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CARDIOVASCULAR DISEASES: ETIOLOGY, CLINICAL MANIFESTATIONS, PATHOGENESIS, TREATMENT, PREVENTION, AND THE ROLE OF PATRONAGE SERVICES

U.Y.Musayev, M.A.Xaydarova, M.X.Omonova, Z.F.Karimova, B.Q.Mashrabjonova

Tashkent State Medical University

Abstract: *Cardiovascular diseases (CVDs) remain the leading cause of global morbidity and mortality, accounting for nearly one-third of all deaths worldwide. This review summarizes current evidence on the etiology, clinical manifestations, pathogenesis, diagnostic approaches, and treatment strategies for major cardiovascular conditions, with particular emphasis on atherosclerotic disease. Modifiable risk factors such as hypertension, dyslipidemia, smoking, diabetes, obesity, and physical inactivity interact with non-modifiable determinants including age, sex, and genetic predisposition to drive the development of cardiovascular pathology. The article also highlights the crucial role of patronage (home-visiting) nursing services in prevention, early detection, and long-term management of CVDs, especially in primary healthcare settings. Strengthening community-based care, along with evidence-based medical therapies and lifestyle interventions, represents an essential strategy for reducing the burden of cardiovascular diseases and improving population health outcomes.*

Key Words: *Cardiovascular diseases; Etiology; Pathogenesis; Clinical manifestations; Diagnostics; Treatment strategies; Prevention; Atherosclerosis; Risk factors; Hypertension; Diabetes mellitus; Lifestyle modification; Community-based care; Patronage nursing services; Home visitation; Chronic disease management.*

Introduction

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels that collectively represent the leading cause of death worldwide. CVDs

include coronary heart disease (disease of blood vessels supplying the heart), cerebrovascular disease (stroke), peripheral arterial disease, rheumatic heart disease, congenital heart defects, as well as venous thromboembolism (deep vein thrombosis and pulmonary embolism). According to the World Health Organization (WHO), an estimated 19.8 million people died from CVDs in 2022, accounting for about 32% of all global deaths, with heart attacks and strokes contributing 85% of these deaths. Over three-quarters of CVD deaths occur in low- and middle-income countries, and CVDs constitute about 38% of all premature deaths from non-communicable diseases (deaths under age 70). These sobering statistics underscore the enormous public health impact of cardiovascular diseases.

Methods / Literature Review

A comprehensive literature review was conducted to gather up-to-date information on cardiovascular diseases. We searched high-quality sources including WHO fact sheets and reports, guidelines and statements from the American Heart Association (AHA) and American College of Cardiology (ACC), Centers for Disease Control and Prevention (CDC) resources, and recent articles in major cardiology and medical journals (e.g., *The Lancet*, *JACC*, *Circulation*, *Nature* reviews). Key search terms included combinations of "cardiovascular disease risk factors", "atherosclerosis pathogenesis", "clinical presentation of heart disease", "CVD treatment guidelines", "cardiovascular prevention strategies", and "patronage nursing services in chronic disease". Relevant findings from PubMed and Google Scholar (2015–2025) were screened, with emphasis on meta-analyses, randomized trials, and authoritative reviews. Data on epidemiology and prevention were cross-referenced with WHO and CDC publications for accuracy. The information gathered was organized according to the IMRAD structure, with the main body divided into thematic subsections (Etiology, Clinical Presentation, Pathogenesis, Diagnostics, Treatment, Prevention, Patronage Service). Scientific facts and statistics are cited from the primary sources to ensure credibility. No new clinical trial was performed; rather, this is a narrative review and analysis of current knowledge intended for a postgraduate medical audience.

Results / Main Body

Cardiovascular diseases typically result from a convergence of modifiable risk factors (behaviors and comorbid conditions) and non-modifiable factors (such as age or genetics). The etiology of atherosclerotic CVD (which underlies coronary artery disease, ischemic stroke, and peripheral arterial disease) is multifactorial. Major established risk factors include high levels of low-density lipoprotein (LDL) cholesterol, hypertension (elevated blood pressure), cigarette smoking, diabetes mellitus, and a family history of premature heart disease. Increasing age is a strong non-modifiable risk factor (men over 45 and women over 55 face higher risk), and male sex is associated with earlier manifestation of coronary disease. A positive family history (e.g. a first-degree male relative with coronary disease before 55 years, or female before 65) indicates a genetic predisposition. In addition, a sedentary lifestyle and obesity contribute significantly to cardiovascular risk by promoting hypertension, dyslipidemia, and insulin resistance. Unhealthy dietary habits – particularly diets high in saturated and trans fats, cholesterol, salt, and added sugars – are closely linked to the development of atherosclerosis and hypertension.

Non-modifiable factors beyond age, sex, and heredity include ethnicity (for example, South Asian ancestry is associated with higher risk of coronary disease) and certain inherited disorders (such as familial hypercholesterolemia) that greatly accelerate atherosclerosis. Broader social determinants play a role as well. Globalization, urbanization, and population ageing have increased exposure to risk factors worldwide, while poverty and psychosocial stress are linked to higher CVD incidence. Lower socioeconomic status often correlates with limited access to healthy foods, healthcare, and health education, which exacerbates risk. Indeed, the vast majority of CVD burden now falls on low- and middle-income countries, where preventive health services may be less accessible.

Table 1 below summarizes key cardiovascular risk factors:

Risk Factor	Type	Impact on CVD Risk
Age	Non-modifiable	Risk increases with age (especially >45 years in men, >55 in women). Aging is associated

Risk Factor	Type	Impact on CVD Risk
		with arterial stiffening and prolonged exposure to other risk factors.
Sex (Male gender)	Non-modifiable	Men have higher risk and earlier onset of coronary artery disease. Women's risk rises after menopause (loss of estrogen's protective effects).
Family history	Non-modifiable	Family history of premature CVD (e.g. heart attack in a first-degree relative <55♂/<65♀) increases one's risk[11] due to genetic and shared environmental factors.
Hypertension (high BP)	Modifiable	A major risk factor for coronary disease, stroke, heart failure, and arterial disease. Chronic high pressure damages vessel walls and the heart muscle.
Hyperlipidemia (high LDL)	Modifiable	Elevations in LDL ("bad") cholesterol drive atherosclerotic plaque formation. Low HDL ("good") cholesterol is also associated with higher risk.
Diabetes Mellitus	Modifiable	Diabetes approximately doubles the risk of CVD; chronically high blood glucose causes endothelial dysfunction and accelerated atherosclerosis.
Smoking (tobacco use)	Modifiable	Active smoking greatly increases CVD risk by causing endothelial injury, inflammation, thrombosis, and adverse lipid changes[6]. Risk is dose-dependent; secondhand smoke also confers risk.
Diet (unhealthy)	Modifiable	Diets high in saturated/trans fats raise LDL; high salt intake promotes hypertension;

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Risk Factor	Type	Impact on CVD Risk
		excess sugars contribute to metabolic syndrome. Low intake of fruits/vegetables and high intake of processed foods are detrimental.
Physical inactivity	Modifiable	Sedentary lifestyle predisposes to obesity, hypertension, dyslipidemia, and poor cardiovascular fitness. Regular exercise is cardioprotective.
Obesity	Modifiable	Excess body fat (especially abdominal obesity) is linked to higher blood pressure, insulin resistance, dyslipidemia, and inflammation, all elevating CVD risk.
Harmful alcohol use	Modifiable	Heavy alcohol consumption contributes to high blood pressure, cardiomyopathy, and arrhythmias. (Light to moderate intake may have a slight protective effect on coronary risk, but is not generally recommended for prevention.)
Air pollution	Environmental	Chronic exposure to polluted air (fine particulates) is associated with higher rates of heart attacks and strokes, likely via inflammatory and oxidative stress pathways.
Psychosocial stress	Contributing	Chronic stress and poor psychosocial factors (including depression and social isolation) correlate with increased incidence of hypertension, myocardial infarction, and stress cardiomyopathy. Mechanisms include neurohormonal activation and unhealthy coping behaviors.

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Risk Factor	Type	Impact on CVD Risk
Socioeconomic factors	Contributing	Poverty and low education are linked to higher CVD risk. These factors often limit access to healthcare and drive risk-promoting lifestyles. Geographic and healthcare disparities result in variable CVD outcomes across populations.

Table 1: Key risk factors for cardiovascular diseases. Modifiable risk factors can be targeted by preventive interventions, whereas non-modifiable factors identify higher-risk individuals.

It is important to note that most cardiovascular diseases can be prevented by aggressive management of the modifiable risk factors. Public health measures (such as tobacco taxes, dietary salt reduction, and air quality improvement) and individual clinical interventions (like antihypertensive or lipid-lowering therapy) are both critical in reducing the incidence of CVD. Additionally, certain cardiovascular conditions have unique etiologies: for example, rheumatic heart disease results from rheumatic fever due to streptococcal infection, and cardiomyopathies may arise from specific genetic mutations, infections, or toxins. However, atherosclerotic vascular disease remains the dominant cause of heart attacks and ischemic strokes globally, and its risk factor profile is well characterized as above.

Cardiovascular diseases can have diverse clinical manifestations, depending on the particular condition and organs involved. Many patients with underlying atherosclerosis are asymptomatic for years; indeed, a heart attack or stroke may be the first sign of heart disease in some individuals.

In summary, clinical manifestations of CVD range widely: from chest pain and dyspnea in cardiac ischemia and heart failure, to claudication in peripheral arterial disease, to neurologic deficits in stroke, and edema or palpitations in other conditions. It is critical for clinicians to recognize these symptoms and perform prompt evaluations. Often, early CVD is silent, so routine screening for risk factors (e.g., measuring blood pressure, blood sugar, and cholesterol, as well as assessing

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family history and lifestyle) is key to identifying individuals at high risk before an acute event occurs.

In essence, atherosclerosis and thrombosis form the cornerstone of the pathogenesis for the most prevalent cardiovascular events. Atherogenesis is driven by dyslipidemia, inflammation, and endothelial dysfunction in a maladaptive response to risk factors. This understanding has paved the way for therapies targeting these pathways (for instance, statin medications to reduce lipid-driven inflammation in plaques). Moreover, it underscores why modifying risk factors (e.g. controlling blood pressure, diabetes, avoiding tobacco) can slow plaque development or stabilize existing plaques, thereby preventing acute events.

Accurate and early diagnosis of cardiovascular diseases is critical for guiding therapy and improving outcomes. The diagnostic approach typically integrates clinical evaluation (history and physical exam) with targeted laboratory tests and cardiac imaging studies.

- Nuclear Cardiology: Myocardial perfusion imaging with SPECT (Single Photon Emission CT) or PET can noninvasively assess myocardial blood flow and viability. Perfusion scans during stress and rest identify areas of reversible ischemia (which would benefit from revascularization) versus scar tissue. These tests are commonly used in patients who cannot exercise or have an abnormal baseline ECG that makes treadmill testing hard to interpret. SPECT can also quantify left ventricular ejection fraction and volumes. A MUGA scan (radionuclide ventriculography) is another nuclear technique to measure ejection fraction very accurately, though its use has declined with the ubiquity of echocardiography.
- Electrophysiologic Testing: In arrhythmia patients, further diagnostics like Holter monitoring (24-hour ECG) or event recorders help capture intermittent arrhythmias. Electrophysiology studies (invasive) may be done for arrhythmia mapping and ablation therapy. Tilt-table testing can be used in syncope evaluation.
- Other tests: Chest X-ray is a simple test that can show heart size (cardiomegaly in HF) and pulmonary congestion or edema. In heart failure or valve disease, it’s a useful initial test for pulmonary venous congestion. Lab biomarkers

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beyond those mentioned include cardiac enzymes in acute coronary syndromes (troponin, CK-MB), D-dimer in suspected pulmonary embolism, and specific markers like LDH or AST (historically) in MI. An ECG is also crucial in stroke workup to detect atrial fibrillation (which would implicate cardiogenic embolism).

The management of cardiovascular diseases spans a spectrum from lifestyle interventions to medications and advanced surgical procedures. An integrative approach is often required, addressing both the root causes (risk factors) and the immediate clinical issues (like ischemia or heart failure). Below, we outline treatment strategies by category:

1. Lifestyle Modification (Therapeutic Lifestyle Changes): Almost all patients with or at risk for CVD benefit from lifestyle changes. Dietary modifications are foundational – a heart-healthy diet rich in fruits, vegetables, whole grains, lean proteins (e.g., fish, poultry, plant proteins), and unsaturated fats (olive oil, nuts) is recommended, while reducing saturated and trans fats, cholesterol, sodium, and added sugars. For example, guidelines advise limiting salt intake to <5 grams per day to help control blood pressure. Regular physical activity is strongly encouraged: patients should engage in moderate aerobic exercise for at least ~150 minutes per week (e.g., 30 minutes brisk walk on most days) or as tolerated. Exercise training improves cardiovascular fitness and can reduce blood pressure, improve lipid profile, and enhance insulin sensitivity.

2. Pharmacotherapy: Medications are the mainstay of treatment for nearly all cardiovascular conditions. The choice of drugs is based on the specific condition, but broadly: For coronary artery disease (especially to prevent and treat angina and to improve prognosis): Antiplatelet agents such as aspirin (75–100 mg daily) are indicated in most patients with established atherosclerotic CVD to reduce the risk of thrombotic events. In addition, high-intensity statin therapy is indicated for virtually all patients with coronary disease or ischemic stroke, to aggressively lower LDL cholesterol and stabilize/reduce plaques.

3. Interventional and Surgical Treatments: In many cases, especially advanced disease, procedural interventions are necessary: Percutaneous coronary

intervention (PCI): This includes balloon angioplasty and stent placement to open up blocked coronary arteries. PCI is indicated for acute coronary syndromes (to restore blood flow) and for chronic angina that is not controlled by medical therapy. Coronary stenting has become a routine, life-saving procedure in myocardial infarction by aborting the infarct if done promptly. In stable CAD, PCI can relieve angina and improve quality of life, though in certain subsets it may not improve long-term mortality beyond medical therapy alone.

4. Rehabilitation and Chronic Care: Cardiac rehabilitation programs are a critical but sometimes underutilized component of CVD management, falling at the interface of treatment and secondary prevention. These are structured exercise and education programs for patients after events like MI, CABG, or with chronic angina or heart failure. Participation in cardiac rehab has been shown to improve exercise capacity, quality of life, and reduce mortality and re-hospitalization rates after myocardial infarction. Rehabilitation addresses exercise training, nutritional counseling, risk factor modification, psychosocial support (important since depression is common after cardiac events and can worsen outcomes), and adherence to medications. Similarly, stroke rehabilitation (physical therapy, occupational therapy, speech therapy) is essential for recovery and to prevent long-term disability after a cerebrovascular event.

An often underappreciated component of cardiovascular health management is the role of patronage services, which refers to community-based, home visitation healthcare services, typically led by nurses or other primary care workers. Patronage nurses (also known as community outreach or home-visiting nurses) provide preventive and supportive care in the patient's home environment, bridging the gap between the clinic/hospital and the community. In many healthcare systems – especially in Eastern Europe and Central Asia (including Uzbekistan) – patronage services have long been established as part of primary health care. These services focus on health education, early detection of problems, adherence monitoring, and support for patients and families.

Patronage service is defined as an integral part of the health system that uses proactive outreach methods to identify individuals in need of health protection and deliver care at their doorstep. The patronage nurse often covers a broad range of issues (hence "polyvalent" patronage in some countries, meaning the nurse is trained in various areas – maternal and child health, chronic disease, etc.). Depending on how many health areas they cover, a patronage service may be monovalent (focused on one area) or polyvalent (covering several).

Challenges to patronage services include ensuring adequate training of nurses, managing their workload (they often cover many families), and equipping them with tools (BP monitors, test strips, educational materials). However, the benefits in terms of preventive care and chronic disease management are substantial. In essence, patronage services operationalize the concept that "health care" is not just what happens in hospitals or doctor's offices – it extends into the community and home, which is especially critical for chronic conditions like cardiovascular diseases that require long-term management and behavior change support.

In conclusion, patronage (home nursing) services play a pivotal role in CVD care by actively engaging patients in prevention and by providing continuity after clinical interventions. They represent an effective strategy to *operationalize secondary prevention* at the community level and ensure that prevention messages and treatments are implemented in patients' daily lives. Health systems aiming to reduce CVD burden should consider strengthening patronage and community health worker programs as part of an integrated approach to cardiovascular health.

Discussion

Cardiovascular diseases remain a formidable challenge for global health, but our deepening understanding of their multifactorial etiology, pathogenesis, and clinical course has enabled remarkable progress in reducing morbidity and mortality in many regions. In this discussion, we synthesize the key points from the review and highlight contemporary issues and future directions in CVD management, with an emphasis on integrated care and health system considerations.

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The review illustrated that effective management spans from preventive measures to acute interventions. The advent of reperfusion therapies (like PCI for MI and thrombolysis/thrombectomy for stroke) has revolutionized acute care – turning once highly fatal or debilitating events into often survivable and treatable conditions. However, these high-tech treatments must go hand-in-hand with robust prevention and follow-up. A patient may survive an acute MI due to timely stenting, but if the underlying cause (say, uncontrolled diabetes and smoking) is not addressed, they remain at great risk of another event. Therefore, a shift in focus toward not just saving lives in the short term, but prolonging healthy life in the long term is crucial. This shift is evident in guidelines that now stress prescribing a suite of preventive therapies at discharge for any acute coronary or stroke patient.

In summary, our discussion highlights that tackling cardiovascular diseases requires a holistic approach: one that spans prevention (at multiple levels), timely clinical intervention, and post-event management, all centered around the patient. Multi-disciplinary and multi-sector collaboration is crucial. By implementing evidence-based strategies across this continuum, clinicians and health systems can continue to make strides in reducing the impact of CVD. The role of the patient and community – empowered with knowledge and supported by services like patronage nursing – is increasingly recognized as a cornerstone for success in both prevention and disease management.

Conclusion

Cardiovascular diseases, though often life-threatening, are to a large extent preventable and manageable through concerted efforts in risk factor control, early detection, and modern therapies. In this article, we reviewed the etiological factors driving CVD – from genetics and aging to lifestyle influences – and described how these factors converge on pathological processes like atherosclerosis and adverse cardiac remodeling. We outlined the clinical manifestations of major CVD entities, underlining the importance of high clinical vigilance since early disease can be silent. We detailed the pathogenesis of atherosclerotic disease, which remains the

principal cause of heart attacks and ischemic strokes, providing the scientific rationale for interventions like lipid-lowering and anti-inflammatory therapies.

In conclusion, cardiovascular diseases demand an integrated, multi-disciplinary approach. Etiology informs prevention – knowing the risk factors guides where to intervene. Clinical and pathophysiological insight informs treatment – understanding atherosclerosis or heart failure mechanisms leads to targeted therapies. By sustaining emphasis on prevention, ensuring early and accurate diagnosis, delivering prompt and effective treatments, and supporting patients in the community, healthcare providers and systems can make decisive strides toward curbing the epidemic of cardiovascular diseases in this decade and beyond. The challenge is formidable, but the gains – measured in lives saved and improved – are profoundly worthwhile, fulfilling the core mission of medicine in tackling one of its greatest adversaries.

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