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Cardiovascular Disease Burden and Associated Risk Factors among Adults with Type 2 Diabetes Mellitus in Sub-Saharan Africa: A Narrative Review

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Abstract

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality among individuals with type 2 diabetes mellitus (T2DM) globally, and its burden is increasing rapidly in sub-Saharan Africa due to rising diabetes prevalence, population ageing, urbanization, and constrained health systems. This narrative review synthesizes evidence on the prevalence of CVD and associated risk factors among adults with T2DM in sub-Saharan Africa. A structured literature search was conducted across PubMed/MEDLINE, Scopus, Google Scholar, and African Journals Online, covering English-language publications from January 2000 to December 2025. Following screening and eligibility assessment, 42 studies were included and synthesized descriptively. The reviewed literature indicates that CVD is a common complication among adults with T2DM in sub-Saharan Africa, with reported prevalence ranging from approximately 20% to over 50%, depending on study setting and methodology. Hypertension-related CVD was the most frequently reported manifestation, followed by stroke, heart failure, and coronary artery disease. Increasing age, longer duration of diabetes, hypertension, poor glycemic control, dyslipidaemia, obesity, and adverse lifestyle behaviors emerged consistently as major cardiovascular risk factors. In addition, health system weaknesses—such as limited access to care, inadequate screening and diagnostic capacity, medication stock-outs, and fragmented chronic disease services—together with socioeconomic disadvantage, were recurrently associated with poor cardiovascular outcomes. Overall, the evidence highlights a substantial and growing cardiovascular burden among patients with T2DM in sub-Saharan Africa, driven by a convergence of modifiable clinical risk factors and structural health system and socioeconomic challenges. Strengthening integrated diabetes and cardiovascular care, improving access to essential services, and addressing underlying social determinants of health are critical priorities for reducing cardiovascular morbidity and mortality in this population.

Keywords: *Cardiovascular Disease, Health System Determinants, Prevalence, Risk Factors, Socioeconomic Factors, Sub-Saharan Africa, Type 2 Diabetes Mellitus.*

Introduction

Type 2 diabetes mellitus (T2DM) is one of the most significant and rapidly growing public health challenges worldwide [1, 2]. The global prevalence of diabetes has risen substantially over recent decades, driven by population ageing, urbanization, sedentary lifestyles, and dietary transitions [2, 3]. Cardiovascular disease (CVD) remains the leading cause of morbidity and mortality among individuals with T2DM, accounting for a substantial proportion of diabetes-related deaths globally [4-6].

The pathophysiological relationship between T2DM and CVD is complex and multifactorial, involving metabolic, inflammatory, and vascular mechanisms.

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Chronic hyperglycemia, insulin resistance, dyslipidemia, and systemic inflammation contribute to endothelial dysfunction and accelerated atherosclerosis [5, 7]. These mechanisms substantially increase the risk of major cardiovascular outcomes, including coronary artery disease, cerebrovascular disease, peripheral arterial disease, and heart failure [4].

In sub-Saharan Africa, the burden of T2DM and its cardiovascular sequelae has increased steadily over the past two decades, reflecting rapid urbanization, population ageing, and changing lifestyle patterns. Health systems in the region, historically oriented toward communicable diseases, now face a dual burden of infectious and non-communicable diseases [1]. Rapid urbanization, changes in lifestyle behaviors, and limited access to preventive healthcare have contributed to the rising prevalence of diabetes and its cardiovascular complications [2, 8]. Recent hospital-based studies across the region report a substantial burden of CVD among adults with T2DM, with hypertension, ischemic heart disease, and stroke among the most frequently reported complications. Evidence from Ethiopia further illustrates this pattern, with a high prevalence of cardiovascular comorbidities and identification of hypertension and longer duration of diabetes as key predictors [9, 10]. These findings are consistent with broader global and regional analyses demonstrating that CVD remains the leading cause of morbidity and mortality among individuals with diabetes [4, 6], including recent updates from the Global Burden of Disease study [11].

Available evidence suggests that patients with T2DM in sub-Saharan Africa experience high rates of undiagnosed or poorly controlled cardiovascular risk factors, including hypertension, dyslipidemia, obesity, and poor glycemic control [2, 4]. Socioeconomic constraints, limited availability of essential medications, and fragmented chronic care services further exacerbate cardiovascular risk [1, 12]. However, published data on the prevalence, patterns, and determinants of CVD among patients with T2DM in the region are heterogeneous and scattered across diverse settings.

A comprehensive synthesis of existing evidence is therefore necessary to clarify the magnitude of CVD risk among patients with T2DM in sub-Saharan Africa, identify key contributing factors, and highlight gaps in current knowledge [4, 5]. Such synthesis is essential to inform clinical practice, guide health policy, and support the development of integrated diabetes and cardiovascular care models tailored to resource-limited settings.

This study aims to examine cardiovascular disease risk among adults with type 2 diabetes mellitus in sub-Saharan Africa by synthesizing existing literature on epidemiological patterns, major risk factors, and health system influences. By consolidating current evidence, this review provides a contextual foundation for interpreting findings from original research conducted within the region.

Literature Review

Pathophysiological Link Between Type 2 Diabetes Mellitus and Cardiovascular Disease

Type 2 diabetes mellitus (T2DM) is characterised by chronic hyperglycemia and insulin resistance, both of which play central roles in the development of cardiovascular disease (CVD) [5]. Persistent hyperglycemia promotes non-enzymatic glycation of proteins and lipids, leading to the formation of advanced glycation end-products (AGEs). These compounds contribute to oxidative stress, vascular inflammation, and structural damage to the arterial wall, thereby accelerating atherosclerotic processes [7, 13].

Insulin resistance, a hallmark of T2DM, further exacerbates cardiovascular risk by disrupting normal metabolic and vascular homeostasis. Reduced insulin sensitivity impairs nitric oxide–mediated vasodilation,

resulting in endothelial dysfunction and increased arterial stiffness. Endothelial dysfunction is widely recognized as an early and critical step in the pathogenesis of atherosclerosis and is strongly associated with increased risk of coronary artery disease and stroke [1, 14].

Dyslipidemia, commonly observed in T2DM and characterised by elevated triglycerides, reduced high-density lipoprotein cholesterol, and increased levels of small, low-density lipoprotein particles, contributes significantly to atherogenesis. These lipid abnormalities promote lipid deposition in the arterial intima and enhance inflammatory responses in atherosclerotic plaques, increasing plaque instability and the risk of acute cardiovascular events [5, 7].

Chronic low-grade inflammation represents another key mechanism linking T2DM to CVD. Adipose tissue dysfunction and metabolic stress stimulate the release of pro-inflammatory cytokines, such as tumor necrosis factor-alpha and interleukin-6, which contribute to endothelial injury and plaque progression. Inflammatory pathways also interact with coagulation mechanisms, promoting a prothrombotic state that heightens the risk of myocardial infarction and cerebrovascular events [5, 15].

In addition to these mechanisms, individuals with T2DM frequently present with clustered cardiometabolic risk factors, including hypertension and obesity, which act synergistically with metabolic abnormalities to amplify cardiovascular risk [1, 2]. In addition, recent studies have highlighted the high prevalence of metabolic syndrome among individuals with T2DM in sub-Saharan Africa. Studies from Ghana and Ethiopia report that obesity, physical inactivity, and longer duration of diabetes are important contributors to cardiometabolic risk [16, 17]. These findings reinforce the multifactorial nature of cardiovascular risk in T2DM and complement existing evidence on metabolic and vascular mechanisms [5, 7].

Diabetes-related microvascular and macrovascular complications are increasingly recognized across African settings, contributing substantially to cardiovascular morbidity among adults with T2DM [18].

Collectively, these interconnected mechanisms provide strong biological plausibility for the observed association between T2DM and CVD. Understanding these pathways is essential for informing integrated prevention and management strategies to reduce cardiovascular morbidity and mortality among patients with T2DM, particularly in resource-limited settings such as sub-Saharan Africa [4, 5].

Epidemiology of CVD in T2DM

Building on the biological mechanisms described above, epidemiological evidence provides insight into the magnitude and distribution of CVD among individuals with T2DM. CVD is the leading cause of morbidity and mortality among individuals with T2DM worldwide. Epidemiological studies consistently demonstrate that adults with T2DM have a two- to four-fold increased risk of developing CVD compared with individuals without diabetes [5, 7]. Major cardiovascular manifestations include coronary artery disease, cerebrovascular disease, peripheral arterial disease, and heart failure, all of which contribute substantially to reduced life expectancy and quality of life among diabetic populations.

Globally, the burden of CVD among patients with T2DM has continued to rise in parallel with increasing diabetes prevalence. Improvements in survival from acute cardiovascular events in high-income countries have shifted the disease burden toward chronic complications, including heart failure and recurrent vascular events [4]. However, these gains have not been uniformly realized across low- and middle-income regions, where access

to early diagnosis and long-term cardiovascular care remains limited.

In sub-Saharan Africa, the epidemiology of CVD in T2DM is shaped by rapid epidemiological transition and health system constraints. The region has experienced a marked increase in diabetes prevalence over the past two decades, driven by urbanization, lifestyle changes, and population ageing [1]. Concurrently, CVD has emerged as a major cause of morbidity and mortality, often occurring at a younger age compared with high-income settings.

Available studies from sub-Saharan Africa indicate a high burden of CVD among patients with T2DM, although reported prevalence estimates vary widely across countries and study settings, with country-level reports from Nigeria reflecting similar trends [2, 4, 19]. Hospital-based studies frequently report high proportions of diabetic patients with coexisting multiple cardiovascular manifestations, including hypertension-related heart disease, stroke, coronary artery disease, and heart failure, reflecting late presentation and limited preventive care [2, 4]. Community-based data, where available, suggest that a significant proportion of CVD among diabetic individuals remains undiagnosed. Recent studies from Ethiopia further reinforce this pattern. A multicentre study in Bahir Dar reported that a substantial proportion of adults with T2DM had at least one cardiovascular comorbidity, while findings from Addis Ababa identified hypertension and longer duration of diabetes as key associated factors [9, 10]. These findings align with broader regional evidence indicating that cardiovascular complications are increasingly common among individuals living with diabetes in sub-Saharan Africa [20].

Hypertension is the most reported cardiovascular comorbidity among patients with T2DM in sub-Saharan Africa and is a major driver of stroke and heart failure in the region. Cerebrovascular disease appears to contribute disproportionately to cardiovascular morbidity and mortality among diabetic populations, consistent with broader regional patterns of CVD and supported by regional stroke epidemiology studies [4, 21]. Coronary artery disease, while historically considered less prevalent, is increasingly recognized as underdiagnosed due to limited access to diagnostic facilities.

Marked heterogeneity exists in the epidemiological profile of CVD among patients with T2DM across sub-Saharan Africa. Differences in study design, diagnostic criteria, healthcare access, and population characteristics complicate direct comparisons across countries. Nevertheless, the available evidence consistently indicates a high and growing burden of CVD among adults with T2DM in the region.

Overall, the epidemiological literature highlights CVD as a major and increasingly prominent complication of T2DM in sub-Saharan Africa. These findings underscore the urgent need for improved cardiovascular risk assessment, early detection, and integrated management within diabetes care programmes, and provide a critical context for interpreting findings from original studies conducted in the region.

Major Cardiovascular Risk Factors in T2DM

The excess cardiovascular burden observed among individuals with T2DM is largely attributable to the clustering of multiple modifiable and non-modifiable risk factors. In patients with T2DM, these risk factors often coexist and interact synergistically, substantially amplifying the risk of adverse cardiovascular outcomes [5].

Hypertension

Hypertension is the most prevalent and consistently reported cardiovascular risk factor among patients with T2DM, both globally and in sub-Saharan Africa. The coexistence of diabetes and hypertension markedly increases

the risk of coronary artery disease, stroke, heart failure, and diabetic microvascular complications, and evidence from large clinical trials shows that effective blood pressure control substantially reduces cardiovascular events in this population [22]. Epidemiological studies indicate that a large proportion of adults with T2DM in sub-Saharan Africa have either undiagnosed or poorly controlled hypertension, reflecting gaps in routine screening and long-term management [2, 4].

Dyslipidemia

Dyslipidemia is another major contributor to cardiovascular risk in T2DM and is characterised by elevated triglyceride levels, reduced high-density lipoprotein cholesterol, and qualitative abnormalities of low-density lipoprotein particles. These lipid abnormalities accelerate atherosclerosis and increase the likelihood of plaque rupture and thrombotic events. Evidence from African studies suggests that dyslipidemia is frequently underdiagnosed and undertreated among patients with T2DM, further compounding cardiovascular risk [5, 7].

Poor Glycemic Control

Poor long-term glycemic control plays a central role in the development and progression of CVD in T2DM. Chronic hyperglycemia contributes to endothelial dysfunction, oxidative stress, and inflammatory activation, thereby accelerating vascular damage. Several studies have demonstrated associations between elevated glycated hemoglobin levels and increased risk of cardiovascular events, particularly when poor glycemic control coexists with other risk factors such as hypertension and dyslipidemia [1, 5].

Obesity and Central Adiposity

Obesity, particularly central or visceral adiposity, is strongly associated with insulin resistance, systemic inflammation, and adverse cardiovascular outcomes in individuals with T2DM. Rapid urbanization and lifestyle transitions in sub-Saharan Africa have contributed to rising rates of overweight and obesity among diabetic populations. Excess adiposity not only worsens glycemic control but also promotes hypertension and dyslipidemia, creating a high-risk cardiometabolic profile [2, 4].

Duration of Diabetes and Age

Longer duration of diabetes and advancing age are important non-modifiable risk factors for CVD in T2DM. Prolonged exposure to hyperglycemia and metabolic abnormalities increases cumulative vascular damage. Studies consistently show a higher prevalence of cardiovascular complications among patients with longer diabetes duration, highlighting the importance of early diagnosis and timely risk factor management [5].

Lifestyle Factors

Lifestyle-related factors, including physical inactivity, unhealthy dietary patterns, tobacco use, and harmful alcohol consumption, further contribute to cardiovascular risk in individuals with T2DM. In sub-Saharan Africa, urban lifestyles and limited opportunities for physical activity have been associated with worsening cardiometabolic profiles [3, 4]. Tobacco use, although variable across countries, remains an important preventable risk factor for CVD among diabetic populations, while harmful alcohol use has been linked to poor glycemic control and hypertension [4].

In summary, cardiovascular risk among patients with T2DM is driven by a complex interplay of metabolic, clinical, and lifestyle factors. The high prevalence and frequent co-occurrence of these risk factors in sub-Saharan Africa underscore the need for comprehensive, integrated cardiovascular risk-reduction strategies within diabetes care services.

Health System and Socioeconomic Factors Influencing Cardiovascular Risk

Health system and socioeconomic factors play a critical role in shaping CVD risk and outcomes among patients with T2DM in sub-

Saharan Africa. Beyond individual-level clinical and metabolic determinants, structural barriers within health systems and broader social conditions significantly influence access to care, quality of disease management, and long-term cardiovascular outcomes [4].

Access to Healthcare Services

Limited access to healthcare services remains a major challenge for effective cardiovascular risk management among individuals with T2DM in sub-Saharan Africa. Geographic barriers, shortages of healthcare professionals, and inadequate healthcare infrastructure contribute to delayed diagnosis of diabetes and cardiovascular complications. Many patients present to health facilities at advanced stages of disease, when cardiovascular damage is already established, reducing the effectiveness of preventive interventions [2].

Screening and Diagnostic Gaps

Routine screening for cardiovascular risk factors such as hypertension, dyslipidaemia, and chronic kidney disease is often inconsistent or unavailable in primary care settings. Limited access to laboratory services and diagnostic tools, including lipid profiling and cardiac imaging, leads to underdiagnosis and undertreatment of CVD among patients with T2DM. These gaps contribute to a substantial burden of undetected cardiovascular risk within diabetic populations [4].

Availability and Affordability of Medications

The availability and affordability of essential medicines for the management of diabetes and CVD remain uneven across sub-Saharan Africa. Interruptions in drug supply chains, high out-of-pocket costs, and limited insurance coverage hinder long-term adherence to antihypertensive, lipid-lowering, and glucose-lowering therapies. Inadequate pharmacological management of cardiovascular risk factors is therefore a common contributor to poor cardiovascular outcomes in patients with T2DM [1, 2].

Health System Organisation and Integrated Care

Fragmentation of health services poses a significant barrier to comprehensive cardiovascular risk management in diabetes care. In many settings, diabetes and cardiovascular services are delivered through separate programmes, resulting in missed opportunities for integrated risk assessment and coordinated management [4, 12]. Strengthening integrated chronic care models that address diabetes and CVD concurrently has been identified as a key priority for improving outcomes in resource-limited settings [4].

Socioeconomic Determinants

Socioeconomic factors, including low income, limited education, unemployment, and food insecurity, further exacerbate cardiovascular risk among patients with T2DM. These determinants influence health-seeking behavior, treatment adherence, and the ability to adopt recommended lifestyle modifications. Evidence suggests that socially disadvantaged individuals with diabetes experience higher rates of cardiovascular complications, reflecting the cumulative effects of structural inequities on health outcomes [1, 2].

Overall, health system weaknesses and adverse socioeconomic conditions substantially contribute to the burden of CVD among patients with T2DM in sub-Saharan Africa. Addressing these factors through health system strengthening, improved access to essential services, and policies that reduce socioeconomic inequities is essential for effective CVD prevention and control in diabetic populations.

Summary of Literature and Identified Gaps

The reviewed literature demonstrates that CVD represents a major and growing complication of T2DM, driven by a complex interplay of biological, clinical, lifestyle, health

system, and socioeconomic factors [4, 5]. Evidence consistently indicates that individuals with T2DM face substantially higher risks of coronary artery disease, cerebrovascular disease, heart failure, and other cardiovascular outcomes compared with the general population [4, 5].

Across sub-Saharan Africa, epidemiological studies highlight a high prevalence of cardiovascular risk factors among patients with T2DM, particularly hypertension, dyslipidaemia, poor glycemic control, obesity, and longer duration of diabetes [1, 5]. These risk factors frequently coexist and are often inadequately detected or managed, reflecting gaps in routine screening, preventive care, and long-term disease management [4, 12]. Health system limitations, including fragmented services, limited diagnostic capacity, and inconsistent access to essential medications, further exacerbate cardiovascular risk and contribute to poor outcomes [1, 8].

Despite the growing body of literature, several important gaps remain. First, there is considerable heterogeneity in reported CVD prevalence estimates among patients with T2DM in sub-Saharan Africa, largely due to differences in study design, diagnostic criteria, and healthcare settings, limiting comparability across studies [4, 12]. Second, many studies rely on hospital-based samples, which may overrepresent individuals with advanced disease and underestimate the true burden of undiagnosed CVD in the community [8].

Furthermore, few studies comprehensively examine the combined influence of sociodemographic, clinical, and health system factors on CVD risk among patients with T2DM within a single analytical framework. As a result, the relative contribution of modifiable risk factors and structural determinants remains insufficiently characterised. There is also limited evidence from routine public-sector healthcare settings, where most patients with T2DM in sub-Saharan Africa receive care.

In addition, data from several countries in the region remain sparse, and there is a particular lack of context-specific evidence to inform targeted cardiovascular risk-reduction strategies. These gaps underscore the need for original research that systematically assesses the prevalence of CVD and its associated factors among patients with T2DM in real-world clinical settings.

By addressing these gaps, original studies conducted within sub-Saharan Africa can contribute valuable evidence to support integrated diabetes and cardiovascular care, inform health policy, and guide the allocation of limited healthcare resources. The present study is therefore well positioned to provide important insights into the burden and determinants of CVD among patients with T2DM, directly addressing gaps identified in the existing literature.

Methods

Review Design

This study employed a narrative review to synthesize evidence on cardiovascular disease (CVD) risk among adults with type 2 diabetes mellitus (T2DM) in sub-Saharan Africa. A narrative approach was considered appropriate to enable a broad, contextualized examination of epidemiological patterns, risk factors, and health system influences across diverse settings within the region.

Literature Search Strategy

A structured narrative review approach was employed. A comprehensive literature search was conducted using PubMed/MEDLINE, Scopus, Google Scholar, and African Journals Online (AJOL). The search covered English-language articles published from January 2000 to December 2025. Key search terms and Boolean combinations included: "type 2 diabetes mellitus", "cardiovascular disease", "cardiovascular complications", "prevalence", "risk factors", "health system factors", and "sub-Saharan Africa".

The search yielded approximately 420 records. After removing duplicates, approximately 310 titles and abstracts were screened for relevance. Of these, 86 full-text articles were assessed for eligibility. Studies were excluded if they did not specifically report cardiovascular outcomes among adults with T2DM, focused exclusively on type 1 diabetes mellitus or pediatric populations, or lacked sufficient methodological clarity. A total of 42 articles were included in the final descriptive synthesis.

Given the narrative nature of the review, no formal risk-of-bias assessment was undertaken. Instead, findings were synthesized thematically across six domains: (1) epidemiology and burden of CVD; (2) biological and metabolic risk factors; (3) lifestyle-related risk factors; (4) health system determinants; (5) socioeconomic determinants; and (6) identified methodological and evidence gaps.

Eligibility Criteria

Included publications comprised original research articles, systematic reviews, narrative reviews, and authoritative reports that examined CVD outcomes or cardiovascular risk factors among adult patients with T2DM in sub-Saharan Africa. Studies focusing exclusively on type 1 diabetes mellitus, gestational diabetes, pediatric populations, or non-African settings were excluded. Editorials, commentaries, and case reports were also excluded unless they provided substantial contextual or policy-relevant information.

Data Extraction and Synthesis

Relevant data were extracted narratively, focusing on reported CVD prevalence, major cardiovascular risk factors, and contextual health system determinants. Due to heterogeneity in study designs, outcome definitions, and reporting methods, a qualitative synthesis was undertaken rather than a quantitative meta-analysis. Although 42 studies met the inclusion criteria and informed the narrative synthesis, only selected representative studies are cited and tabulated in the Results section to illustrate key patterns and findings across the broader body of literature. Findings were organized thematically to highlight common patterns and regional challenges.

Ethical Considerations

This review was based exclusively on published literature and publicly available data. It did not involve human participants, identifiable personal data, or primary data collection. Ethical approval was therefore not required.

Results

Characteristics of Included Studies

A total of 42 studies met the inclusion criteria and were included in the narrative synthesis. The characteristics of these studies are summarised in Table 1. Many included studies were observational, predominantly cross-sectional, and largely hospital-based. Study settings spanned multiple countries within sub-Saharan Africa, with considerable variation in sample size, study populations, and cardiovascular outcomes assessed.

Most studies focused on the prevalence of cardiovascular disease (CVD) or its major risk factors among adults with type 2 diabetes mellitus (T2DM). Hypertension was the most frequently reported cardiovascular comorbidity, followed by stroke, heart failure, and coronary artery disease. Several studies assessed composite cardiovascular outcomes, while others examined specific manifestations such as cerebrovascular disease or hypertensive heart disease.

Methodological heterogeneity was evident across the included studies, particularly regarding diagnostic criteria for CVD and data collection methods. Despite these differences, the studies collectively provide valuable insights into the burden and patterns of CVD

among patients with T2DM in sub-Saharan Africa.

Prevalence of CVD among Patients with T2DM

Across included studies, CVD was consistently reported as a common complication among adults with T2DM in sub-Saharan Africa. Reported CVD prevalence estimates varied substantially across study settings, reflecting differences in study design, population characteristics, diagnostic criteria, and healthcare access.

Hospital-based studies generally reported a higher prevalence of CVD among patients with T2DM compared with community-based studies. In several tertiary and secondary care settings, between one-third and over half of adults with T2DM were reported to have at least one form of CVD, including hypertension-related heart disease, stroke, coronary artery disease, or heart failure. These higher estimates are likely to reflect referral bias and late presentation of patients with advanced CVD.

Hypertension-related CVD emerged as the most frequently reported manifestation across studies. Many studies documented the high burden of hypertensive heart disease and related complications among patients with T2DM, underscoring the strong overlap between diabetes and hypertension in the region. CVD, particularly stroke, was also commonly reported and, in some settings, accounted for a substantial proportion of cardiovascular morbidity among diabetic populations.

Coronary artery disease was reported less frequently than hypertension or stroke in many studies; however, several authors noted that this likely reflects underdiagnosis rather than true low prevalence. Limited access to diagnostic investigations such as electrocardiography, cardiac biomarkers, and coronary imaging was frequently cited as a contributing factor to under-recognition of ischemic heart disease among patients with T2DM.

Marked heterogeneity in reported CVD prevalence was observed across countries and healthcare levels. Studies conducted in urban settings and referral hospitals tended to report higher prevalence estimates than those conducted in rural or primary care settings. Despite this variability, the collective findings indicate that cardiovascular disease constitutes a major burden among adults with T2DM across sub-Saharan Africa.

Table 1. Characteristics of Studies Included in the Narrative Review (Representative Studies)

Author(s) / Year	Country / Setting	Study Design	Study Population	Sample Size	Cardiovascular Outcomes Assessed	Key Findings Relevant to CVD
Kengne et al., 2010 [23]	Cameroon; tertiary hospital	Cross-sectional	Adults with T2DM	~500	Hypertension, stroke, heart disease	High prevalence of hypertension and CVD among long-standing T2DM patients
Levitt et al., 2011 [24]	South Africa; urban clinics	Cross-sectional	Adults with T2DM	~800	Hypertension, IHD, stroke	Strong coexistence of diabetes and hypertension
Sobngwi et al., 2012 [25]	Cameroon; referral hospitals	Cross-sectional	Adults with T2DM	~600	Hypertensive heart disease, stroke	Late presentation and poor risk factor control
Amoah et al., 2014 [26]	Ghana; teaching hospital	Cross-sectional	Adults with T2DM	~400	Hypertension, CAD	High burden of undiagnosed

						hypertension and dyslipidemia
Erasmus et al., 2015 [27]	South Africa; tertiary hospital	Cross-sectional	Adults with T2DM	~300	Heart failure, stroke	CVD common with long diabetes duration
Pastakia et al., 2017 [28]	Kenya; mixed settings	Cohort	Adults with T2DM	~700	CVD risk factors	Integrated care improved detection
Uloko et al., 2018 [29]	Nigeria; multi-centre clinics	Cross-sectional	Adults with T2DM	>1,000	Composite CVD outcomes	High prevalence of hypertension and obesity
Kibirige et al., 2019 [30]	Uganda; outpatient clinics	Cross-sectional	Adults with T2DM	~600	Hypertension, stroke	Poor BP control linked to CVD
Ekoru et al., 2020 [31]	Multi-country SSA	Population-based	Adults with diabetes	>2,000	Stroke, heart disease	Diabetes associated with premature CVD
Nyenwe et al., 2021 [19]	Nigeria; tertiary hospital	Cross-sectional	Adults with T2DM	~500	CAD, heart failure	Coronary artery disease likely underdiagnosed
IDF, 2023 [2]	Sub-Saharan Africa	Report	Adults with diabetes	—	CVD mortality	CVD is the leading cause of death among patients with diabetes
Addis et al., 2025 [9]	Ethiopia, multi-centre hospital	Cross-sectional	Adults with T2DM	~600	Composite CVD comorbidity	Hypertension major predictor
Yeshitla et al., 2025 [10]	Ethiopia, selected public hospitals	Cross-sectional	Adults with T2DM	~450	CVD prevalence	High burden of cardiovascular complications

Note: This table presents representative studies included in the narrative synthesis. Although 42 studies informed the overall synthesis, not all included studies are shown individually in this table. CAD= Coronary Artery Disease; CVD= Cardiovascular Disease; IDF= International Diabetes Federation; IHD= Ischemic Heart Disease; SSA= Sub-Saharan Africa; T2DM= Type 2 Diabetes Mellitus.

Overall, the results demonstrate that a substantial proportion of patients with T2DM in the region are affected by cardiovascular disease, often at relatively young ages and with multiple coexisting conditions. The prevalence ranges presented in Table 2 reflect pooled patterns observed across the hospital- and community-based studies summarised in Table 1, rather than estimates from any single study. These findings provide important context for understanding the scale of cardiovascular risk in this population and set the stage for examining associated risk factors and health system influences in subsequent sections.

Cardiovascular Risk Factors Reported among Patients with T2DM

According to the studies included, several demographics, clinical, and metabolic factors were consistently reported to be associated with CVD among patients with T2DM. These risk factors frequently coexist within individuals, contributing to a high cumulative cardiovascular risk profile.

Increasing age was one of the most consistently reported non-modifiable risk factors. Studies commonly demonstrated a higher prevalence of cardiovascular disease

among older adults with T2DM compared with younger patients. Similarly, longer duration of diabetes was repeatedly associated with increased cardiovascular burden, reflecting cumulative exposure to hyperglycemia and metabolic abnormalities.

Hypertension emerged as the most prevalent and strongly associated modifiable cardiovascular risk factor. A large proportion of patients with T2DM were reported to have either diagnosed or previously unrecognized hypertension, and the coexistence of diabetes and hypertension was associated with markedly higher rates of stroke, heart failure, and hypertensive heart disease.

Table 2. Summary of Reported Prevalence of CVD among Patients with T2DM in Sub-Saharan Africa

Cardiovascular Outcome	**Reported Prevalence Range**	**Study Settings Commonly Reporting Outcome**
Any cardiovascular disease	~20% – >50%	Predominantly hospital-based studies
Hypertension-related CVD	~30% – 70%	Hospital and outpatient clinics
Stroke / cerebrovascular disease	~5% – 25%	Tertiary and referral hospitals
Coronary artery disease	~5% – 20%	Mostly hospital-based; underdiagnosed
Heart failure	~10% – 30%	Secondary and tertiary facilities

Note: Prevalence ranges are indicative and reflect heterogeneity in study design, diagnostic criteria, and healthcare settings across included studies. The prevalence ranges summarised in this table are derived from hospital- and community-based studies listed in Table 1, with hospital-based studies contributing predominantly to the higher end of reported ranges. CVD = Cardiovascular Disease; T2DM = Type 2 Diabetes Mellitus.

Dyslipidaemia was also frequently reported among patients with T2DM, particularly in hospital-based studies. Common lipid abnormalities included elevated triglyceride levels, reduced high-density lipoprotein cholesterol, and increased low-density lipoprotein cholesterol. These abnormalities were often inadequately treated, contributing to increased atherosclerotic cardiovascular risk.

Poor glycemic control was consistently associated with CVD across multiple studies. Patients with elevated glycated hemoglobin levels were more likely to have cardiovascular complications, especially when poor glycemic control coexisted with hypertension or dyslipidaemia.

Obesity, particularly central adiposity, was another commonly reported risk factor. Studies noted higher CVD prevalence among overweight and obese patients with T2DM, reflecting the combined effects of insulin resistance, inflammation, and adverse metabolic profiles.

Lifestyle-related factors, including physical inactivity, tobacco use, and harmful alcohol consumption, were also identified as important contributors to cardiovascular risk among patients with T2DM. Although the prevalence of these behaviours varied across settings, their presence was generally associated with poorer cardiovascular outcomes.

In summary, the results indicate that CVD among patients with T2DM is driven by a constellation of interrelated demographic, clinical, metabolic, and lifestyle factors, as shown in Table 3. The consistent identification of modifiable risk factors across studies underscores the potential for targeted prevention and integrated risk reduction strategies in this population.

Table 3. Cardiovascular Risk Factors Reported in Representative Studies among Patients with T2DM in Sub-Saharan Africa

Author(s) / Year	Country / Setting	Major Risk Factors Assessed	Risk Factors Associated with CVD	Direction of Association
Kengne et al., 2010 [23]	Cameroon	Age, duration, hypertension, obesity	Hypertension, longer duration	Increased risk
Levitt et al., 2011 [24]	South Africa	Hypertension, obesity	Hypertension, obesity	Increased risk
Sobngwi et al., 2012 [25]	Cameroon	Glycemic control, hypertension	Poor control, hypertension	Increased risk
Amoah et al., 2014 [26]	Ghana	Hypertension, dyslipidemia	Hypertension, dyslipidemia	Increased risk
Erasmus et al., 2015 [27]	South Africa	Age, duration	Older age, longer duration	Increased risk
Pastakia et al., 2017 [28]	Kenya	Lifestyle, access to care	Physical inactivity, poor access	Increased risk
Uloko et al., 2018 [29]	Nigeria	Obesity, inactivity, hypertension	Obesity, hypertension	Increased risk
Kibirige et al., 2019 [30]	Uganda	BP control	Uncontrolled hypertension	Increased risk
Nyenwe et al., 2021 [19]	Nigeria	Dyslipidemia, hypertension	Dyslipidemia, hypertension	Increased risk

Note: This table summarizes cardiovascular risk factors reported in representative studies included in the narrative synthesis. Associations reflect patterns reported by study authors and do not imply causality. BP= Blood Pressure; CVD= Cardiovascular Disease; T2DM= Type 2 Diabetes Mellitus.

Health System and Socioeconomic Factors Reported in the Included Studies

Across the included studies, health system and socioeconomic factors were frequently reported to be important contributors to cardiovascular disease risk and poor outcomes among patients with T2DM, as shown in Table 4. These factors influenced access to care, treatment continuity, and the effectiveness of cardiovascular risk management.

Limited access to healthcare services was a recurrent finding, particularly in rural and underserved urban settings. Several studies reported delayed diagnosis of both diabetes and CVD due to geographic barriers, shortages of healthcare personnel, and inadequate healthcare infrastructure. As a result, many patients presented with advanced disease and established cardiovascular complications.

Inadequate screening and diagnostic capacity were another commonly reported health system challenge. Studies noted inconsistent screening for hypertension, dyslipidemia, and other cardiovascular risk factors in primary care settings. Limited availability of laboratory testing and diagnostic equipment contributed to the underdiagnosis of CVD, particularly coronary artery disease.

Table 4. Health System and Socioeconomic Factors Reported in Representative Studies among Patients with T2DM in Sub-Saharan Africa

Author(s) / Year	Country / Setting	Health System Factors Identified	Socioeconomic Factors Identified	Reported Impact on CVD Outcomes
Kengne et al., 2010 [23]	Cameroon; tertiary hospital	Late presentation, limited screening	Low income	Advanced CVD at diagnosis
Levitt et al., 2011 [24]	South Africa; urban clinics	Fragmented chronic care	Unemployment	Poor cardiovascular risk control
Sobngwi et al., 2012 [25]	Cameroon; referral hospitals	Inadequate follow-up systems	Low educational attainment	Higher CVD complications
Amoah et al., 2014 [26]	Ghana; teaching hospital	Medication stock-outs	Out-of-pocket payments	Poor BP and lipid control
Erasmus et al., 2015 [27]	South Africa; tertiary hospital	Late referral to specialist care	Socioeconomic inequality	Severe CVD at presentation
Pastakia et al., 2017 [28]	Kenya; mixed rural–urban settings	Weak integration of NCD services	Food insecurity	Suboptimal long-term CVD risk management
Uloko et al., 2018 [29]	Nigeria; multi-centre clinics	Limited access to preventive services	Urban poverty	High prevalence of uncontrolled risk factors
Kibirige et al., 2019 [30]	Uganda; outpatient clinics	Inconsistent routine screening	Rural residence	Delayed detection of CVD
Ekoru et al., 2020 [31]	Multi-country SSA	Health system capacity constraints	Low socioeconomic status	Premature cardiovascular events
Nyenwe et al., 2021 [19]	Nigeria; tertiary hospital	Limited diagnostic capacity	Low insurance coverage	Underdiagnosis of coronary artery disease
WHO, 2022 [1]	SSA; regional analysis	Weak primary healthcare systems	Socioeconomic inequality	Persistent CVD burden in T2DM
IDF, 2023 [2]	SSA; regional estimates	Limited access to essential medicines	Household poverty	High diabetes-related CVD mortality

Note: This table summarizes health system and socioeconomic determinants of cardiovascular disease (CVD) reported in representative studies included in the narrative synthesis. Associations reflect patterns described by study authors and do not imply causality. BP= Blood Pressure; IDF= International Diabetes Federation; NCD= Non-Communicable Diseases; SSA= Sub-Saharan Africa; T2DM= Type 2 Diabetes Mellitus; WHO= World Health Organization.

Medication availability and affordability were also highlighted as major constraints. Interruptions in the supply of essential medicines, high out-of-pocket costs, and limited insurance coverage were associated with poor adherence to antihypertensive, lipid-lowering, and glucose-lowering therapies. These challenges undermined long-term cardiovascular risk control among patients with T2DM.

Fragmented chronic care services further compounded these challenges. Several studies reported that diabetes and CVD were often managed through separate, poorly coordinated programmes, resulting in missed opportunities

for integrated risk assessment and comprehensive management.

Socioeconomic factors, including low income, limited education, unemployment, and food insecurity, were frequently associated with higher cardiovascular burden among patients with T2DM. These factors influenced health-seeking behaviour, treatment adherence, and the ability to adopt recommended lifestyle modifications.

Overall, the results indicate that weaknesses in the health system and adverse socioeconomic conditions substantially shape CVD risk and outcomes among patients with T2DM. These findings highlight the importance of strengthening health systems and addressing social determinants of health to reduce the cardiovascular burden in diabetic populations.

Discussion

Principal Findings

This narrative review synthesized evidence on the burden of cardiovascular disease (CVD) and its associated factors among adults with type 2 diabetes mellitus (T2DM) in sub-Saharan Africa. The findings demonstrate that CVD remains a major and persistent complication of T2DM in the region, with reported prevalence ranging from approximately one-fifth to more than half of affected patients, depending on study setting and methodology (Table 2). These findings are consistent with global evidence identifying CVD as the leading cause of morbidity and mortality among individuals with diabetes [4, 5]. Hypertension-related CVD emerged as the most frequently reported manifestation, followed by stroke, heart failure, and coronary artery disease, reflecting patterns described in regional epidemiological studies [8, 32].

Comparison with Existing Literature

The high prevalence of CVD among patients with T2DM observed in this review aligns with international literature demonstrating a two- to four-fold increased cardiovascular risk among individuals with diabetes compared with the general population [4, 7]. However, compared with high-income countries, studies from sub-Saharan Africa frequently report earlier onset of cardiovascular complications and a greater likelihood of presentation at more advanced stages of the disease [2, 8]. This pattern likely reflects delayed diabetes diagnosis, limited access to preventive healthcare, and suboptimal long-term risk factor management in resource-constrained health systems [1, 10].

The findings of this review highlight the substantial and evolving burden of CVD among adults living with T2DM in sub-Saharan Africa. This pattern is supported by regional epidemiological studies showing high rates of cardiovascular complications among diabetic populations [2, 8, 32]. Recent hospital-based studies in the region, including evidence from Ethiopia, further demonstrate a high prevalence of cardiovascular comorbidities and identify hypertension and prolonged duration of diabetes as important predictors of cardiovascular complications [9, 10]. In addition, studies from other African settings report a high prevalence of metabolic syndrome and related cardiometabolic risk factors among individuals with T2DM, further contributing to cardiovascular risk [16, 17]. Together, these findings reinforce the convergence of multiple risk factors driving the cardiovascular burden in this population.

Hypertension was the most consistently identified cardiovascular risk factor across representative studies (Table 3), mirroring findings from regional and global literature highlighting the synergistic effect of diabetes and hypertension on cardiovascular risk [4, 5]. Poor glycemic control, longer duration of diabetes, dyslipidemia, and obesity were also repeatedly associated with increased cardiovascular burden, consistent with established pathophysiological and epidemiological evidence [2, 13, 33].

Coronary artery disease appeared less frequently than stroke or hypertension-related

complications; however, several studies suggest that this likely reflects underdiagnosis rather than true lower prevalence [8, 32]. Limited access to diagnostic investigations, such as electrocardiography, cardiac biomarkers, and coronary imaging, remains a major barrier to the accurate detection of ischemic heart disease in many sub-Saharan African settings [4].

Health System and Socioeconomic Context

An important contribution of this review is the synthesis of the health system and socioeconomic determinants of cardiovascular risk among patients with T2DM (Table 4). Recurrent themes included limited access to healthcare services, inadequate screening for cardiovascular risk factors, medication stock-outs, fragmented chronic care services, and constrained diagnostic capacity. Similar health system challenges have been widely documented in sub-Saharan Africa and are recognized contributors to poor non-communicable disease outcomes [1, 12].

Socioeconomic disadvantage further amplifies cardiovascular risk among patients with T2DM. Low income, limited education, unemployment, rural residence, and food insecurity were frequently associated with poor treatment adherence, delayed care-seeking, and reduced ability to implement recommended lifestyle modifications. These findings are consistent with broader evidence demonstrating the strong influence of social determinants on cardiovascular and diabetes outcomes in low- and middle-income countries [1, 2].

Implications for Clinical Practice and Public Health

The findings of this review have important implications for clinical practice and public health in sub-Saharan Africa. Given the high prevalence of modifiable cardiovascular risk factors, there is a clear need to strengthen integrated models of diabetes and cardiovascular care, as recommended by international guidelines [4, 5]. Routine screening for hypertension, dyslipidemia, and poor glycemic control should be prioritized within diabetes care services, alongside early identification of high-risk individuals.

At the health system level, improving the availability and affordability of essential medicines, enhancing diagnostic capacity, and promoting continuity of care are critical steps toward reducing cardiovascular morbidity among patients with T2DM [1, 12]. Strengthening primary healthcare systems and integrating NCD services may offer feasible and cost-effective strategies in resource-limited settings [4].

Strengths and Limitations

This review has several strengths. It provides a comprehensive synthesis of evidence spanning more than two decades, incorporates data from multiple countries across sub-Saharan Africa, and adopts a structured narrative approach that integrates epidemiological, clinical, and health system perspectives. The use of summary tables enhances transparency and facilitates comparison across studies, as recommended for high-quality narrative reviews [8].

However, several limitations should be acknowledged. As a narrative review, the findings are subject to potential selection bias, and no formal risk-of-bias assessment was undertaken. The included studies showed considerable heterogeneity in design, settings, diagnostic criteria, and outcome definitions, which limited direct comparability across studies, a challenge commonly noted in regional non-communicable disease research [4, 12]. In addition, the predominance of hospital-based studies may overestimate the true population-level burden of CVD among individuals with T2DM.

Future Research Directions

Future studies should prioritize population-based designs to generate more representative estimates of cardiovascular disease burden among patients with type 2 diabetes mellitus in sub-Saharan Africa [2, 4]. Longitudinal studies are also needed to better characterize temporal relationships between risk factors and cardiovascular outcomes. Strengthening routine health information systems and standardizing diagnostic criteria would further improve the quality and comparability of evidence in this field [1].

Conclusion

This narrative review demonstrates that cardiovascular disease (CVD) constitutes a major and growing complication of type 2 diabetes mellitus (T2DM) in sub-Saharan Africa. The synthesis of evidence indicates that a substantial proportion of adults with T2DM are affected by CVD, often at relatively young ages and in the presence of multiple coexisting risk factors. Hypertension-related CVD, stroke, heart failure, and coronary artery disease emerge as prominent manifestations, reflecting both the biological impact of diabetes and contextual health system challenges within the region.

The review highlights that cardiovascular risk among patients with T2DM is driven by a convergence of modifiable clinical factors—particularly hypertension, poor glycemic control, dyslipidemia, obesity, and longer duration of diabetes—as well as lifestyle behaviors such as physical inactivity, tobacco use, and harmful alcohol consumption. Importantly, these individual-level risk factors are compounded by health system weaknesses and adverse socioeconomic conditions, including limited access to care, inadequate screening and diagnostic capacity, medication stock-outs, fragmented chronic disease services, and socioeconomic disadvantages.

Addressing the cardiovascular burden among patients with T2DM in sub-Saharan Africa therefore requires integrated, context-specific strategies that extend beyond individual risk-factor management. Strengthening primary healthcare systems, improving access to essential medicines and diagnostic services, and integrating diabetes and cardiovascular care within existing NCD programmes are critical priorities. In parallel, broader policy interventions to reduce socioeconomic inequities and support healthy lifestyles are essential to achieve sustainable reductions in cardiovascular morbidity and mortality.

Overall, the findings of this review provide a robust evidence base to inform clinical practice, health policy, and future research focused on CVD prevention and control among patients with T2DM in sub-Saharan Africa. These findings underscore the need for strengthened prevention efforts, sustained investment in high-quality population-based research, and integrated health system strengthening to mitigate the growing cardiovascular impact of diabetes in the region.

Author Contributions

The author conceptualized the study, designed the review framework, conducted the literature search and synthesis, and drafted the manuscript. The author reviewed and approved the final version of the manuscript and takes full responsibility for its content.

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Conflict of Interest

The author declares no conflicts of interest.

Ethical Approval

This study was based exclusively on published literature and publicly available data. It did not involve human participants, personal

identifiers, or primary data collection. Ethical approval was therefore not required.

Data Availability

All data supporting the findings of this study are derived from published sources cited in the manuscript. No new datasets were generated or analysed during the current study.

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