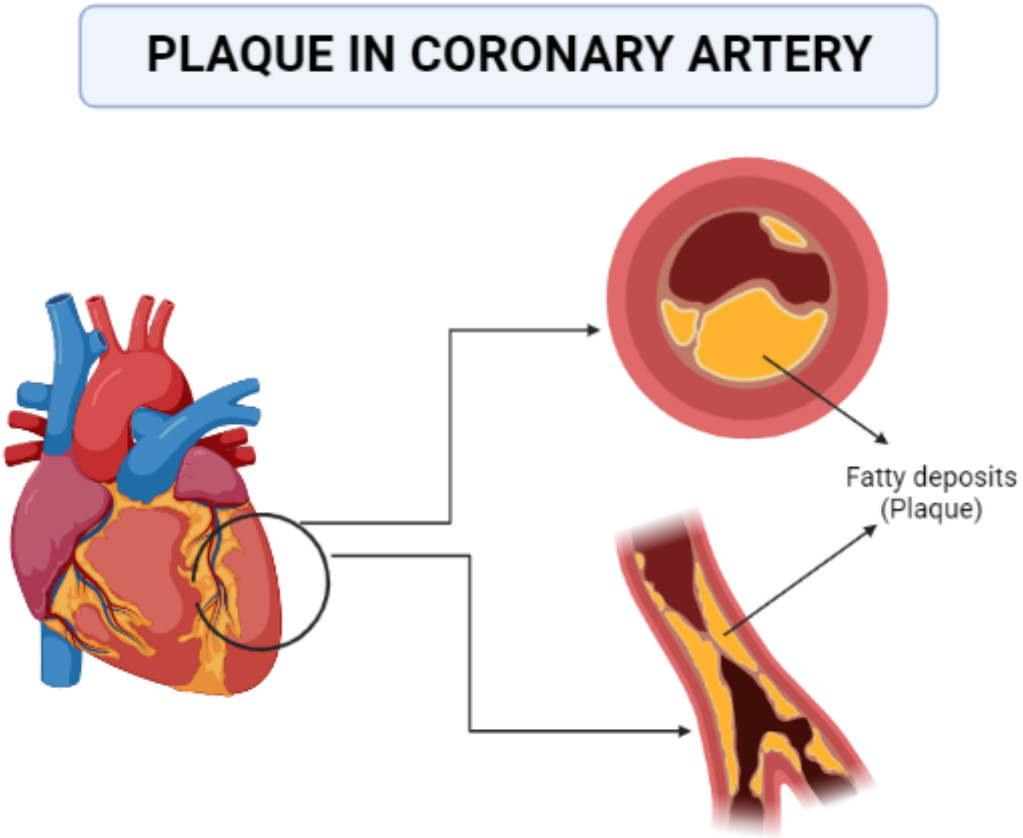


Figure 2: Illustration showing the development of plaque (fatty deposits) in a coronary artery.

1.2.2. Angina Pectoris

Angina, also known as **angina pectoris**, is a type of pressure or pain in the chest that is typically brought on by inadequate blood flow to the cardiac muscle (myocardium). It is a common sign of coronary artery disease [17]. Angina is frequently the result of blockage or spasms of the arteries that deliver blood to the cardiac muscle. Atherosclerosis, a characteristic of coronary artery disease, is the primary mechanism of coronary artery impairment. Other causes of angina include irregular cardiac rhythms, heart failure, and, less frequently, anemia [18]. The word angina pectoris is derived from the **Latin** words **angere** ("to strangle") and **pectus** ("chest") which means “a strangling feeling in the chest”. The level of oxygen starvation to the heart of the danger of myocardial infarction (heart attack) does not always correlate with the intensity of angina discomfort. Even while there is minimal to no danger of having a heart attack, some individuals may endure excruciating pain. Some people may endure a heart attack with little to no pain [19].

Types of Angina Pectoris:

- **Stable angina:** The most common type of angina is **stable angina**. Exertion usually triggers it, and it normally subsides with rest or angina medicine. Discomfort from stable angina is predictable and frequently comparable to chest pain from earlier episodes. The average duration of chest pain is five minutes or less [20].

- **Unstable angina:** Unpredictable and happening while at rest is **unstable angina**. Or the angina pain is getting worse and requires less physical exertion. It often lasts for at least 20 minutes and is more severe than stable angina. Rest and the typical angina drugs don't relieve the pain. If the blood circulation does not improve, the heart will become oxygen-starved and have a heart attack. Unstable angina is serious and needs urgent care [20].

- **Microvascular angina:** A kind of angina called **Microvascular Angina** is brought on by difficulties with the coronary arteries' smallest blood capillaries. The coronary arteries that round the heart provide the organ with an ongoing supply of oxygen-rich blood. The heart's blood supply is largely provided by the small vessels (known as the coronary microvasculature). It is previously known as **Cardiac Syndrome X**. Another term is M**icrovascular Coronary Artery Disease** [21].

- **Variant angina: Prinzmetal angina**, another name for **variant angina**, doesn't result from coronary artery disease. It is brought on by a spasm in the arteries in the heart, which abruptly lowers blood flow. The primary symptom of variant angina is severe chest pain. It usually happens in cycles, usually while sleeping or at rest. Medication for angina may be able to reduce pain [20].

1.2.3. Myocardial Infarction

A **Myocardial Infarction**, often known as a **Heart Attack**, is a very serious condition that develops when the cardiac muscle isn't receiving enough blood. Although there are numerous potential causes, a blocking in one or more of the arteries is the most common one. The injured cardiac muscle will start to deteriorate without blood flow. A heart attack might result in permanent cardiac damage and perhaps death if blood flow isn't rapidly restored. It is a life-threatening emergency issue. Chest pain is a frequent indication of a heart attack (angina). This may be slight and feel heavy or uncomfortable, or it may be severe and feel excruciatingly painful. It could begin in the chest and then spread to the left arm (or both arms), shoulder, neck, jaw, back, or downward toward the waist. Other signs and symptoms include difficulty breathing, tiredness, insomnia, nausea, palpitations, sweating, feeling lightheaded, faint, or passing out [22].

Types of Myocardial Infarction or Heart Attack:

- **Non-ST-elevation myocardial infarction (NSTEMI):** When the coronary artery is partially blocked and blood circulation is significantly limited, NSTEMI heart attacks happen. Despite being less severe than STEMI heart attacks, they can nonetheless result in long-term damage [23].

- **ST-elevation myocardial infarction (STEMI):** A **STEMI** heart attack is serious and demands urgent care. These attacks happen when a major portion of the coronary artery is completely stopped, cutting off blood flow to the heart [23].

- **Coronary spasm or, unstable angina:** These spasms are sometimes known as unstable angina or silent heart attacks. They take place when the arteries leading to the heart constrict, stopping or limiting blood supply to the heart. Less serious than those of other forms of coronary artery disease, the symptoms do not result in long-term damage [23].

1.2.4. Valvular Heart Disease

The heart is made up of four valves. The aortic, mitral, pulmonary, and tricuspid valves are the heart's four valves. When blood needs to flow through the heart, valves open and close. Heart valves can be harmed by a variety of factors. Heart valve injury is a common occurrence. Another name for heart valve disease is valvular heart disease. Heart valve disease symptoms typically include chest pain, fatigue, fainting, shortness of breath, and irregular heartbeat [24].

Types of Valvular Heart Disease:

- **Atresia:** A heart condition known as atresia may be congenitally present at birth (referred to as a congenital heart defect) or, very rarely, acquired later in life. It happens when a heart valve has absolutely no opening. Instead, a substantial piece of solid tissue develops between the heart's chambers, obstructing blood flow [25]. Two main types of atresia are:

    1. **Pulmonary atresia:** The pulmonary valve is altered by pulmonary atresia. The pulmonary artery is blocked, making it impossible for blood to go from the heart to the lungs [25].

    2. **Tricuspid atresia:** The tricuspid valve is disrupted by tricuspid atresia. Blood cannot move from the right atrium to the right ventricle when this condition exists [25].

- **Regurgitation:** When a valve does not seal completely, it can regurgitate, also known as backflow or insufficiency. Because of this, blood might leak backward instead of forward through the heart or into an artery. The heart cannot perform effectively to provide blood to the body because some blood flows in the wrong way. Regurgitation may occur if the valve aperture is extended or if the valve flaps are the wrong size or shape. Heart valve regurgitation can be acquired over time or be present at birth. Prolapse in the mitral valve is the most frequent cause of regurgitation. Backflow isn't usually caused by mitral valve prolapse. The majority of persons with mitral valve prolapse never experience backflow and never exhibit any symptoms or issues associated with it. Backflow, however, can deteriorate with time and cause consequences like infections and elevated heart and lung pressure [25].
- **Stenosis:** An excessively small valve opening is known as stenosis. The flaps could have formed improperly before birth, or the valve could be excessively thin. Blood flow through the valve may be impeded by this problem and others that lead to stenosis, thereby making it more difficult for the heart to supply sufficient blood to the body [25].

1.2.5. Rheumatic Heart Disease

A cardiac disease known as rheumatic heart disease occurs when rheumatic fever permanently damages the heart valves. After an untreated or inadequately treated streptococcal infection, such as strep throat or scarlet fever, heart valve damage may begin. An inflammatory state brought on by an immunological reaction can lead to ongoing valve damage. Rheumatic fever, an inflammatory condition that can damage numerous connective tissues, particularly in the heart, joints, skin, or brain, is the root cause of rheumatic heart disease. Over time, the heart valves may become damaged and irritated. This can cause the heart valve to constrict or leak, making it more difficult for the heart to operate normally. Heart failure may ensue from this, which could take years to manifest. Depending on the extent of valve damage, rheumatic heart disease symptoms may include breathing difficulties (especially with activity or when lying down), chest discomfort and/or chest pain, tiredness, swelling, and nodules (lumps under the skin) [26].

1.2.6. Cardiac Arrhythmias

An erratic heartbeat is referred to as a cardiac arrhythmia. When the electrical signals that regulate the heart's beats don't function properly, heart rhythm issues (heart arrhythmias) result. The heart beats excessively quickly (tachycardia), too slowly (bradycardia), or irregularly as a result of the flawed signaling [27].

Types of Cardiac Arrhythmias: Based on the speed of the heart rate arrhythmias are categorized into the following types:

1. **Tachycardia:** Tachycardia is a rapid heartbeat during the resting period. More than 100 beats per minute. Different types of tachycardia include:

   - **Atrial fibrillation:** A rapid, uncontrolled heart rate results from chaotic heart signals. The condition might be transient, but some instances might not disappear without treatment. Serious consequences like stroke are linked to atrial fibrillation [27].

   - **Atrial flutter:** Similar to atrial fibrillation, atrial flutter has more regular heartbeats. Stroke risk is also increased by atrial flutter [27].

   - **Supraventricular tachycardia:** An arrhythmia that begins above the lower heart chambers is referred to as supraventricular tachycardia. It causes episodes of palpitations or a pounding heartbeat that abruptly starts and stops [27].

   - **Ventricular fibrillation:** It is a dangerous form of cardiac arrhythmia. It starts from the lower heart chamber called the ventricle. This kind of arrhythmia happens when the lower heart chambers (ventricles) quiver instead of connecting in a coordinated manner that supplies blood to the other parts of the body. It is brought on by rapid, erratic electrical signals. If a regular heartbeat isn't restored within a few minutes, this serious problem could lead to death [27,28].

   - **Ventricular tachycardia:** Faulty electrical signaling starts from the ventricle and causes rapid heartbeat, known as ventricular tachycardia. The ventricles cannot fill with blood effectively because of the rapid heartbeat. In turn, the body receives insufficient blood pumping from the heart. When a person's heart is healthy overall, ventricular tachycardia may not result in major issues. Ventricular tachycardia can be an emergency issue in people who have heart problems and must be treated very immediately [27].

2. **Bradycardia:** Bradycardia is a slower heartbeat. Less than 60 beats per minute during the resting period. Fewer types of bradycardia include:

   - **Sick sinus syndrome:** Scarring in the area of the sinus node, which slows, obstructs, or blocks the passage of impulses, can result in sick sinus syndrome. Older individuals are the most prevalent age group for sick sinus syndrome [27].

- **Conduction block:** The electrical signals that start heartbeats can slow down or halt if the heart's electrical pathways are blocked. While some blocks may not show any symptoms at all, others could result in missing beats or bradycardia [27].

3. **Premature heartbeats or extra systole:** Premature heartbeats are extra heartbeats that happen one at a time, occasionally in patterns that change with the regular heartbeat. Premature atrial contractions or Premature ventricular contractions of the heart may be the source of the extra heartbeats. Usually, premature heartbeats are harmless and need no treatment [27,29].

1.2.7. Cardiomyopathy

A heart muscle disorder known as cardiomyopathy makes it more difficult for the heart to pump blood throughout the body. Heart failure can be caused by cardiomyopathy. Depending on the kind of cardiomyopathy, treatment options may include drugs, surgically implanted devices, heart surgery, or, in extreme circumstances, a heart transplant. Early on in the development of cardiomyopathy, there may be neither indications nor symptoms. However, when the illness worsens, several indications and symptoms may occur such as shortness of breath during exercise or even while at rest, legs, ankles, and feet swelling, abdominal bloating brought on by a fluid buildup, difficulty falling asleep flat, fast, or fluttering heartbeats, chest pressure or discomfort, unsteadiness, fainting, and dizziness [30].

Types of Cardiomyopathy:

- **Dilated cardiomyopathy:** In this condition, the main pumping chamber (left ventricle) of the heart becomes dilated (enlarged) and cannot effectively pump blood out of the body [30].

- **Hypertrophic cardiomyopathy:** This involves the abnormal thickening of the heart muscle so that it is harder for the heart to work effectively [30].

- **Restrictive cardiomyopathy:** The heart muscle stiffens and loses flexibility in this type, making it incapable of expanding and filling with blood in between heartbeats. Any age can experience this least prevalent form of cardiomyopathy; however, elderly persons are more frequently affected [30].

- **Arrhythmogenic right ventricular dysplasia:** This particular cardiomyopathy is rare. Scar tissue has taken the place of the muscle in the right ventricle, which can cause irregular heartbeats [30].

1.2.8. Heart Failure

Heart failure is often referred to as Congestive Heart Failure. It is a condition where the heart is unable to pump blood as efficiently as it should. Shortness of breath is frequently brought on by this because blood frequently backs up and fluid can accumulate in the lungs. The heart eventually becomes too weak or stiff to refill and pump blood adequately as a result of some cardiac diseases, such as coronary artery disease, or excessive blood pressure. Moreover, heart failure is a life-threatening cardiac condition. Heart failure may develop gradually over time (chronic) or suddenly (acute). Major signs and symptoms of heart failure include shortness of breath (SOB) during physical exercise or when lying down, legs, ankles, and foot swelling, an erratic or quick heartbeat, decreased capacity for exercising, trouble concentrating, or a decline in alertness, chest pain if a heart attack led to heart failure [31].

1.2.9. Congenital Heart Disease

Any defects or any abnormality in the heart present at birth is known as Congenital Heart Disease. There are several milder forms of congenital cardiac disease. However, complicated defects could result in potentially fatal issues. Typical adult congenital heart disease signs and symptoms include abnormal heartbeats (arrhythmias), blue fingernails, lips, and skin (cyanosis), breathing difficulty, experiencing fatigue after vigorous activities, bodily organs, or tissue swelling (edema) [32].

Types of Congenital Heart Disease:

Various types of congenital heart conditions include Atrial Septal Defect (ASD), Atrioventricular canal defect, Coarctation of the aorta, Bicuspid aortic valve, Congenital mitral valve anomalies, Double-outlet right ventricle, Ebstein anomaly, Eisenmenger syndrome, Hypoplastic left heart syndrome, Kawasaki disease, Long QT syndrome, Partial anomalous pulmonary venous return, Patent ductus arteriosus (PDA), Patent foramen ovale, Pulmonary atresia, Pulmonary atresia with an intact ventricular septum, Pulmonary atresia with ventricular septal defect, Pulmonary valve stenosis, Tetralogy of Fallot, Total anomalous pulmonary venous return (TAPVR), Transposition of the great arteries, Tricuspid atresia, Truncus arteriosus, Vascular rings, Ventricular septal defect (VSD), Wolff-Parkinson-White (WPF) syndrome [32].

1.2.10. Carditis

Inflammation of the heart muscle is called carditis. The heart's capacity to pump blood may be hampered by inflammation. Various types of carditis are

1. **Pericarditis:** The term "pericarditis" refers to pericardial inflammation.
2. **Myocarditis:** Myocarditis refers to inflammation of the heart muscle.
3. **Endocarditis:** The term "endocarditis" refers to endocardial inflammation [33].

Viral infection, bacteria, fungus, parasites, medicines, toxins, radiation, and other inflammatory illness can cause carditis. Fatigue, edema, an irregular heartbeat, chest pain, joint pain or body aches, etc. are common signs and symptoms of carditis [33,34].

1.3. Cardiac Disease: The Root Causes and Risk Factors

There are various causes of cardiovascular disease, depending on the individual cardiac illnesses. Several root causes and risk factors associated with developing cardiac diseases are mentioned in (**Figure 3**).

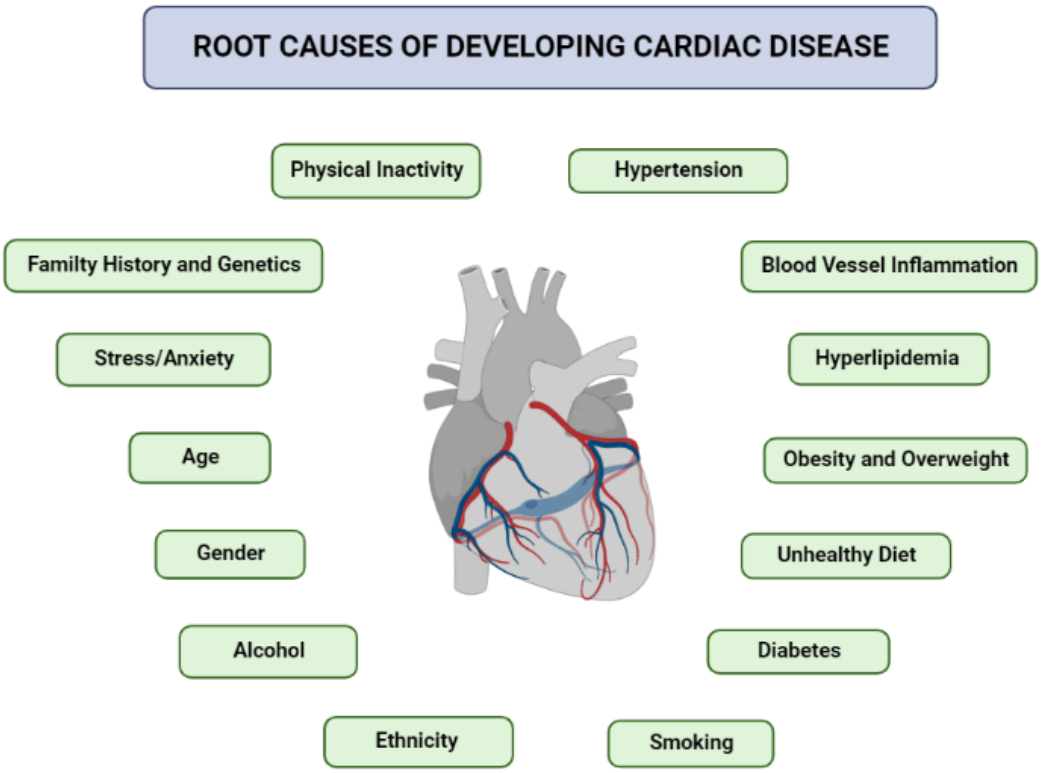


Figure 3: Illustration highlighting the root causes and risk factors for developing a cardiac disease.

- **Hypertension:** The force of the blood pressing against the artery walls is called blood pressure. So, high blood pressure is known as hypertension in medical terminology. The arteries become weaker or narrower due to the high blood pressure which increases the risk of rupture or blockage from plaque particles that develop inside the arteries. So, if blood pressure is consistently too high, the heart must use more effort to pump blood throughout the body [35].

- **Hyperlipidemia:** Too much fat in the blood is known as hyperlipidemia. Also, known as high cholesterol. When blood contains too much cholesterol that builds up in the artery walls and causes them to thicken and narrow. This may cause slowing down the blood carrying oxygen to the heart and giving chest pains. The patient suffers a heart attack if the blood supply is cut off [35].

- **Blood Vessel Inflammation:** When blood vessels get irritated by chronic low levels of inflammation. Inflammation may then promote plaque development, loosen artery plaque, and produce blood clots, which are the primary cause of cardiac disease. Smoking and cholesterol can lead to inflammation in blood vessels. This can cause heart attack and stroke [36].

- **Diabetes:** Diabetes patients commonly have cardiovascular problems, especially type 2 diabetes. Additionally, having diabetes with cardiac disease greatly increases the chance of dying [37]. Therefore, atherosclerosis is an accumulation of cholesterol in the blood vessels that provide the heart with oxygen and nutrients. It is the most prevalent cause of heart disease in a person with diabetes. However, cholesterol plaques are prone to rupture, the body sends platelets to help close the gap. Due to the narrowness of the artery, platelets may obstruct blood flow, preventing oxygen from being delivered, which could result in a heart attack [38].

- **Obesity and Overweight:** Obesity raises the chance of developing a cardiac disease. Excessive weight can lead to fatty material building up in arteries and the blood vessels that carry blood to other body regions. Blocked and damaged arteries that deliver blood to the heart may cause a heart attack. Obesity leads to other risk factors such as hyperlipidemia, diabetes, and elevated blood pressure [39,40].

- **Stress:** Another potential issue linked to stress is cardiac disease. The exact link between stress and cardiac disease is still being researched, but chronic, high levels of stress undoubtedly have a role in chronic conditions like high blood pressure. High blood pressure from stress might increase the chance of having a heart attack or stroke. Stress can alter behavior and raise lifestyle-related risk factors for cardiac disease. Along with smoking, obesity, and lack of physical activity, stress has been linked to an increased risk of cardiovascular disease [37,41].

- **Smoking:** Smokers have a higher risk of developing atherosclerosis and heart attacks. This is because nicotine raises blood pressure and carbon monoxide can damage the lining of blood vessels. Smoking damages cardiac tissue, reduces High-Density Lipoprotein (HDL), rises blood pressure, and lowers blood pressure. Additionally, the risk of cardiac disease is increased by being around smokers. Any amount of smoking or even light smoking or occasional smoking damages the heart and blood vessels [35,37].

- **Alcohol:** Normally, blood is pumped around the body by the heart, via these blood vessels through arteries, capillaries, and veins. As a result, blood carries nutrients and other elements to all body regions. This absorption occurs primarily through the stomach and small intestine, but excessive alcohol consumption also causes direct absorption into the bloodstream. Too much alcohol consumption can raise blood pressure, heart rate, and cholesterol levels, which can cause atherosclerosis (fatty deposits in coronary arteries). Additionally, it may cause arrhythmias, stroke, and cardiomyopathy [37,42].

- **Unhealthy Diet:** Diet directly affects the development of atherosclerosis, the plaques that can block arteries and cause cardiac disease or cardiovascular disease (CVD). A diet rich in fat, sugar, and cholesterol can increase the risk of cardiac diseases. Diet also has an effect on elevating blood pressure, blood sugar, blood cholesterol, and body weight. Also, elevated blood pressure can be caused by eating too much salt [37].

- **Physically Inactivity:** The cardiac muscles require exercise, much as other muscles. Additionally, a lack of exercise contributes to obesity and the issues it causes, such as diabetes and hypertension, which raise the risk of cardiac problems. People who are less fit and active are 30–50% more likely to have high blood pressure. A significant risk factor for the cardiac disease itself is physical inactivity [35,43].

- **Age:** With aging, arteries may get damaged and cardiac muscle may become weaker and/or thicker. The majority of deaths occur in those 65 years of age or older persons experienced the cardiac disease. The likelihood of having a heart attack, a stroke, or developing coronary heart disease and heart failure is significantly higher in those 65 and older than in younger people. The cardiac disease leads to disability, activity restriction, and lowering the quality of life for millions of older people [37,44].

- **Gender:** Men, and women, both suffer heart attacks and develop cardiac disease. There is a more likely risk of developing the cardiac disease in males than in females. After menopause, the risk for females rises, but it is still lower than for males [37].

- **Family and Genetics:** Cardiac disease risk is increased by a family history of early cardiac disease and research has shown that some genes are associated with an increased risk of developing specific cardiac illness based on lifestyle and environmental factors such as anxiety, smoking, obesity, etc. [35,45].

- **Ethnicity:** Cardiac disease is more common in some groups certain than others. The higher rates of cardiac disease in Asian Americans, African Americans, Mexican Americans, Native Americans, and Native Hawaiians [37].

1.4. Major Consequences of Cardiac Disease

Patients having cardiac disease may experience the following consequences or negative complications in life:

- **Chest pain (Angina):** Chest pain from heart disease is referred to as angina. Although it is not the same as a heart attack, it might still be an indication. Additionally, it can restrict activities and alter lifestyle. Angina causes a tightening pressure in the chest. The patient may also experience jaw, neck, or shoulder pain. The most typical kind of angina is stable angina. When the heart is working more forcefully than normal, it happens [46].

- **Abnormal heartbeat:** An abnormal heartbeat is called atrial fibrillation. Maybe it will come and go. The heartbeat might be fast. Additionally, it could beat erratically. Shortness of breath, palpitations—which feel like the heart is pounding—and weakness are examples of indications [46].

- **Heart failure:** A slow weakening of the heart might result from cardiac disease. The heart has a tougher time pumping blood out to the body as it becomes weaker. One of the most common reasons for hospital admissions is heart failure. Additionally, it is the main cause of death for persons over 60. When the heart is unable to pump enough blood to accommodate the body's demands, heart failure develops [46].

- **Heart attack:** When a coronary artery is so completely clogged that blood cannot get to a portion of the heart muscle, a heart attack happens. Patients can get severe chest pain, chilly chills, and breathing difficulties. A heart attack can strike quickly or deteriorate gradually over several hours. During a heart attack, the heart continues to beat. The key to avoiding severe cardiac damage is receiving emergency care as soon as possible [46].

- **Sudden cardiac arrest:** Heart attacks and cardiac arrest are not the same things. Cardiac arrest ultimately results in heart-stopping. People who experience cardiac arrest would not have a pulse. Thus, the brain and other organs would not receive any blood. A victim of cardiac arrest passes away in a matter of seconds [24,46].
- **Stroke:** An ischemic stroke is a form of a stroke brought on by cardiac problems. It is also known as a cerebral embolism. This indicates that a blood clot originated out in the heart, then was released, and moved on to the brain. When a blood clot becomes clogged in the brain, it stops the blood flow. The result is a stroke. A drooping face, trouble speaking, and weakness are typical symptoms. A stroke is an urgent medical issue [24,46].
- **Pulmonary edema:** Lungs become flooded with fluid due to pulmonary edema. Pulmonary edema is most frequently caused by heart failure. Blood cannot be efficiently pumped because of a weak heart. As a result, blood accumulates in the lungs' blood vessels. As a result, fluid leaks out. Extreme breathlessness, chest pain, blue lips and nails, and coughing up a little amount of blood are a few symptoms that can occur in a patient with pulmonary edema [46].
- **Peripheral artery disease:** In this condition, there is insufficient blood flow to the arms or legs, typically the legs. This results in symptoms, chief among them walking-related leg pain (claudication). Peripheral artery disease can result from atherosclerosis [24].

1.5. Management of Cardiac Disease

Treatment for different cardiac illnesses typically entails modifying lifestyle, such as quitting smoking, eating a healthy diet, low sugar intake, maintaining healthy cholesterol levels, and exercising more. To lessen the clinical indications of cardiac disease or to decrease the likelihood of hospitalization and mortality, medications and other essential surgical treatments may occasionally be required.

1.5.1. Pharmacological Management

A wide range of cardiac medications is now available in the market. Appropriate prescribing, modification, and suggestions are essential for making cardiac care more rational.

1.5.1.1. Drugs for Hypertension

Making healthy lifestyle modifications is advised for anyone with high blood pressure. Depending on the blood pressure level and the likelihood of experiencing issues like heart attacks or strokes, medication may also be advised [47].

Classification of anti-hypertensive drugs includes:

- **Beta-blockers:** Bisoprolol, Atenolol, Propranolol, Carvedilol, Nebivolol, etc.
- **Alpha-blockers:** Prazosin, Terazosin, Doxazosin, etc.
- **Centrally Acting Agents:** Methyldopa, Clonidine, etc.
- **ACE Inhibitors:** Ramipril, Lisinopril, Captopril, Enalapril, etc.
- **Angiotensinogen II Receptor Blockers (ARBs):** Olmesartan, Valsartan, Losartan, etc.
- **Calcium Channel Blockers (CCBs):** Amlodipine, Nifedipine, Cilnidipine, Verapamil, Diltiazem, Nicardipine, etc.
- **Diuretics:** Different types of diuretics are-
  1. **Osmotic Diuretics:** Mannitol
  2. **Carbonic Anhydrase Inhibitor:** Acetazolamide
  3. **Loop Diuretics:** Furosemide, Torsemide, etc.
  4. **Thiazide Diuretics and related Agents:** Hydrochlorothiazide, Chlorothiazide, Indapamide, etc.
  5. **Potassium-sparing Diuretics:** Spironolactone, Amiloride, Triamterene, etc.
- **Vasodilators:** Nitroglycerine, Hydralazine, etc.

Drugs for high blood pressure frequently have side effects including constipation, unsteadiness or faintness, erection issues, anxiety, dizziness, headache, nausea, skin rash, etc. [48].

1.5.1.2. Drugs for Heart Failure

Patients with heart failure may require several drugs. Each one comes with guidelines and tackles a particular symptom or contributing cause [49].

Variety of drugs used to manage heart failure are:

- **Beta-blockers:** Bisoprolol, Metoprolol, Carvedilol, Nebivolol, etc.
- **Angiotensin Converting Enzyme (ACE) inhibitors:** Ramipril, Lisinopril, Captopril, Enalapril, etc.
- **Angiotensinogen II Receptor Blockers (ARBs):** Olmesartan, Valsartan, Losartan, etc.
- **Calcium Channel Blockers (CCBs):** Amlodipine, Nifedipine, Cilnidipine, Verapamil, Diltiazem, Nicardipine, etc.
- **Diuretics:** Furosemide, Bumetanide, Torsemide, Spironolactone, Eplerenone.
- **Vasodilators:** Nitroglycerine, Hydralazine, Isosorbide dinitrate, etc.
- **Soluble Guanylate Cyclase Activators:** Vericiguat
- **HCN Channel Blocker:** Ivabradine
- **Angiotensin Receptor-Neprilysin Inhibitors (ARNIs):** Sacubitril/Valsartan
- **Cardiac Glycosides:** Digoxin, etc.

Other drugs that might be prescribed are:

- **Lipid-lowering Agents:** Rosuvastatin, Atorvastatin, Simvastatin, Ciprofibrate, etc.
- **Antithrombotic/Anti-platelets/Anti-coagulants:** Aspirin, Clopidogrel, Warfarin, etc.

Novel drugs for Heart Failure: A **novel family** of medications called angiotensin receptor-neprilysin inhibitors (ARNIs) is used to treat heart failure. The first combination drug in this new class to receive approval is **sacubitril/valsartan**. Sacubitril is a prodrug that, when activated, inhibits neprilysin. The renin-angiotensin-aldosterone pathway is blocked by the angiotensin II receptor blocker - valsartan. In patients with heart failure who have a low ejection fraction, it is advised to use it in place of an angiotensin-converting enzyme inhibitor or an angiotensin receptor blocker [50]. The FDA authorized the newest treatment for heart failure, **Vericiguat**, in **January 2021** [51].

1.5.1.3. Drugs for Cardiac Arrhythmias

There are different types of arrhythmias (cardiac rhythm problems), and many different pharmacological treatment options are available. Classifications of anti-arrhythmic drugs are given in (**Table 1**):

Table 1: Classification of antiarrhythmics [52,53].

Anti-arrhythmic drugs		
Class	**Therapeutic Class**	**Examples**
Class-I	**Sodium Channel Blockers**	Quinidine
		Procainamide
		Disopyramide
		Phenytoin
		Lidocaine
		Mexiletine
		Flecainide
		Propafenone
Class-II	**Beta-Blockers**	Atenolol
		Acebutolol
		Bisoprolol
		Metoprolol
		Nadolol
		Propranolol

Class-III	**Potassium Channel Blockers**	Amiodarone
		Sotalol
		Dofetilide
		Ibutilide
		Dronedarone
		Bretylium
Class-IV	**Calcium Channel Blockers**	Verapamil
		Diltiazem

Drugs are not classified primarily as anti-arrhythmias but are used to treat important cardiac arrhythmia conditions [53]. These types of drugs are:

- **Digoxin** is used to treat **rapid atrial fibrillation**.
- **Adenosine** is preferred for **symptomatic sinus bradycardia.**
- **Atropine** is used for **supraventricular tachycardia**.
- **Adrenaline** is used for **cardiac arrest**.
- **Calcium Chloride** is used for **ventricular tachycardia** caused by hyperkalemia.
- **Magnesium Chloride** is used for **ventricular fibrillation**.

Side effects of antiarrhythmics include constipation, dizziness, extreme thirst, headache, nausea, sensitivity to sunlight, swelling caused by a fluid buildup (edema), problem urinating, deterioration of asthma, etc. [52].

1.5.1.4. Drugs for Angina Pectoris

Few drug classes can improve angina symptoms. Classification of Anti-anginal agents is given in below:

- **Nitrites and Nitrates:** This type of drug is often used to treat angina. Examples of these classes are- Isosorbide dinitrate, Isosorbide mononitrate, Glyceryl trinitrate, or Nitroglycerin.
- **Calcium Channel Blockers:** Nifedipine, Diltiazem, Verapamil, Amlodipine, Felodipine, Nicardipine, Cilnidipine, etc.
- **Beta-Blockers:** Atenolol, Propranolol, Sotalol, Labetalol, Timolol, Bisoprolol, etc.
- **Fatty acid oxidase inhibitors:** Trimetazidine.
- **Potassium Channel Openers:** Nicorandil, Pindacidil, Cromakalim.
- **Hyperpolarization-activated cyclic nucleotide-gated (HCN) channel blockers:** Ivabradine.
- **Other anti-anginal:** Ranolazine

Therapeutic classes that are not often thought of as being anti-anginal are still recommended to decrease ischemic circumstances for patients having angina pectoris. These are:

- **Lipid-lowering agents:** Rosuvastatin, Atorvastatin, Simvastatin, Ciprofibrate, etc.
- **Antithrombotic/Anti-platelets/Anti-coagulants:** Aspirin, Clopidogrel, Warfarin, etc.

Newer, non-traditional antianginal drugs like **Ranolazine** and **Ivabradine** are used to treat symptomatic angina in the context of long-term, stable ischemic heart disease. Patients with cirrhosis and those using potent inducers or inhibitors of CYP3A, such as rifampin, phenytoin, or ketoconazole, should not use Ranolazine. Patients with sick sinus syndrome and those using CYP3A4 inhibitors should not take Ivabradine [54].

1.5.1.5. Drugs for Myocardial Infarction

Treatment for myocardial infarction is to increase the amount of blood reaching the cardiovascular system. A doctor might advise either medicine, surgery, or both depending on how serious the disease is. Drugs for Myocardial Infarction are given in below:

- **Nitrates:** Glyceryl trinitrate or Nitroglycerin.
- **Calcium Channel Blockers:** Nifedipine, Diltiazem, Verapamil, Amlodipine, Nicardipine, Cilnidipine, etc.
- **Beta-blockers:** Atenolol, Bisoprolol, Metoprolol, Carvedilol, Sotalol, Labetalol, Timolol, etc.
- **Angiotensin-converting enzyme inhibitors:** Ramipril, Lisinopril, etc.
- **Soluble guanylate cyclase activators:** Vericiguat
- **Lipid-lowering agents:** Rosuvastatin, Atorvastatin, Simvastatin, Ciprofibrate, etc.
- **Antithrombotic/Anti-platelets/Anti-coagulants:** Aspirin, Clopidogrel, Warfarin, etc.
- **Potassium Channel Openers:** Nicorandil, etc.
- **Hyperpolarization-activated cyclic nucleotide-gated (HCN) channel blockers:** Ivabradine.
- **Other drugs:** Ranolazine, etc.

1.5.2. Non-pharmacological Management

- **Maintain a healthy diet and nutrition:** Consume lots of healthy fruits, veggies, and whole grains. Reduce the intake of salt, sugar, and saturated fats. A healthy dietary pattern is very important for the non-pharmacological management of the cardiac disease. A diet rich in whole grains, veggies, and fruits is advised to lower blood pressure. As well as lowering the intake of sweets, sugar-sweetened beverages, and red meat, other suggestions include consuming low-fat dairy products, poultry, fish, legumes, non-tropical vegetable oils, and nuts. A hypertensive patient should

deliberately limit the intake of foods prepared outside the home, canned foods, and prepackaged foods (dry or frozen), as they frequently contain more sodium than home-cooked meals or frozen veggies [55].

- **Maintain healthy body weight:** Being overweight or obese considerably elevates the chance of other cardiac risk factors, such as elevated blood pressure, hyperlipidemia, and diabetes, which in turn raises the risk of cardiac disease. A good diet and regular exercise will help cardiac patients to maintain a healthy weight, which will minimize the risk of developing these disorders and cardiac disease [56].

- **Maintain blood pressure:** It has been discovered that a 5 mm Hg reduction in systolic blood pressure is linked to mortality reductions of 14% from stroke, 9% from heart disease, and 7% from all causes. Blood pressure monitoring at home is highly advised [55]. Maintaining blood pressure is the major non-pharmacological management for effectively reducing cardiac disease complications.

- **Stop smoking:** Smoking or secondary tobacco exposure is the major risk factor for developing a cardiac disease. Smoking increases the risk of heart attack and stroke and raises blood pressure [57]. The greatest strategy to lower the chance of developing cardiac disease and its complications is to stop using tobacco.

- **Manage stress/anxiety:** Stress or anxiety can have a variety of negative effects on the heart, including rising blood pressure and, in severe circumstances, even triggering a heart attack. Additionally, some people use unhealthy coping mechanisms to deal with stress, such as bingeing on food or abusing alcohol or tobacco, both of which raise the risk of developing a cardiac disease. Exercise, mindfulness meditation, and cognitive behavioral therapy are all effective approaches to handling stress [57]. However, family support and social support is very essential for this purpose.

- **Regular physical exercise:** There are several advantages to physical activity, including improved circulation and cardiovascular health. The American Heart Association (AHA) advises engaging in at least 30 minutes of moderate-intensity aerobic exercise five days a week, or at least 25 minutes of vigorous aerobic exercise three days a week in addition to moderate- to high-intensity muscle-strengthening exercise two days a week, for best cardiovascular health [58]. Exercises have been advised for the management of stable people with heart failure for approximately three decades. It raises effort tolerance, enhances lifestyle, and lowers the number of heart failure hospitalizations [59]. Despite several research examining the benefits of exercise, its impact on various cardiac aggressive circumstances is still not entirely understood [59,60].

1.6. The Significance of Polypharmacy for Cardiac Patients

The simultaneous use of several medications by a patient for one illness is known as polypharmacy (polypragmasia) [61]. Particularly for elderly patients with numerous chronic health conditions, taking an excessive number of medications raises the possibility of an adverse occurrence. A lower limit of five concurrent medicines is typically specified by narrower definitions used in research quantifying the prevalence and negative consequences of polypharmacy, though they can range from two to 11 [62–64]. The prescription of many medications can be appropriate and therapeutically advantageous in some situations, even though polypharmacy is often thought to be undesirable [65]. To maintain safety and well-being, "appropriate polypharmacy" is defined as the practice of prescribing for complicated or many illnesses in a way that ensures the use of any necessary medications is based on the best evidence at the moment. Although clinically indicated for some chronic illnesses, such as diabetes mellitus, cardiac diseases, etc. polypharmacy should be stopped when there is no longer any evidence that the benefits of the recommended medications outweigh the risks [65].

Therefore, one of the reasons for different drug-related issues and unneeded medication loads in cardiovascular patients is polypharmacy. These require pharmaceutical care that includes medication review and prescription medication optimization to be avoided and controlled [66]. The degree of polypharmacy and patient medication experience become more significant factors in determining the quality of life associated with patient medication. Reducing polypharmacy and enhancing medication experiences are at the forefront of pharmaceutical care, along with attaining a positive therapeutic outcome and addressing patients' drug-related needs. It is critical to understand the amount of polypharmacy in cardiovascular patients since it is a growing issue that has been linked to potentially inappropriate prescribing and unfavorable health outcomes, especially in older cardiovascular patients [66,67]. Both during hospital admission and discharge, polypharmacy is frequent, and its frequency is on the rise. Older persons with Heart Failure typically take non-cardiovascular drugs for their condition. Heart Failure-affected older persons require the development of techniques that can reduce the harmful consequences of polypharmacy [68].

CHAPTER TWO

AIM OF THE STUDY

2.1. Main Objective

- To evaluate the recent prescribing patterns in cardiac management in Dhaka North City in Bangladesh.

2.2. Specific Objective

- To analyze the non-pharmacological management situation among cardiac patients.
- To identify whether the cardiac patients are well concerned about polypharmacy or not.
- To find out whether the patients are effectively maintaining prescriptions guidelines or not.
- To find out whether cardiac patients are worried about their disease or not.
- To assess the overall satisfaction and cost-effectiveness of cardiac care.

CHAPTER THREE

LITERATURE REVIEW

3.1. Recent Prescribing Patterns of Cardiac Physicians in Metropolitan Dhaka City, Bangladesh

Abstract: A large number of people in Bangladesh suffer from many cardiovascular diseases (CVDs). Therefore, cardiovascular drugs are one of the major classes of drugs prescribed in Bangladesh. The study of prescribing patterns seeks to monitor, evaluate and suggest modifications in clinicians' prescribing habits to make medical care more rational. This study was mainly focused on the recent trends of prescribing patterns of oral cardiovascular drugs in Dhaka city. It was a questionnaire-based direct interview type of descriptive study, conducted in the cardiology departments of eight most renowned hospitals of Dhaka, during the study period of February 2017 to April 2017. Most patients in the disease states belonged to the older age group of 50-60 years. More male patients were found in the cardiology departments than the female patients. Hypertension was the most prevalent diseases (86.67%) followed by angina (75.00%) and myocardial infarction (53.33%). Most commonly prescribed antihypertensive medication was angiotensin-II receptor blocker (ARB, 55.00%) and individually losartan (61.67%), followed by angiotensin-converting enzyme inhibitor (ACEI, 25.00%) and only ramipril (90.00%). Amlodipine was the first choice of every respondent when prescribing a calcium-channel blocker (CCB). In case of combination products, amlodipine plus atenolol was found to be the most preferred (65%) medication, followed by hydrochlorothiazide plus losartan (40%) [69].

3.2. Prevalence of Cardiovascular Diseases and Prescription Patterns in a Randomly Selected Population in Bangladesh

Abstract: The basis for assessment of cardiovascular disease management is reliable on the demographic study of cardiovascular diseases (CVDs) and drug usage in a population. The aim of this study was not only to observe the prevalence of CVD in a population and the trend of drugs prescribed but to also identify the most prominent CVDs, the reasons behind their occurrence, types of treatment for all kinds of CVDs reported and the reason for choosing the particular drug singly or in a combination with other therapeutic classes. This descriptive study was carried out for a period of three months from July 2016 to the end of September 2016 among 853 patients, of which 427 patients visited National Institute of Cardiovascular Diseases (NICVD) while the other 426 visited the National Heart Foundation Hospital in Dhaka, Bangladesh. The patients were questioned with a self-developed questionnaire and their prescriptions were analysed to comprehend the trends of prescribed medicines and other diagnosis results. Out of 853 patients, the male and female patients were distributed in the ratio 5.8:4.2 with most patients coming from urban areas and suffering from lipid level disorder (more than 48%). The other CVDs reported were hypertension (30%), heart failure (28.5%),

myocardial infarction (20.9%), ischemic heart disease (19.9%), stroke (17.1%) and angina (11%). Among all the combinations of drugs advised, the antianginal, ACE inhibitor and coronary vasodilator combination had a prevalence of 27.5% which was the maximum while the second most prescribed combination was the beta blocker and antihyperlipidemic drug (21.3%). This particular study allowed a detailed and extensive analysis of the CVDs, different methods of diagnosis and preferred treatment choice by the physicians and will also further help to determine and evaluate the usage of cardiovascular drugs utilisation in Bangladesh to successfully manage CVDs in the future [8].

3.3. A review on prescribing patterns of antihypertensive drugs

Hypertension continues to be an important public health concern because of its associated morbidity, mortality and economic impact on the society. It is a significant risk factor for cardiovascular, cerebrovascular and renal complications. It has been estimated that by 2025, 1.56 billion individuals will have hypertension. The increasing prevalence of hypertension and the continually increasing expense of its treatment influence the prescribing patterns among physicians and compliance to the treatment by the patients. A number of national and international guidelines for the management of hypertension have been published. Since many years ago, diuretics were considered as the first-line drugs for treatment of hypertension therapy; however, the recent guidelines by the Joint National Commission (JNC8 guidelines) recommend both calcium channel blockers as well as angiotensin-converting enzyme inhibitors as first-line drugs, in addition to diuretics. Antihypertensive drug combinations are generally used for effective long-term management and to treat comorbid conditions. This review focuses on the antihypertensive medication utilization, their cost factors, adherence to treatment by patients, and physicians' adherence to guidelines in prescribing medications in different settings including Indian scenario. The antihypertensive medication prescribing pattern studies help in monitoring, evaluation and necessary modifications to the prescribing habits to achieve rational and cost-effective treatment. Additionally, periodic updating of recommended guidelines and innovative drug formulations, and prescription monitoring studies help in rational use of antihypertensive drugs, which can be tailored to suit the patients' requirements, including those in the developing countries [70].

CHAPTER FOUR

METHODOLOGY

4.1. Method Design

This present study was designed to be a questionnaire-based observational study conducted by direct interviewing patients with the help of self-structured questionnaires and collecting prescriptions to obtain recent prescribing patterns. This survey was conducted in two renowned hospitals in Dhaka North City, Bangladesh. These are 1. National Heart Foundation Hospital & Research Institute, and 2. National Institute of Cardiovascular Disease (NICVD). This survey was conducted from 11 September 2022 to 13 October 2022 among patients who visited hospitals for cardiac treatment. The total data collected for this study was 107. Prescriptions were collected physically in JPEG format.

4.2. Questionnaire

This survey was conducted by interviewing patients using a questionnaire form. The structured survey questionnaire form was self-developed by reviewing previous studies from various sources such as online scholarly databases, google searches, etc. The questionnaire form consists of 22 questions that took approximately 12-15 minutes to fill up by interviewing patients. The questionnaire form of this study has the following questions:

1. Name
2. Gender
3. Residence
4. Profession
5. How could you know that you had the cardiovascular disease?
6. What type of cardiovascular disease you are suffering from?
7. How long have you been suffering from cardiovascular disease?
8. How long have you been taking cardiovascular medicines?
9. Do you have any other diseases along with cardiovascular diseases?
10. If yes, mention the name of the diseases.
11. What type of medicines you are taking for your cardiovascular disease?
12. Have you ever used non-prescribed medications for your cardiovascular disease?
13. Do you follow prescriptions guideline strictly?
14. Did you face any side effects after taking these medications?
15. If yes, mention the side effects (adverse effects) of medicines that you often faced?
16. Are you maintaining non-pharmacological management? (Lifestyle, food habits, physical activity)
17. Are you well informed about the lifetime continuation of these cardiovascular medications?
18. Are you well concerned about polypharmacy?
19. Are you facing any financial problems to buy these medications?
20. Are you worried about your disease?
21. Are you satisfied with the treatment that your physician provided?
22. Are you getting proper support from family members?

4.3. Inclusion Criteria

The inclusion criteria were that the respondent must be a cardiac patient and had at least a recent cardiac medications prescription generated by a physician.

4.4. Exclusion Criteria

The exclusion criteria were that the cardiac patients who were not willing to take an interview and/or could not provide his/her cardiac medications prescription were avoided from this study. On the others hand, patients who did not have any prescriptions contained cardiac medicines.

4.5. Statistical Analysis

The statistical data analysis was performed using Microsoft (MS) Excel. All data have been entered in the MS Excel sheet and calculated for the percentage, proportion, and/or ratio by developing pie-chart, columns, etc.

CHAPTER FIVE

RESULT AND DISCUSSION

5.1. Result

Number of patients (respondents), **n = 107**

❖ **Gender**

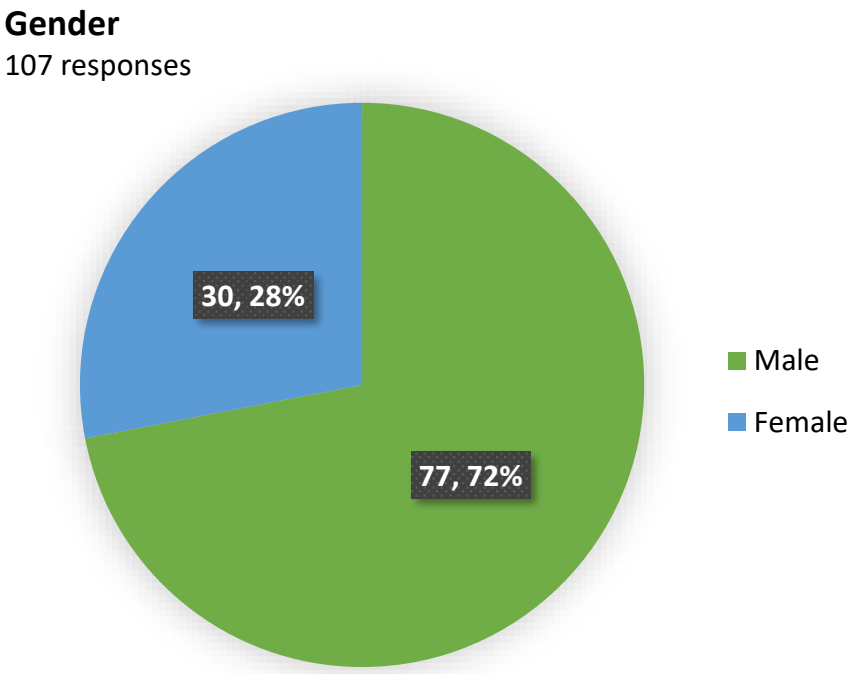


Figure 4: Percentages of the respondents by gender.

According to this survey, 107 cardiac patients responded to the questions about their salutation, with 72% male cardiac patients and 28% **female** cardiac patients.

❖ **Age**

Table 2: Listed the respondents in this survey based on age (range).

Age (Range)	*Respondents*	
	Male	*Female*
<15	0	0
15-30	1	1
31-60	50	28
>60	27	1

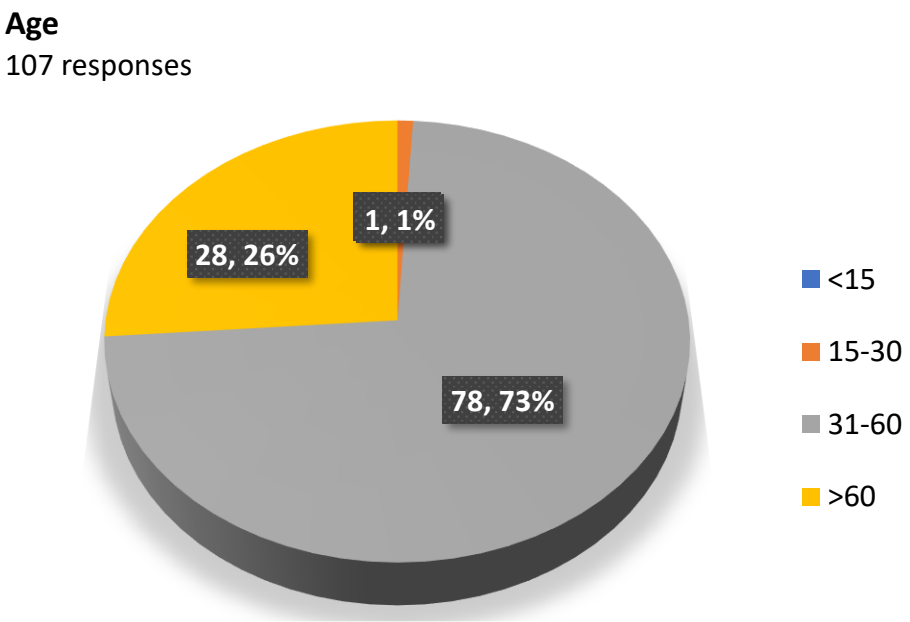
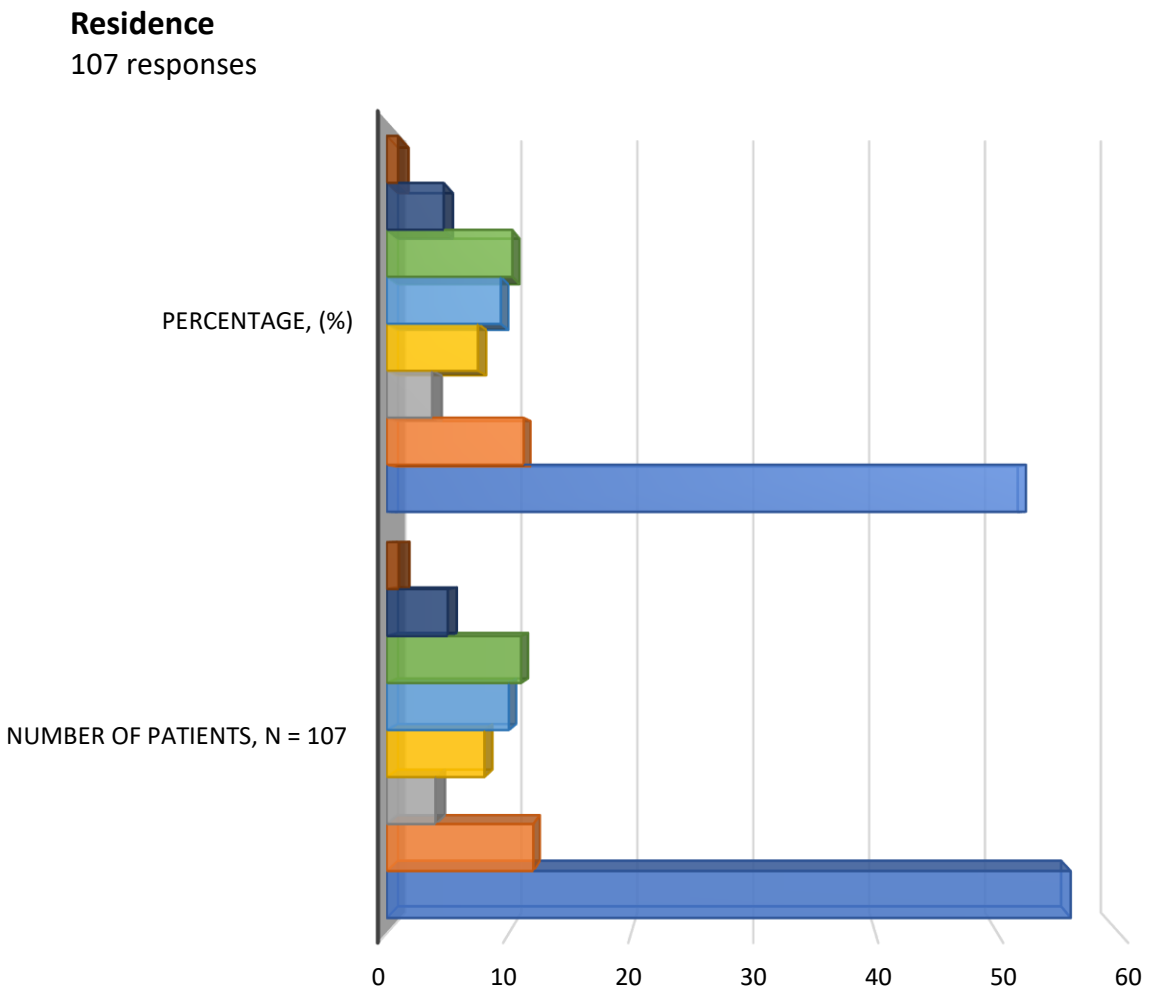


Figure 5: Percentages of the respondents by age range.

The majority of respondents have ages ranging from **31 to 60 years** old which is **73%**. However, it has been observed that **26%** of cardiac patients are over **60 years** (mostly male), while **1%** of cardiac patients are under **15 to 30 years** old range.

❖ **Residence**



	Number of Patients, n = 107	Percentage, (%)
Sylhet	1	0.93
Rangpur	5	4.67
Rajshahi	11	10.28
Mymensingh	10	9.34
Khulna	8	7.47
Barisal	4	3.73
Chattogram	12	11.21
Dhaka	56	52.33

Figure 6: Diagram of the percentages of living areas (divisions) of the respondents.

❖ **Occupational status**

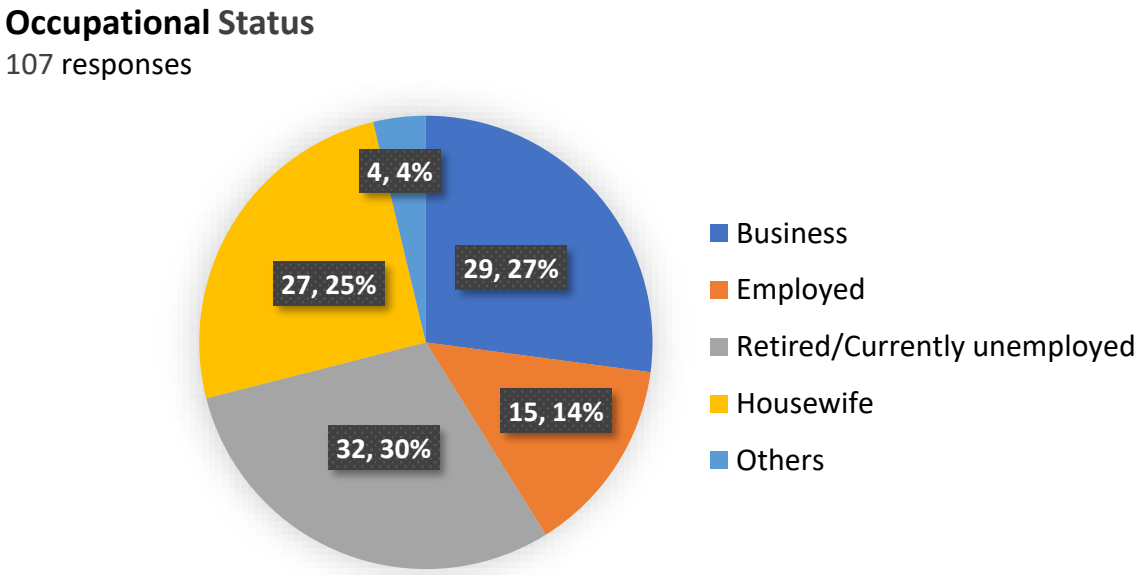
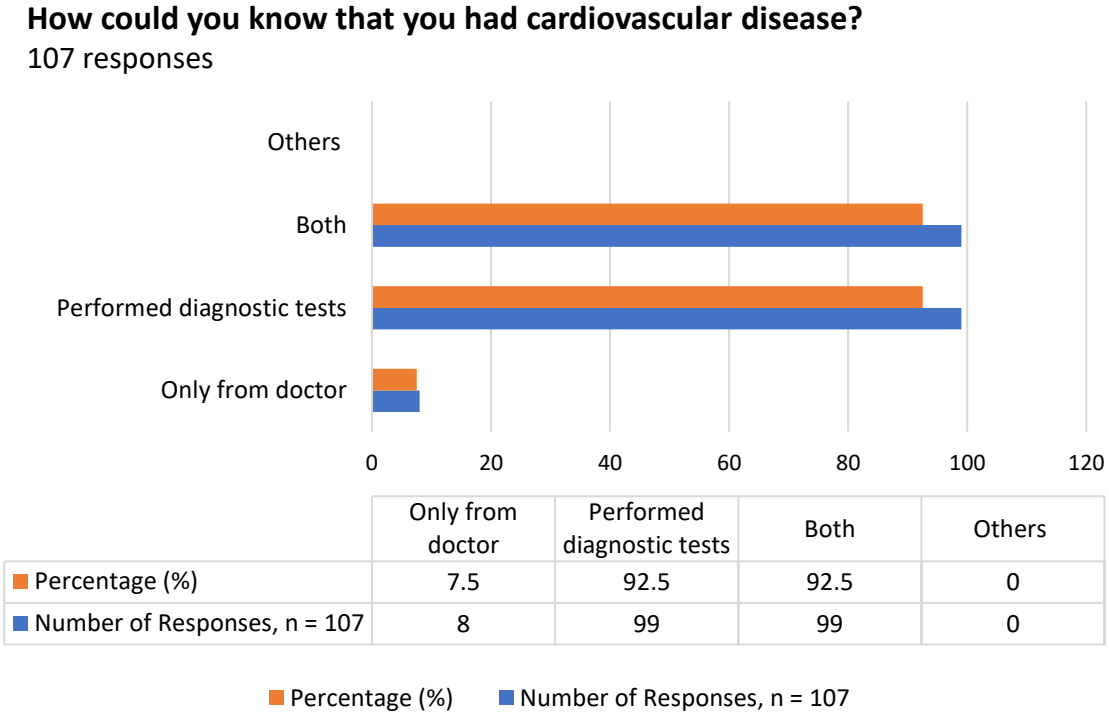


Figure 7: Percentages of the respondents based on occupational status.

According to this survey, the majority of male cardiac patients, almost 30% were currently unemployed or, retired. 25% of female cardiac patients were housewives.

❖ **How could you know that you had the cardiovascular disease?**



	Only from doctor	Performed diagnostic tests	Both	Others
Percentage (%)	7.5	92.5	92.5	0
Number of Responses, n = 107	8	99	99	0

Figure 8: Sources from which respondents received their confirmation of having the cardiac disease.

❖ **What type of cardiovascular disease you are suffering from?**

Table 3: Listed various cardiac conditions experienced by the respondents.

Types of cardiac disease	***Number of Patients (n = 107)***	***Percentage (%)***
Hypertension	103	96.26
Angina Pectoris	70	65.42
Myocardial Infarction	14	13.08
Rheumatic Heart Disease	1	0.93
Coronary Heart Disease	93	86.91
Cardiomyopathy	2	1.86
Valvular Heart Disease	5	4.67
Heart Failure	0	0
Congenital Heart Disease	0	0
Heart Attack	6	5.6
Stroke	7	6.54
Heart Arrhythmias	5	4.67
Carditis	1	0.93

❖ **How long have you been suffering from cardiovascular disease?**

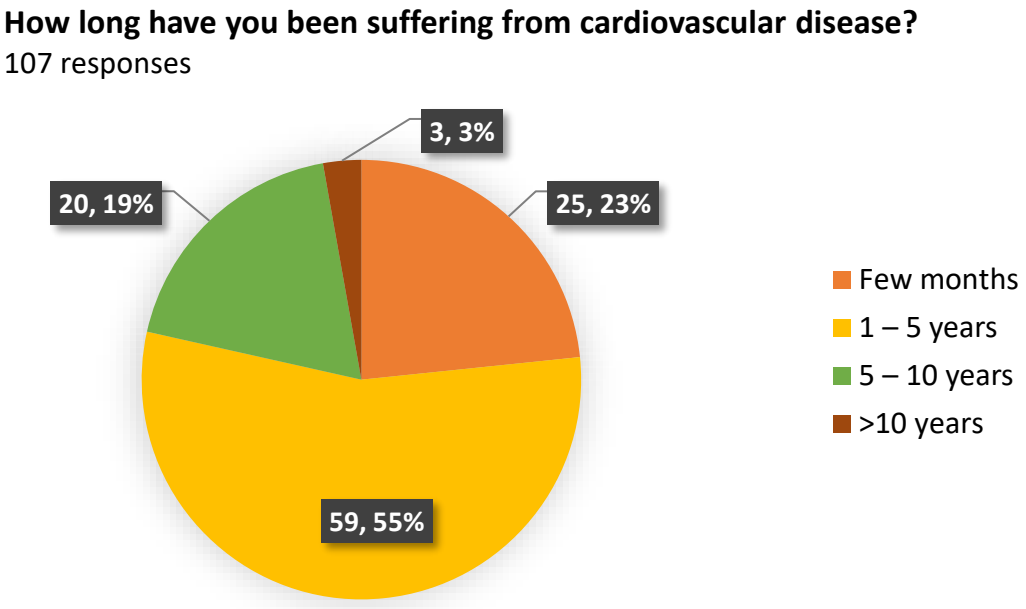


Figure 9: Percentages of the respondents based on the duration of time they had experienced the cardiac disease.

❖ **How long have been taking cardiovascular medicines?**

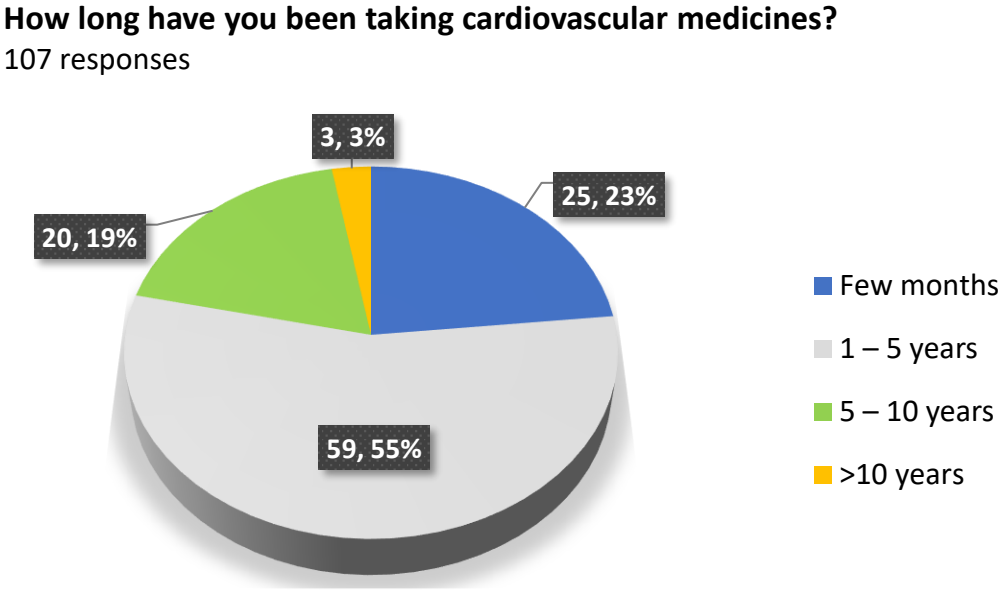


Figure 10: Percentages of respondents who had taken cardiac medications for how long.

❖ **Do you have any other diseases along with cardiovascular disease?**

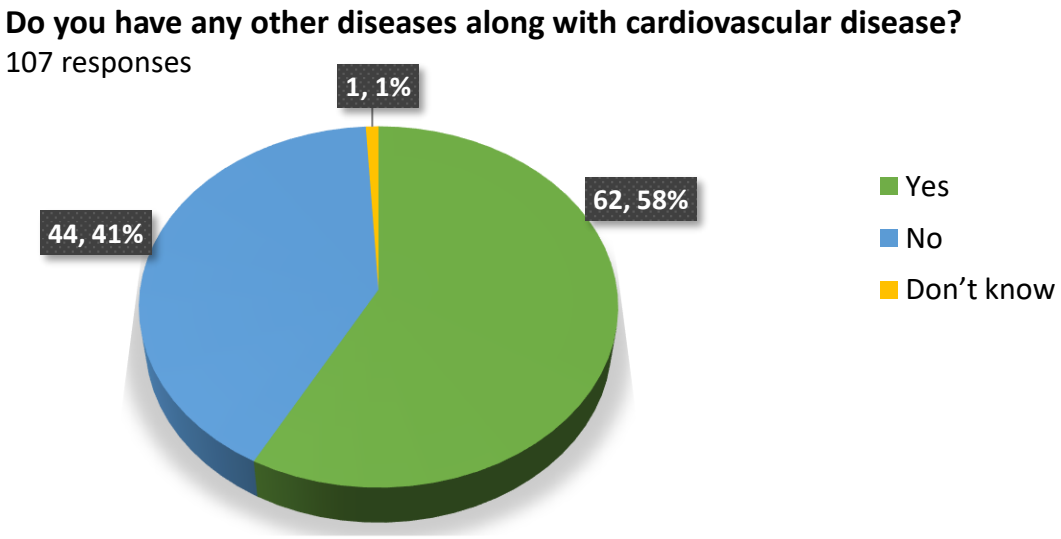


Figure 11: Proportion of the respondents who also have other diseases along with the cardiac disease.

❖ **If yes, mention the name of the disease.**

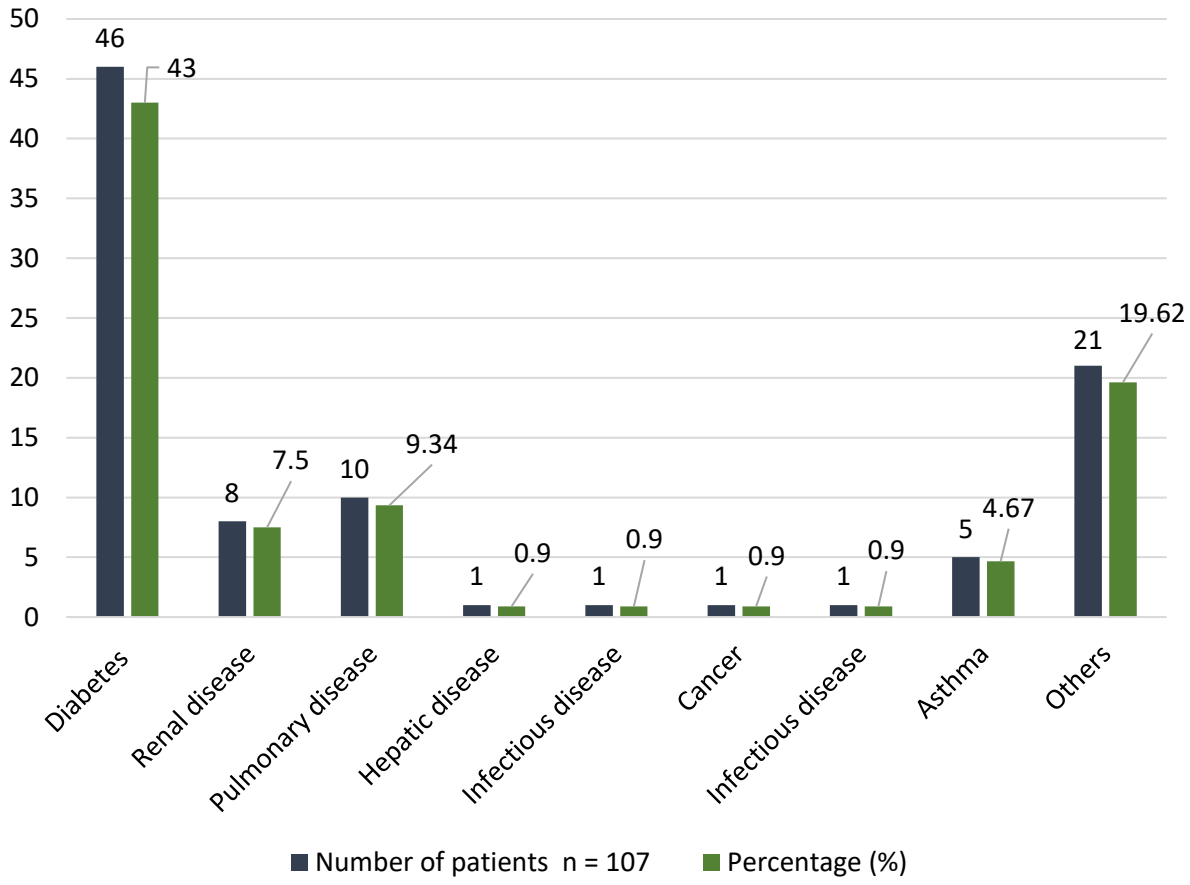


Figure 12: Diagram of other diseases that the respondents had experienced along with cardiac diseases.

❖ **Analysis of prescribing patterns of cardiac disease management:**

Table 4: Listed therapeutic classes for cardiac management in this study.

Therapeutic Class	*Number of prescriptions*	*Percentage (%)*
Beta-blockers	88	82.24
Calcium channel blockers (CCBs)	10	9.34
Nitrates	73	68.22
Angiotensin II receptor blockers (ARBs)	48	44.85
Angiotensin-converting enzyme (ACE) inhibitors	29	27.1
Diuretics	35	32.71
Antithrombotics, Anti-platelets, Anti-coagulants	98	91.58
Lipid-lowering agents	95	88.78
Fatty acid oxidation inhibitors	63	58.87
Potassium channel activators	7	6.54
Soluble guanylate cyclase (sGC) stimulators	2	1.86
HCN channel blockers	2	1.86
Other anti-anginal & anti-ischaemic agents	5	4.67
Anxiolytics	53	49.53

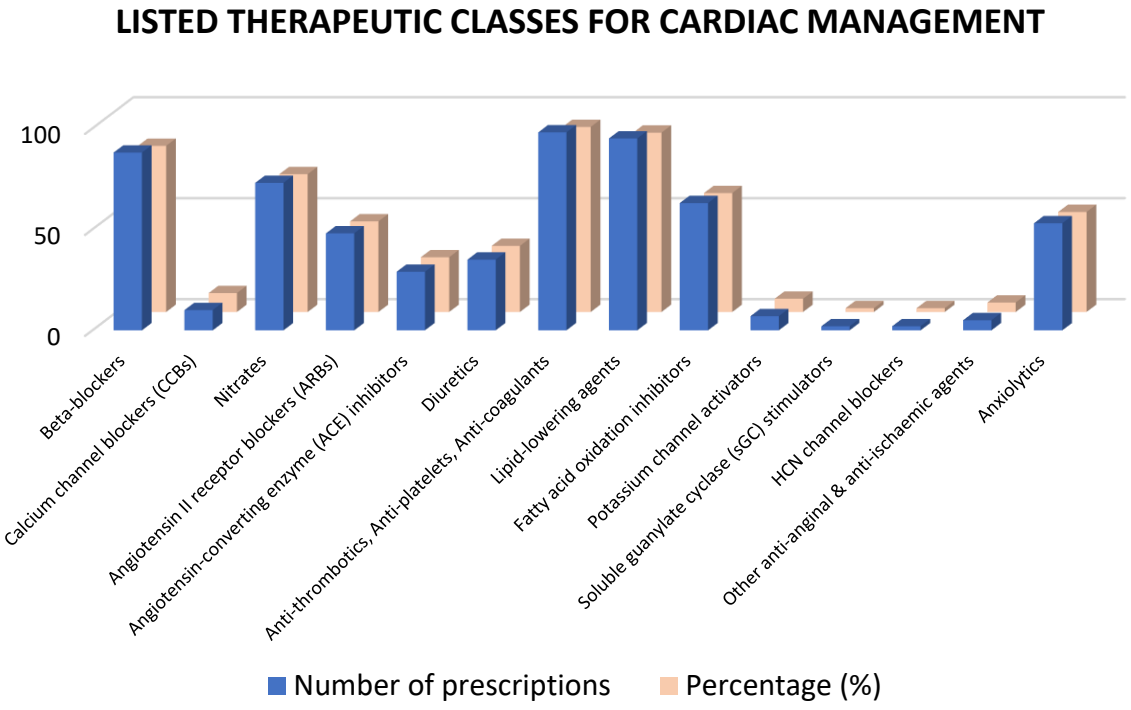


Figure 13: Diagram of listed prescribed therapeutic classes of cardiac management in this study.

Combination drugs prescribed:

Table 5: Listed prescribed combined therapeutic classes for cardiac management.

Combination Drugs	*Number of Prescriptions*	*Percentage (%)*
CCBs + ARBs	4	3.73
Angiotensin receptor-Neprilysin inhibitors (ARNIs) ***(ARBs + Neprilysin inhibitors)***	7	6.54
Diuretics + Beta-adrenoceptor blocker	1	0.93
Beta-blockers + CCBs	1	0.93
ARBs + Diuretics	1	0.93

Diversity in generics of prescribing the same therapeutic class:

- **Beta-blockers**

Table 6: Listed various generics of beta-blockers prescribed among patients.

Generics	*Number of Prescriptions*	*Percentage (%)*
Bisoprolol	55	51.4
Metoprolol	16	14.95
Carvedilol	12	11.21
Nebivolol	4	3.73
Atenolol	1	0.93

- **Calcium Channel Blockers (CCBs)**

Table 7: Listed various generics of CCBs prescribed among patients.

Generics	*Number of Prescriptions*	*Percentage (%)*
Cilnidipine	2	1.86
Amlodipine	5	4.67
Diltiazem	2	1.86
Verapamil	1	0.93

- **Nitrates**

Table 8: Listed various generics of Nitrates (Coronary Vasodilators) prescribed among patients.

Generics	*Number of Prescriptions*	*Percentage (%)*
Nitroglycerin	72	67.28
Isosorbide dinitrate	1	0.93

- **Diuretics**

Table 9: Listed various generics of diuretics prescribed among patients.

Generics	*Number of Prescriptions*	*Percentage (%)*
Furosemide	1	0.93
Spironolactone	1	0.93
Hydrochlorothiazide	1	0.93
Torsemide	2	1.86
Furosemide + Spironolactone	30	28.03

- **Angiotensin II receptor blockers (ARBs)**

Table 10: Listed various generics of ARBs prescribed among patients.

Generics	*Number of Prescriptions*	*Percentage (%)*
Olmesartan	15	14.01
Valsartan	8	7.47
Losartan	7	6.54
Telmisartan	18	16.82

- **Angiotensin-converting enzyme (ACE) inhibitors**

Table 11: Listed various generics of ACE inhibitors prescribed among patients.

Generics	*Number of Prescriptions*	*Percentage (%)*
Ramipril	28	26.16
Enalapril	1	0.93

- **Antithrombotics, Anti-platelets, Anti-coagulants**

Table 12: Listed various generics of Antithrombotics, Anti-platelets, and Anti-coagulants prescribed among patients.

Generics	*Number of Prescriptions*	*Percentage (%)*
Aspirin	8	7.47
Clopidogrel	13	12.14
Aspirin + Clopidogrel	73	68.22
Aspirin + Prasugrel	2	1.86
Aspirin + Ticagrelor	2	1.86

- **Lipid-lowering agents**

Table 13: Listed various generics of lipid-lowering agents prescribed among patients.

Generics	*Number of Prescriptions*	*Percentage (%)*
Atorvastatin	43	40.18
Rosuvastatin	49	45.79
Ciprofibrate	2	1.86
Atorvastatin + Ezetimibe	1	0.93

- **Anxiolytics**

Table 14: Listed various generics of anxiolytics prescribed among patients.

Generics	*Number of Prescriptions*	*Percentage (%)*
Clonazepam	41	38.31
Alprazolam	1	0.93
Bromazepam	5	4.67
Escitalopram	1	0.93
Flupentixol + Melitracen	5	4.67

❖ **Have you ever used non-prescribed medications for your cardiovascular disease?**

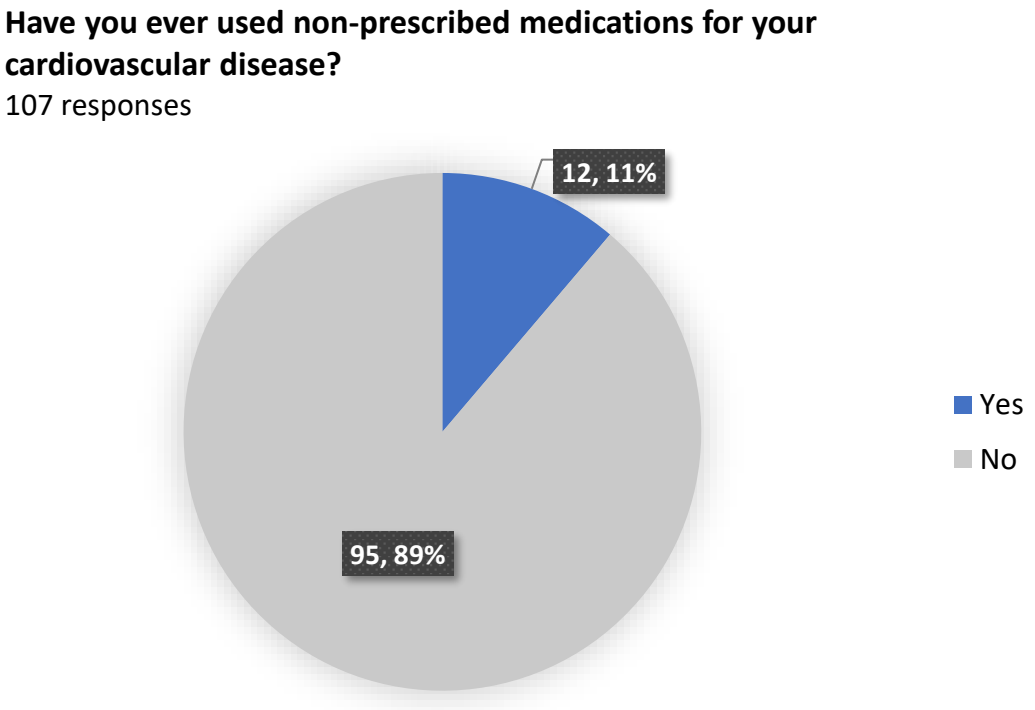


Figure 14: Percentages of the respondents who used non-prescribed medicines.

❖ **Do you follow prescriptions guideline strictly?**

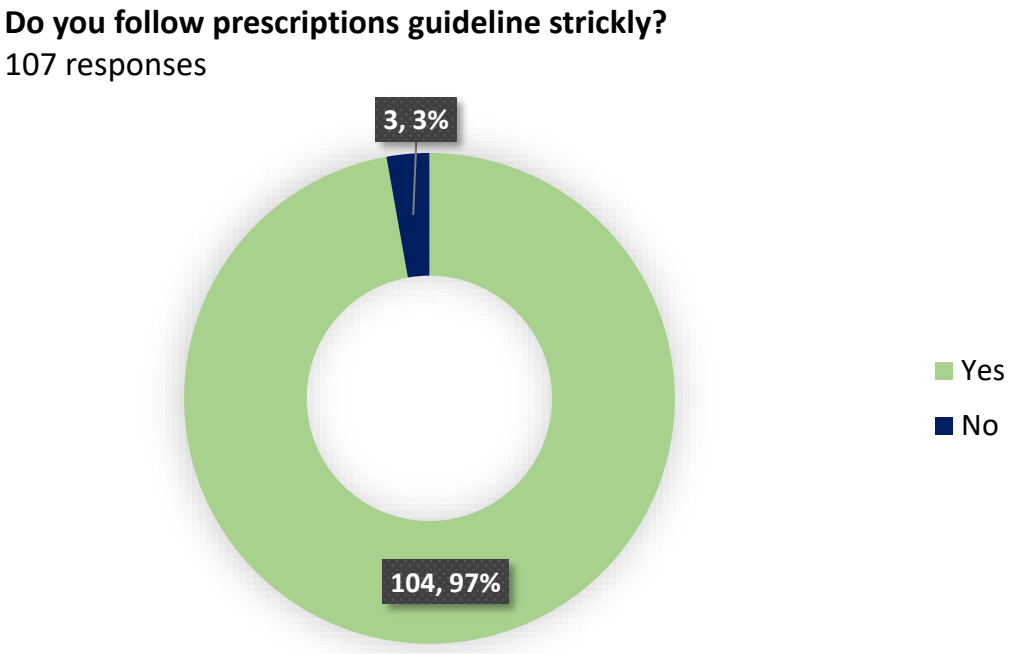


Figure 15: Percentages of the respondents who correctly maintained prescriptions guidelines.

❖ **Did you face any side effects after taking these medications?**

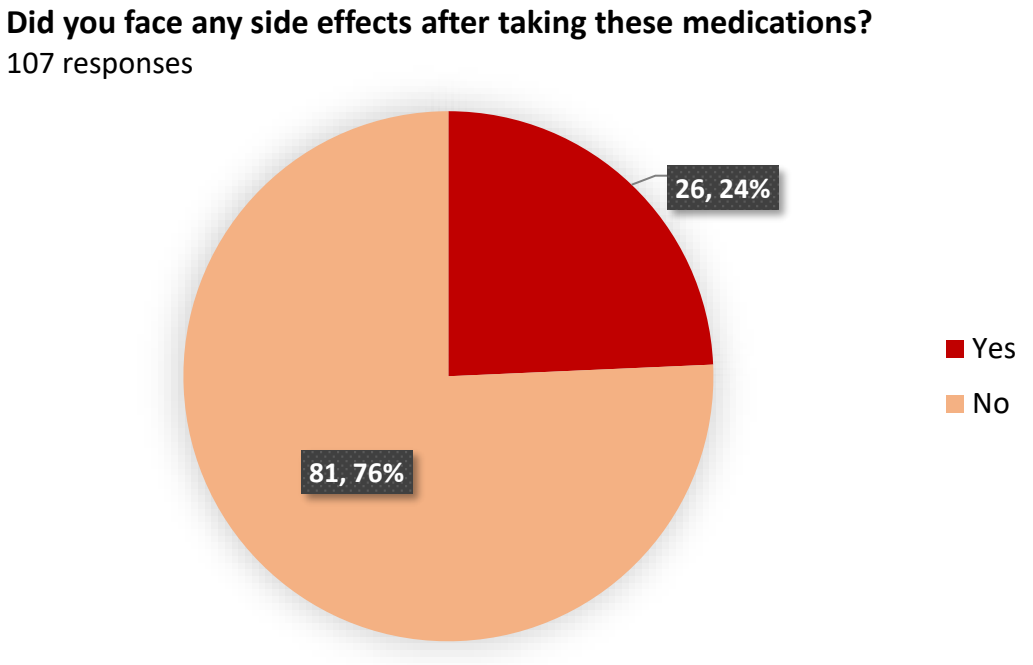


Figure 16: Percentages of the respondents who faced side effects after taking cardiac medications.

❖ **If yes, mention the side effects of medicines that you often faced.**

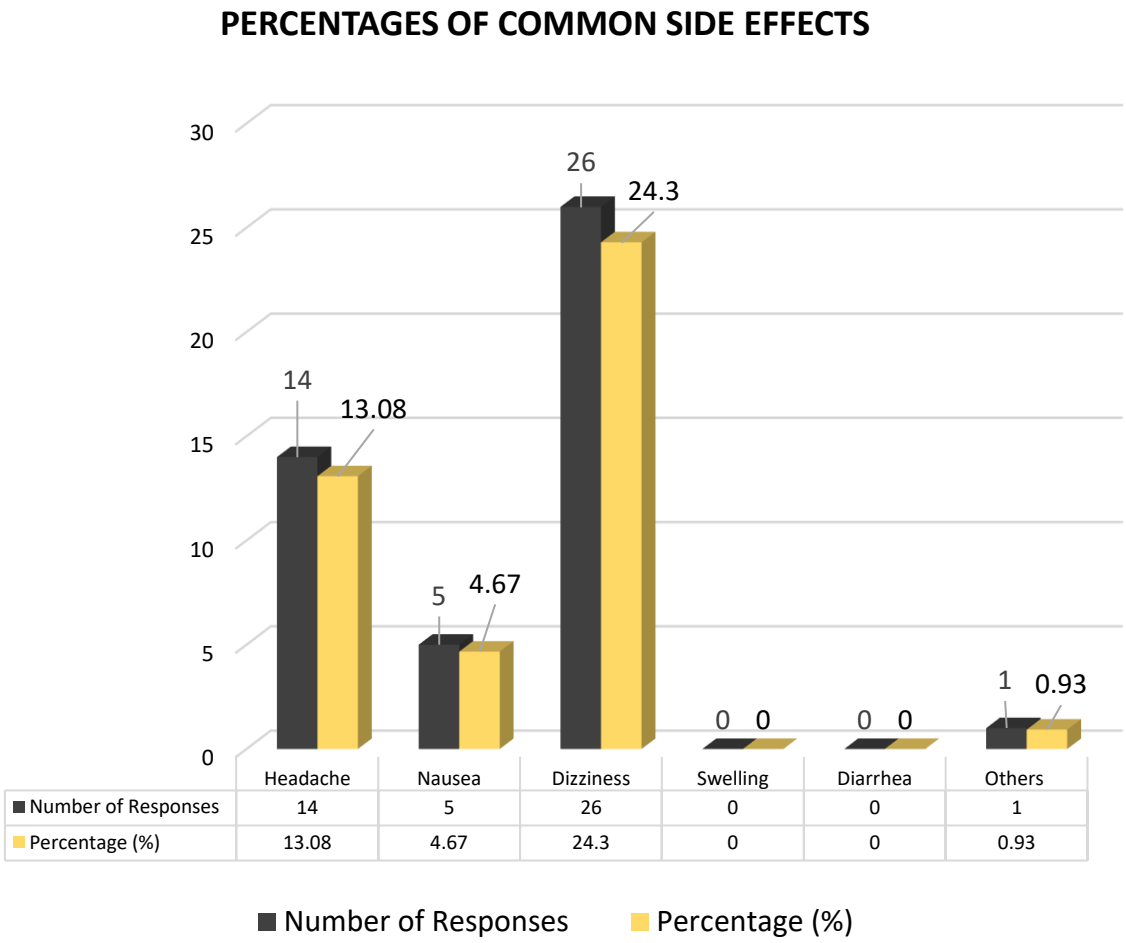


Figure 17: Ratio of the common side effects faced by the respondents after taking cardiac medicines.

❖ **Are you maintaining non-pharmacological management? (Lifestyle, food habits, physical activity)**

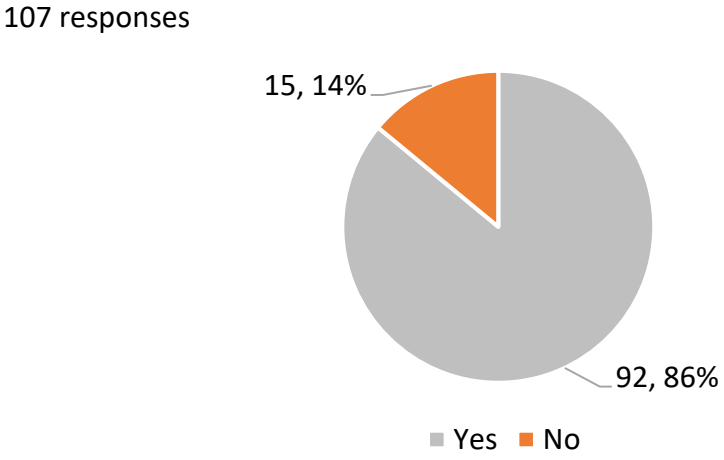


Figure 18: Percentages of the respondents who maintained non-pharmacological management.

❖ **Are you well informed about the lifetime continuation of these cardiovascular medications?**

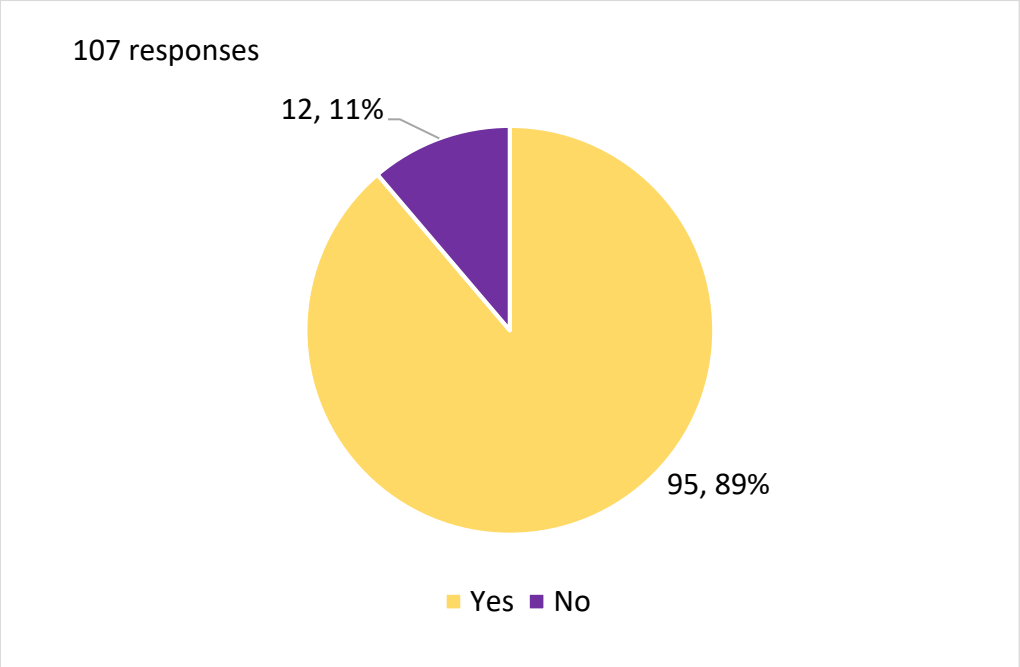


Figure 19: Percentages of the respondents based on how well they were informed about the lifetime continuation of these cardiovascular medications.

❖ **Are you well concerned about polypharmacy?**

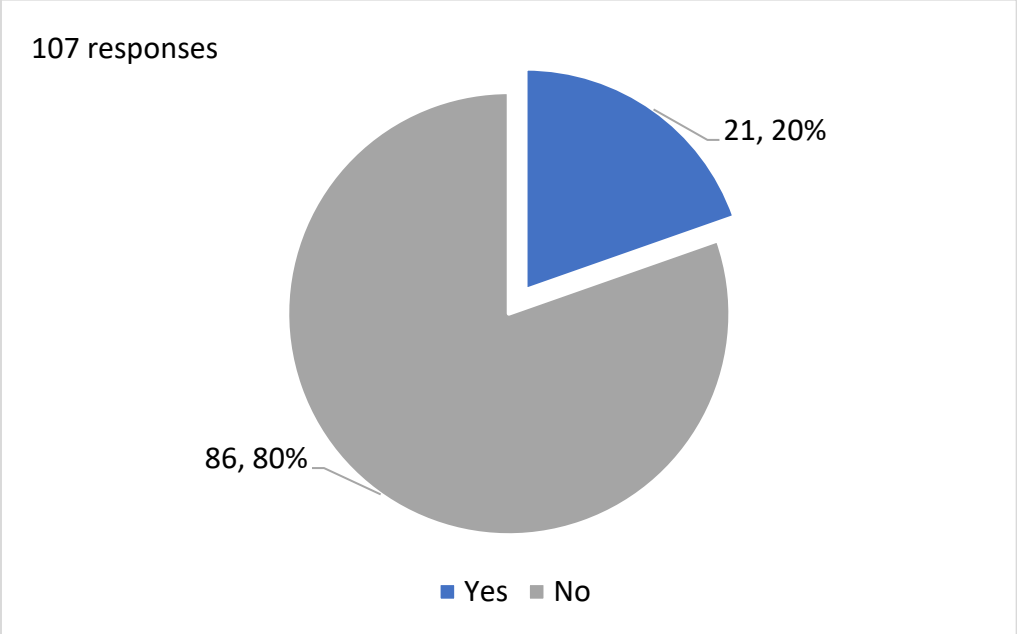


Figure 20: Percentages of the respondents based on how well they are concerned about polypharmacy.

❖ **Are you facing any financial problems to buy these medications?**

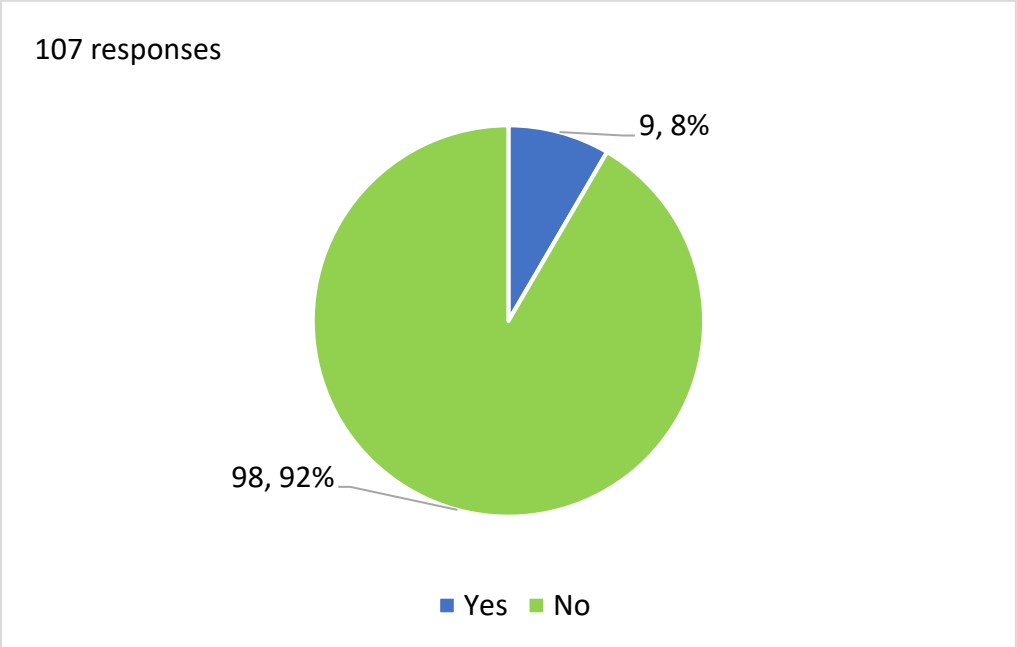


Figure 21: Percentages of the respondents based on the affordability of buying cardiac medicines.

❖ **Are you worried about your disease?**

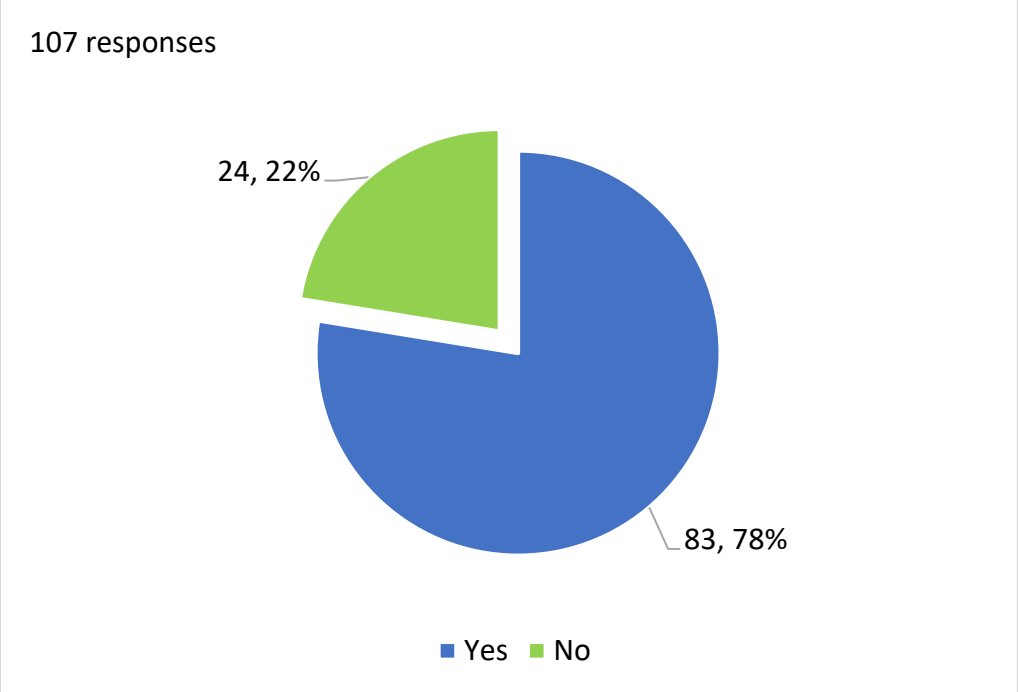


Figure 22: Percentages of the respondents based on how worried they are about their disease.

❖ **Are you satisfied with the treatment that your physician provided?**

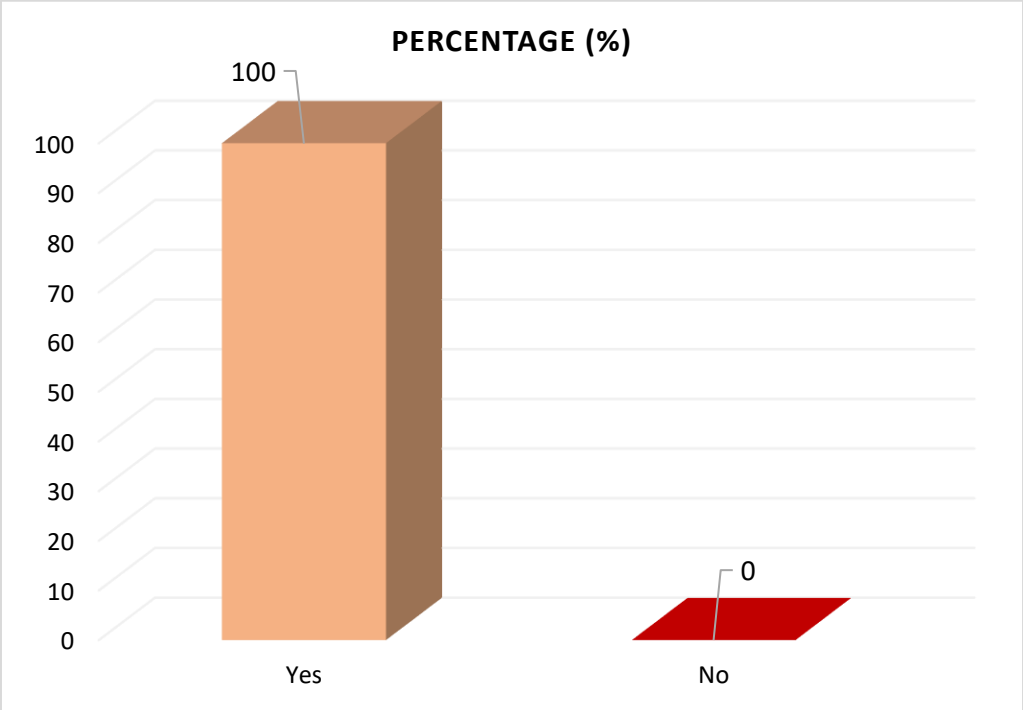


Figure 23: Satisfaction level of the respondents with the cardiac treatment.

❖ **Are you getting proper support from family members?**

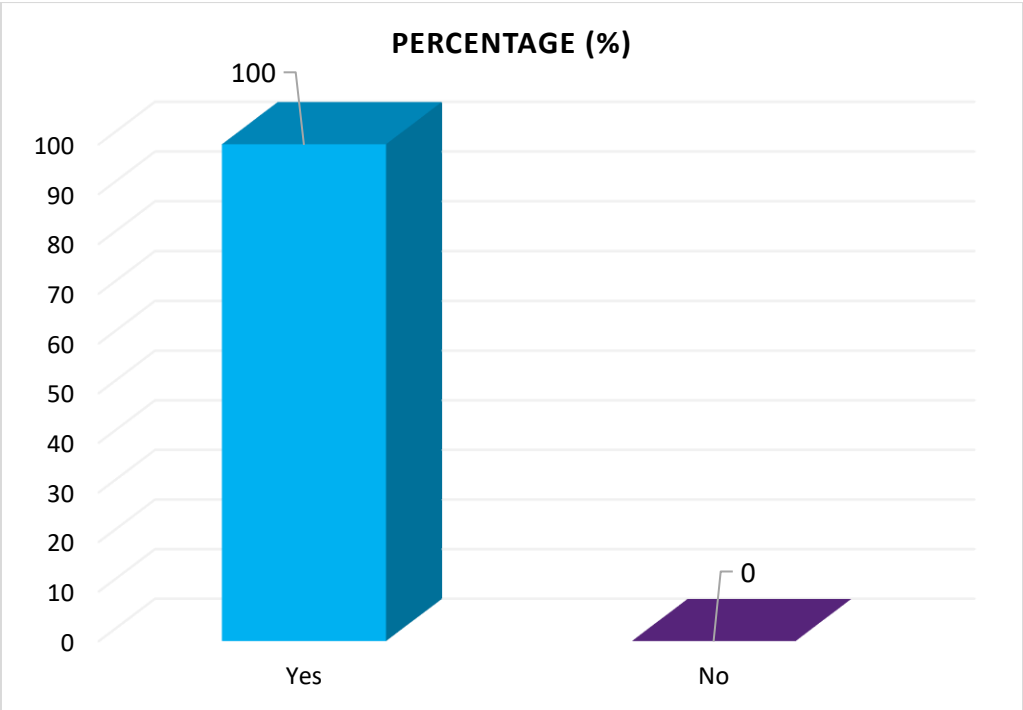


Figure 24: Percentages of the respondents based on the support they are getting from family members.

5.2. Discussion

Discussion is carried out according to the statistical analysis report:

- **Gender/Age/Residence:**
  This study revealed that the majority of the respondents were male, whilst the minority were female patients. While conducting this survey, it was observed that more males were visited for a cardiac check-up than females. So, it may conclude that males are the most susceptible to cardiac disease than females. Various risk factors are associated with it such as unhealthy diet, smoking, no physical activity, family background, variety of clinical conditions, high Low-Density Lipoprotein (LDL) level, stressful events, etc. 73% of the respondents were within the (31-60) years age range, followed by ages above 60 years (28%). The majority of patients came from Dhaka city whereas a minority of the patients were from rural areas. People from all divisions in Bangladesh almost came to visit those two hospitals located in Dhaka North City for their cardiac check-ups maybe because of the treatment facility and/or availability of renowned cardiac physicians in Bangladesh.

- **Common group of cardiac disease:** This study revealed that Hypertension (96.26%), followed by Coronary Heart Disease (86.91%), Angina Pectoris (65.42%), Myocardial Infarction (13.08%), Stroke (6.54%), Valvular Heart Disease (4.67%), Heart Arrhythmias (4.67%), Heart Attack (5.6%), Cardiomyopathy (1.86%), Carditis (0.93%) among 107 respondents. Most of them experienced multiple diseases along with cardiac disease. Most prominently diabetes (43%), followed by pulmonary disease (9.34%), renal disease (7.5), asthma (4.67), and others (19.62%) like arthritis, neuropathy, insomnia, GERD, abdominal fullness, etc.

- **Therapeutic classes for cardiac care:** Individual patients were prescribed various therapeutic classes. Each of the 107 respondents' prescriptions was observed and statistical analysis revealed that prescribed therapeutic classes for cardiac management were Beta-blockers (82.24%), CCBs (9.34%), ARBs (44.85%), ACE inhibitors (27.1%), Diuretics (32.71%), Nitrates (Coronary Vasodilators) (68.22%), Antithrombotics/Anti-platelets/Anti-coagulants (91.58%), Lipid-lowering agents (88.78%), Fatty acid oxidation inhibitors (58.87%), ARNIs (new combination class) (6.54%), sGC stimulators (1.86%), HCN channel blockers (1.86%), Anxiolytics (49.53%), other Anti-anginal & Anti-ischaemic agents (4.67%), Potassium Channel Activators (6.54%). Most of the respondents were advised for lipid-lowering agents, Antithrombotics/anti-platelets/anti-coagulants (mostly a combination of Aspirin + Clopidogrel), Beta-blockers (mostly Bisoprolol), followed by nitrates (mostly Nitroglycerin), ARBs, Fatty acid oxidation inhibitors (Trimetazidine), Anxiolytics (mostly Clonazepam).

- **Preferred combination drugs:** Clopidogrel + Aspirin (68.22%), ARNIs (6.54%), Furosemide + Spironolactone (28.03%), CCBs + ARBs (3.73%), etc.

- **Preferred mostly prescribed generics:**
  - **Beta-blockers:** Most commonly Bisoprolol (51.4%). It may be its high selectivity in beta receptors present in the heart. Others are Metoprolol (14.95%), Carvedilol (11.21%), Nebivolol (3.73%), and Atenolol (0.93%).
  - **CCBs:** Most commonly Amlodipine (4.67%), Cilnidipine (1.86%), Diltiazem (1.86%), and Verapamil (0.93%).
  - **ARBs:** Telmisartan (16.82%), followed by Olmesartan (14.01%), Valsartan (7.47%), Losartan (6.54%).
  - **ACE inhibitors:** Most Ramipril (26.16%) was preferred, followed by Enalapril (0.93%).
  - **Nitrates:** Most commonly Glyceryl Trinitrate (Nitroglycerin) was preferred.
  - **Diuretics:** Most commonly combination of Furosemide + Spironolactone (28.03%) was preferred.
  - **Antithrombotics/Anti-platelets/Anti-coagulants:** A combination of Clopidogrel + Aspirin (68.22%) was most preferred, followed by Aspirin (7.47%), Clopidogrel (12.14%), Aspirin + Prasugrel (1.86%), and Aspirin + Ticagrelor (1.86%).
  - **Lipid-lowering agents:** Mostly Rosuvastatin (45.79%) was preferred, followed by Atorvastatin (40.18%), Ciprofibrate (1.86%), Combination drug such as Atorvastatin + Ezetimibe (0.93%).
  - **Anxiolytics:** Most commonly prescribed anxiolytics were Clonazepam (38.31%), followed by Bromazepam, Flupentixol + Melitracen, and Alprazolam. Escitalopram, etc.

- **Preferred newest medicines:** This study revealed that a few newest medicines were now available in the market and prescribed for cardiac management. These were Angiotensin receptor-neprilysin inhibitors (ARNIs) and Vericiguat (sGC stimulator). Effective monitoring, appropriateness in taking the newest medicines, and providing suggestions and modifications would be relevant for making cardiac care more rational.

- **Non-pharmacological management:** 86% of the respondents in this study were maintaining non-pharmacological management (lifestyle, food habits, physical activity) of cardiac care.

- **Concerned about polypharmacy:** The findings from this study conclude that majority of patients did not concern about polypharmacy. Though the majority were older and had multiple clinical issues with taking multiple medicines for various clinical conditions. So, knowledge about polypharmacy is very essential for all.

- **Affordability of medicines:** This study revealed that almost the majority (92%) of respondents did not face any financial problems to buy prescribed cardiac medicines. It may conclude that the overall scenario of affordability in buying cardiac medicines seems satisfactory.

- **Overall satisfaction and support:** This study concluded that overall 100% of respondents were satisfied with the treatment that physicians provided for cardiac care and they got proper support from their families.

CHAPTER SIX

CONCLUSION

6.1. Conclusion

The regular assessment of drug prescribing patterns and questionnaire-based descriptive study is essential to get more reliable data on prescribing trends, the newest drugs availability, affordability of medicines, and patients' overall satisfaction level about their treatment outcomes. This study mainly aims to observe the recent prescribing patterns of cardiac disease management in Dhaka North City. So, the current study data may or may not be generalized to the whole of Dhaka City in Bangladesh. However, the sample size of this study was quite small to obtain a more precise scenario in prescribing patterns for cardiac disease management. One thing should be ensuring that every cardiac patient should have precise clinical data files. It is still important to educate patients on the consequences of improper medication use as well as the significance of 'appropriate polypharmacy'. Patients also should know the benefits of non-pharmacological management in cardiac care besides pharmacological management. This study concludes that the fewest newly approved drugs were prescribed among cardiac patients such as Vericiguat (sGC stimulators), and ARNIs (Combination of ARBs with neprilysin inhibitors). The proper utilization, therapeutic monitoring, and suggestions among the newest available drugs are also essential to make cardiac care more rational. Moreover, the availability of newly approved drugs will expand the thinking capability as well as reduce cardiac death and hospitalization in the future.

CHAPTER SEVEN

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