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Reducing Cardiovascular Disease and Stroke Risk Through Diabetes Control, Lifestyle Modification, Psychological Wellbeing, and Community-Based Health Education: A Public Health Mixed-Methods Study

Dr Nilani Sammuarachchi
Doctor of Health Science, Master of Business Administration, London School Of Management & Technology (LSMT) International Higher Education & Research Institution London, United Kingdom

Abstract **– Cardiovascular disease (CVD) and stroke remain the leading causes of mortality and long-term disability worldwide, representing a critical and escalating public health challenge. Despite significant advances in medical treatment and diagnostic technologies, the global burden of CVD and stroke continues to rise, largely driven by preventable and modifiable risk factors including diabetes mellitus, unhealthy lifestyle behaviours, psychological stress, and inadequate community awareness of prevention and early intervention strategies. These factors disproportionately affect vulnerable and high-risk populations, contributing to persistent health inequities and increasing strain on healthcare systems. This doctoral research examined strategies for reducing cardiovascular disease and stroke risk through an integrated public health framework encompassing diabetes control, lifestyle modification, psychological wellbeing, and community-based health education. A TAP-IT mixed-methods research design was adopted to integrate quantitative and qualitative evidence, enabling a comprehensive examination of biomedical risk factors alongside behavioural patterns, psychosocial experiences, and community-level influences. Quantitative data were collected using structured questionnaires to assess diabetes status, cardiovascular risk profiles, lifestyle behaviours, psychological stress, and awareness of cardiovascular disease and stroke prevention. Qualitative data were obtained through semi-structured interviews, capturing participants lived experiences, emotional challenges, health beliefs, and perceived barriers and facilitators to preventive behaviour change. The study identified critical gaps in diabetes management, sustained lifestyle adoption, psychological coping capacity, and community health literacy related to cardiovascular disease and stroke prevention. The integrated findings informed the development of a conceptual public health prevention framework that highlights the interdependent roles of metabolic control, behavioural modification, psychological support, and community engagement. By adopting a holistic and people-centred public health perspective, this research contributes evidence to support the design of culturally responsive, community-focused prevention strategies, strengthen cardiovascular and stroke prevention programmes, enhance patient and community engagement, and ultimately reduce long-term cardiovascular risk at both individual and population levels.**

Keywords – Cardiovascular Disease; Stroke; Diabetes Mellitus; Lifestyle Modification; Psychological Wellbeing; Community-Based Education; Public Health; Health Promotion; Chronic Disease Prevention; Mixed -Methods Research.

I. INTRODUCTION

Background and Global Context

Cardiovascular disease (CVD) and stroke remain the leading causes of mortality and long-term disability worldwide, accounting for approximately one-third of all global deaths [1–3]. According to the World Health Organization (WHO), an estimated 17.9 million people die annually from cardiovascular causes, with more than 85% of these deaths attributable to heart attacks and strokes [1,2]. Despite substantial advances in medical technology, pharmacological therapies, and diagnostic capabilities, the global burden of cardiovascular disease continues to rise. This persistent trend reflects the growing dominance of non-communicable diseases (NCDs) as the principal contributors to global morbidity and mortality, particularly in ageing and urbanising populations [3–5].

The global epidemiological transition from infectious diseases to chronic, lifestyle-related conditions has been accelerated by rapid urbanisation, industrialisation, and globalisation. These processes have profoundly altered population health behaviours, resulting in reduced physical activity, increased consumption of energy-dense and highly processed foods, rising obesity prevalence, tobacco use, and harmful alcohol consumption [4 –7].

Collectively, these behavioural and environmental shifts have reshaped the global cardiovascular risk landscape. Contemporary lifestyles expose individuals to sustained cardiometabolic risk from early adulthood, increasing lifetime exposure to major cardiovascular risk factors including hypertension, diabetes mellitus, dyslip idaemia, and central obesity [6–8].

Among these risk factors, diabetes mellitus has emerged as one of the most powerful drivers of the global cardiovascular epidemic. The Global Burden of Disease Study estimates that more than 537 million adults worldwide are currently living with diabetes, with projections expected to exceed 780 million by 2045 if current trends persist [8,9]. Diabetes substantially amplifies cardiovascular disease and stroke risk through multiple pathophysiological mechanisms, including accelerated atherosclerosis, endothelial dysfunction, chronic inflammation, and impaired vascular repair processes [10 –12]. The coexistence of diabetes and cardiovascular disease is associated with markedly poorer clinical outcomes, significantly increased mortality rates,

and escalating healthcare costs, placing considerable strain on health systems globally.

Socioeconomic disparities further shape the global distribution of cardiovascular disease and stroke. Low- and middle-income countries (LMICs) now account for more than 75% of global cardiovascular deaths, reflecting disproportionate exposure to risk factors combined with limited access to preventive healthcare services [1,5].

Populations in these regions face compounded vulnerabilities arising from delayed diagnosis, fragmented disease management, under-resourced public health infrastructure, and restricted access to long-term preventive care [5,13]. In contrast, high-income countries benefit from more established preventive screening programmes and integrated chronic disease management systems, highlighting persistent global inequities in cardiovascular health outcomes.

Demographic factors including age, sex, and ethnicity further influence cardiovascular disease patterns. While men historically experience higher rates of cardiovascular events at younger ages, women often demonstrate poorer outcomes following cardiovascular events, particularly in the post-menopausal period [14,15]. Ethnic minority groups and Indigenous populations consistently experience higher cardiovascular burden due to a complex interplay of genetic susceptibility, socioeconomic disadvantage, cultural barriers, and reduced access to culturally appropriate healthcare services [13, 16]. These disparities underscore the necessity of equity –focused and culturally responsive prevention strategies.

From a public health perspective, cardiovascular disease and stroke represent not only a medical crisis but also a profound social and economic challenge. The direct costs associated with medical treatment are compounded by substantial indirect costs arising from lost productivity, long-term disability, informal caregiving demands, and premature mortality [3,17]. The World Economic Forum has projected those non-communicable diseases—particularly cardiovascular diseases—will impose trillions of dollars in economic losses globally over coming decades in the absence of effective prevention strategies [17].

Importantly, cardiovascular disease is largely preventable. Large-scale epidemiological and interventional studies consistently demonstrate that the majority of cardiovascular events can be attributed to modifiable behavioural, metabolic, and psychosocial risk factors [6,10,18]. Effective prevention therefore requires a paradigm shift away from an exclusive reliance on medical treatment toward integrated public health models that address diabetes control, lifestyle modification, psychological wellbeing, and community-based health education as foundational pillars of cardiovascular disease and stroke prevention.

Within this global context, cardiovascular disease and stroke are increasingly recognised not as isolated biomedical conditions but as complex, multidimensional public health challenges shaped by behavioural, psychological, social, cultural, and environmental determinants. Addressing this multifaceted burden necessitates comprehensive prevention strategies that extend beyond clinical settings into communities, workplaces, schools, and broader social environments. Grounded within this public health imperativ e, the present study seeks to contribute to sustainable, community-driven solutions for reducing cardiovascular disease and stroke risk through integrated, evidence-based preventive approaches.

Figure: Global Causes of Death

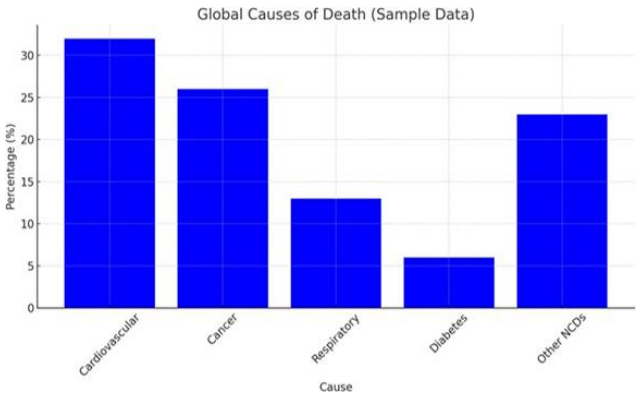

Figure 1.1: Global causes of death by major disease categories.

Cardiovascular diseases represent the leading cause of global mortality, followed by cancer and other non - communicable diseases. Respiratory diseases and diabetes contribute a smaller but significant proportion of deaths worldwide.

Source: Adapted from World Health Organization and Global Burden of Disease estimates [1 –3].

Diabetes Control and Cardiovascular Diseases

Diabetes mellitus is one of the strongest independent predictors of cardiovascular disease and stroke and has emerged as a central driver of the global cardiovascular epidemic [8 –10]. Individuals living with diabetes are two to four times more likely to develop coronary artery disease, stroke, heart failure, and peripheral vascular disease compared with individuals without diabetes [9,10]. Type 2 diabetes mellitus (T2DM), which accounts for more than 90% of all diabetes cases worldwide, is particularly associated with accelerated atherosclerosis, endothelial dysfunction, and impaired vascular integrity [8,11]. The coexistence of diabetes and cardiovascular disease significantly worsens clinical outcomes, increases healthcare utilisation, and leads to substan tially higher mortality rates, placing a considerable burden on individuals, families, and health systems [10 –12].

The pathophysiological mechanisms linking diabetes to cardiovascular disease are well established. Chronic hyperglycaemia induces endothelial dysfunction through oxidative stress, systemic inflammation, and the formation of advanced glycation end products (AGEs), which collectively damage vascular structures and impair normal vascular function [11–13]. These processes promote lipid deposition within arterial walls, accelerate atherosclerotic plaque formation, and increase plaque instability. Insulin resistance further contributes to hypertension, dyslipidaemia, and pro-thrombotic states, thereby markedly increasing the risk of myocardial infarction and ischaemic stroke [12–14]. In addition, diabetes is associated with autonomic dysfunction, impaired coronary microcirculation, and reduced myocardial energy efficiency, all of which further compromise cardiovascular health and resilience [13, 15].

Large longitudinal and interventional studies have consistently confirmed the strong association between poor glycaemic control and increased cardiovascular morbidity and mortality. Findings from the United Kingdom Perspective Diabetes Study (UKPDS) demonstrated that each 1% reduction in glycated haemoglobin (HbA1c) is associated with a 14% reduction in myocardial infarction risk and a 37% reduction in microvascular complications [9,10]. Subsequent global cohort studies have reinforced these findings, showing that prolonged exposure to uncontrolled hyperglycaemia significantly increases lifetime cardiovascular risk, even after adjustment for other traditional risk factors [11,16]. These data highlight the critical importance of early detection, continuous monitoring, and sustained glycaemic control in preventing downstream cardiovascular complications.

Despite the well-documented benefits of effective glycaemic control, optimal diabetes management remains difficult to achieve in real-world settings. Barriers to effective diabetes control include poor medication adherence, limited access to regular glucose monitoring, inadequate health literacy, financial constraints, psychological distress, and fragmented healthcare delivery systems [14 –17]. Many individuals with diabetes also present with clustered cardiovascular risk factors, including obesity, hypertension, dyslipidaemia, physical inactivity, and smoking, which further amplify cardiovascular risk [13 –16]. This clustering of interrelated metabolic and behavioural abnormalities—commonly referred to as cardiometabolic syndrome—represents a major challenge for public health systems worldwide.

Importantly, diabetes and cardiovascular disease are frequently managed as separate clinical entities, despite their strong pathophysiological interdependence [12,18]. This fragmented approach results in missed opportunities for early cardiovascular prevention among people living with diabetes. Contemporary international guidelines increasingly emphasise the need for integrated diabetes–cardiovascular care models that simultaneously target glycaemic control, blood pressure regulation, lipid management, and lifestyle modification within a unified prevention strategy [12,18,19]. Evidence indicates that such integrated approaches significantly reduce cardiovascular events and improve long-term survival in diabetic populations.

From a public health perspective, diabetes control represents one of the most powerful and cost -effective intervention points for reducing the global burden of cardiovascular disease and stroke. Effective community -based diabetes screening, early diagnosis, continuous disease monitoring, lifestyle intervention programmes, and multidisciplinary care models have demonstrated substantial potential to reduce long-term cardiovascular complications [16–20]. Population-level strategies—including sugar reduction policies, physical activity promotion, dietary education, and obesity prevention initiatives—further support diabetes control and cardiovascular risk reduction at a broader societal level.

In this study, diabetes control is conceptualised as a central pillar of cardiovascular disease and stroke prevention. By examining the clinical, behavioural, psychological, and community -level dimensions of diabetes management, this research seeks to contribute to more integrated and sustainable public health strategies that reduce the dual burden of diabetes and cardiovascular disease. The strong biological, epidemiological, and behavioural links between diabetes and cardiovascular disease reinforce the necessity of addressing these conditions through a unified prevention framework rather than isolated disease-specific interventions.

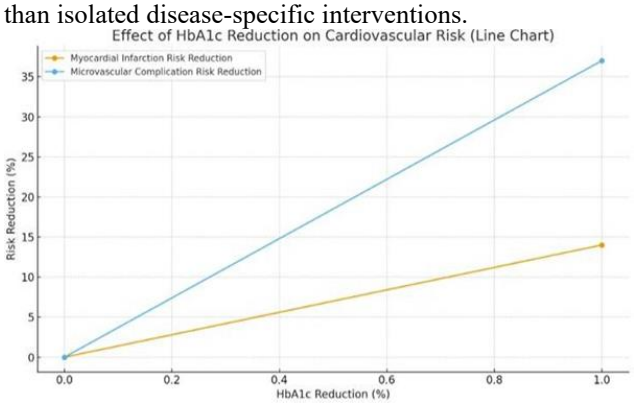

Figure 1.2: Effect of HbA1c Reduction on Cardiovascular Risk

Figure 1.2 illustrates the association between reductions in glycated haemoglobin (HbA1c) and cardiovascular outcomes. Progressive reductions in HbA1c are associated with a greater relative decrease in microvascular complications compared with myocardial infarction risk. This pattern highlights the critical role of sustained glycaemic control in reducing cardiovascular morbidity and preventing long-term diabetes-related complications.

Source: Adapted from the United Kingdom Perspective Diabetes Study (UKPDS) and related longitudinal evidence [9–11].

Lifestyle Modification and Cardiovascular Prevention

Lifestyle behaviours play a foundational role in the development, progression, and prevention of cardiovascular disease and stroke [13–15]. Major modifiable lifestyle-related risk factors include unhealthy dietary patterns, physical inactivity, obesity, tobacco use, excessive alcohol consumption, and poor sleep quality [13 –16]. These behavioural factors act both independently and synergistically to promote hypertension, insulin resistance, dyslipidaemia, systemic inflammation, and endothelial dysfunction—key mechanisms underlying atherosclerosis and cardiovascular events [14,17,18].

Dietary habits, in particular, exert a profound influence on cardiovascular health. Diets high in saturated fats, trans fats, refined carbohydrates, and sodium are strongly associated with elevated blood pressure, obesity, dyslipidaemia, impaired glucose metabolism, and increased cardiovascular risk [14,17]. Excessive sodium intake contributes to hypertension, while high refined sugar consumption promotes insulin resistance and central adiposity, both of which accelerate cardiometabolic disease [17 –19]. In contrast, dietary patterns rich in fruits, vegetables, whole grains, legumes, nuts, and unsaturated fats—such as the Mediterranean and DASH diets—have been consistently shown to reduce cardiovascular morbidity and mortality [19,20]. These cardioprotective dietary patterns improve lipid profiles, reduce oxidative stress, lower blood pressure, and enhance glycaemic regulation.

Physical activity is another cornerstone of cardiovascular disease prevention. Regular moderate-to-vigorous physical activity improves insulin sensitivity, lowers blood pressure, promotes weight control, improves endothelial function, and enhances lipid metabolism [15,18]. The World Health Organization recommends at least 150–300 minutes of moderate-intensity physical activity per week for adults to achieve cardiovascular protection [1,15]. Large epidemiological studies have demonstrated that physically ina ctive individuals face up to a 30–40% higher risk of cardiovascular disease compared with those who meet recommended activity levels [15,18]. Despite these well-established benefits, physical inactivity remains highly prevalent worldwide due to urban lifestyles, sedentary occupations, unsafe neighbourhood environments, screen-based behaviours, and limited access to recreational facilities.

Tobacco smoking remains one of the most powerful and preventable causes of cardiovascular disease globally [13,14]. Smoking accelerates atherosclerosis, promotes platelet aggregation, induces endothelial injury, and increases oxidative stress, significantly elevating the risk of myocardial infarction, stroke, and sudden cardiac death [14,18]. Similarly, excessive alcohol consumption contributes to hypertension, cardiomyopathy, arrhythmias, and stroke, particularly when combined with other metabolic risk factors [16,19].

Obesity, particularly central (abdominal) obesity, represents a major mediator linking unhealthy diet and physical inactivity to cardiovascular disease [13,17]. Adipose tissue acts as an active endocrine organ releasing inflammatory cytokines and adipokines that promote insulin resistance, endothelial dysfunction, and chronic low-grade inflammation—all of which significantly increase cardiovascular risk [17,18]. The global obesity epidemic has therefore become one of the most important upstream drivers of the rising burden of cardiovascular disease and type 2 diabetes.

Landmark intervention studies provide compelling evidence that lifestyle modification can both prevent and reverse cardiovascular disease progression. The Framingham Heart Study, the Lifestyle Heart Trial, and large - scale community-based prevention trials consistently demonstrate that comprehensive lifestyle changes—combining diet, physical activity, smoking cessation, and stress management—lead to substantial reductions in cardiovascular risk and even regression of atherosclerotic disease [15 –18]. These interventions are not only clinically effective but also highly cost-effective compared with long-term pharmacological treatment alone.

Despite the strong evidence base, long-term adherence to healthy lifestyle behaviours remains a major public health challenge. Socioeconomic disadvantage, cultural norms, time constraints, occupational demands, food insecurity, limited health literacy, and psychological stress significantly undermine sustained behavioral change [16,20]. Behavior modification is further complicated by the fact that many lifestyle behaviours are deeply embedded within social, familial, and environmental contexts. As a result, purely individual-level interventions often achieve limited long-term success unless supported by community and policy-level changes.

From a public health perspective, effective cardiovascular prevention therefore requires multi-level lifestyle interventions that operate at individual, community, and population levels. These include health education, urban design that promotes physical a ctivity, food environment regulation, tobacco control policies, workplace wellness programmes, and school-based health promotion initiatives [19,20]. Lifestyle modification is not merely a personal choice, but a societal responsibility shaped by social determinants of health, environmental infrastructure, economic policies, and cultural values.

In this study, lifestyle modification is conceptualised as a central behavioural pathway through which cardiovascular disease and stroke risk can be substantially reduced. By examining physical activity, dietary patterns, smoking, alcohol use, sleep quality, and obesity within a real-world community context, this research aims to generate evidence that supports the design of more practical, culturally responsive, and sustainable lifestyle-based cardiovascular prevention strategies.

Table 1.1: Lifestyle-Related Risk Factors Associated with Urbanisation and Cardiovascular Disease

Risk Factor	Global Trend	Cardiovascular Impact
Physical inactivity	Increasing	Increased hypertension and obesity
High-fat diet	Increasing	Increased dyslipidemia and atherosclerosis
Tobacco use	Persistent	Increased stroke and myocardial infarction (MI)
Alcohol misuse	Rising	Increased cardiomyopathy and hypertension
Obesity	Rapid growth	Increased diabetes mellitus and cardiovascular disease

Note. ↑ indicates increased risk.

Source: Adapted from the World Health Organization and Global Burden of Disease reports [1,4 –7,13].

Psychological Wellbeing and Cardiovascular Health

Psychological wellbeing is increasingly recognised as a fundamental determinant of cardiovascular health and disease outcomes, exerting significant influence across the entire cardiovascular disease (CVD) continuum — from risk factor development to disease onset, progression, recovery, and long-term prognosis [21–23]. Chronic psychological stress, anxiety, depression, and unresolved emotional trauma activate complex neuroendocrine, autonomic, and inflammatory pathways that directly contribute to the pathogenesis of cardiovascular disease [21,22]. These psychosocial factors not only worsen biological risk profiles but also undermine health - protective behaviours, thereby amplifying overall cardiovascular risk.

At a biological level, chronic psychological stress activates the hypothalamic–pituitary–adrenal (HPA) axis and the sympathetic nervous system, leading to sustained elevations in cortisol, catecholamines, heart rate, and blood pressure [21,22]. Prolonged a ctivation of these stress pathways promotes endothelial dysfunction, oxidative stress, insulin resistance, visceral fat accumulation, and systemic inflammation —key mechanisms underlying atherosclerosis and cardiovascular instability [22,23]. Elevated infla mmatory markers such as C-reactive protein, interleukin-6, and tumour necrosis factor-α observed in individuals with chronic stress and depression further reinforce the biological link between psychological distress and cardiovascular disease [23,24].

Depression and anxiety are highly prevalent among individuals with diabetes and cardiovascular disease and are consistently associated with poorer clinical outcomes [22 –24]. Epidemiological studies indicate that people with depression have a 1.5–2-fold increased risk of developing coronary heart disease and stroke compared with those without depression [23,24]. Among patients with established cardiovascular disease, depression is associated with higher rates of recurrent cardiac events, reduced quality of life, increased healthcare utilisation, and significantly elevated mortality risk [22,24]. Anxiety disorders similarly contribute to adverse cardiovascular outcomes through heightened sympathetic activation, poor sleep quality, and maladaptive coping behaviours.

Psychological distress also exerts a powerful indirect effect on cardiovascular health through its impact on health behaviours and treatment adherence. Individuals experiencing depression, chronic stress, or anxiety are significantly less likely to engage in regular physical activity, adhere to dietary recommendations, quit smoking, comply with medication regimens, or attend follow-up medical appointments [23–25]. Poor self-efficacy, low motivation, hopelessness, and cognitive distortions commonly associated with depression further impair an individual's capacity to sustain long-term lifestyle modification and disease self-management. As a result, psychological distress becomes both a cause and a consequence of worsening cardiometabolic health.

The burden of psychological morbidity is particularly pronounced among people living with diabetes, stroke, and advanced cardiovascular disease. Stroke survivors experience exceptionally high rates of post -stroke depression, anxiety, emotional lability, cognitive impairment, and social isolation [6,31]. These psychological sequelae significantly hinder post-stroke rehabilitation, functional recovery, reintegration into society, and long-term independence. Similarly, individuals with diabetes often experience diabetes distress, fear of complications, and treatment fatigue, which further compromise cardiovascular risk control [21,24].

From a public health perspective, psychological wellbeing is therefore not a peripheral concern but a core component of effective cardiovascular disease prevention and management. The World Health Organization and leading cardiovascular societies increasingly emphasise the integration of mental health screening, psychosocial assessment, stress management, and behavioural counselling within routine cardiovascular and diabetes care [23,27]. Interventions such as cognitive behavioural therapy (CBT), mindfulness-based stress reduction, peer support programmes, and community-based counselling services have demonstrated significant benefits in improving psychological wellbeing, enhancing treatment adherence, and reducing cardiovascular risk indicators [21–24].

Importantly, psychological health is deeply shaped by broader social determinants such as income security, employment conditions, family support, education, housing stability, exposure to violence, and community cohesion [26–28]. High levels of social isolation, financial stress, and occupational strain significantly elevate cardiovascular risk through both behavioural and physiological pathways. Conversely, strong social support networks, community connectedness, and positive coping resources have been sho wn to buffer stress responses and improve cardiovascular outcomes [23,28].

In the context of this study, psychological wellbeing is conceptualised as a critical psychosocial pathway through which cardiovascular disease and stroke risk can be either amplified or mitigated. By examining perceived stress, emotional health, coping ca pacity, and access to psychosocial support alongside biomedical and behavioural factors, this research adopts a genuinely holistic public health approach. Integrating psychological wellbeing into cardiovascular prevention strategies is essential for achieving sustainable risk reduction, improving patient engagement, and addressing the full complexity of cardiovascular disease as a biopsychosocial condition rather than a purely biomedical disorder.

Community-Based Education and Public Health Awareness

Limited community awareness of cardiovascular risk factors, early warning signs, and evidence-based preventive strategies remains a major global public health concern [25 –27]. In many populations, inadequate knowledge of modifiable risk factors, poor recognition of early symptoms of heart attack and stroke, and misconceptions regarding disease causation contribute to delayed diagnosis, suboptimal disease management, and increased morbidity and mortality [25,26]. Low levels of health literacy, combined with cultural beliefs, language barriers, socioeconomic disadvantage, and limited access to healthcare services, further exacerbate disparities in cardiovascular outcomes, particularly among vulnerable and marginalised communities [26,28].

Community-based health education has been widely recognised as a cornerstone of effective cardiovascular disease and stroke prevention [25,27,29]. Unlike clinic-based interventions alone, community-based programmes have the capacity to reach individuals across the life course, including those who may not routinely engage with formal healthcare systems. These programmes play a critical role in improving public understanding of cardiovascular risk factors, promoting healthy lifestyle behaviours, enhancing diabetes self - management, strengthening psychological resilience, and encouraging early help-seeking behaviour in response to heart attack and stroke warning signs [27–30].

Evidence from public health intervention studies demonstrates that community -based education initiatives can significantly improve health knowledge, self-efficacy, medication adherence, and engagement in preventive behaviours such as physical activity, hea lthy dietary practices, smoking cessation, and regular health screening [27–30]. Educational interventions delivered through community centres, primary healthcare clinics, workplaces, schools, religious institutions, and digital platforms have been shown to increase awareness of cardiovascular disease prevention while fostering sustained behavioural change [29,30]. Importantly, culturally tailored and linguistically appropriate education programmes are particularly effective in reducing health inequities among ethnically diverse and socioeconomically disadvantaged populations [26 –28].

Community education also plays a vital role in improving recognition of acute cardiovascular and stroke symptoms, thereby reducing delays in emergency response and improving survival outcomes [25,27]. Early recognition and timely access to emergency care a re critical determinants of stroke and myocardial infarction outcomes. Public awareness campaigns focusing on symptom recognition, emergency response pathways, and the importance of rapid medical intervention have been associated with improved treatment timelines and reduced long-term disability [25,29].

From a public health perspective, community-based education represents a cost-effective and sustainable strategy for reducing the population burden of cardiovascular disease and stroke. By addressing upstream social determinants of health and empowering communities with knowledge, skills, and supportive environments, such programmes contribute to long-term disease prevention rather than reactive treatment [28 –30]. Community engagement further enhances programme acceptability, trust, and sustainability, rein forcing the collective responsibility for cardiovascular health promotion.

In the context of this study, community-based education is conceptualised as a critical structural pathway through which diabetes control, lifestyle modification, and psychological wellbeing can be effectively translated into real-world cardiovascular disease and stroke prevention. Integrating community education within a broader public health framework aligns with international recommendations and supports the development of holistic, equitable, and culturally responsive prevention strategies that extend beyond clinical care settings.

Problem Statement

Despite substantial advances in medical treatment, cardiovascular disease (CVD) and stroke remain leading causes of mortality and long-term disability worldwide, indicating that current prevention strategies are insufficient to address the full complexity of cardiovascular risk [1–3]. Although pharmacological therapies for hypertension, diabetes, and dyslipidaemia have improved clinical outcomes, population -level reductions in cardiovascular morbidity and mortality have

been limited, particularly among high -risk and socioeconomically disadvantaged groups [1,8,21]. This persistent burden highlights a critical gap between biomedical treatment advances and effective, sustainable ca rdiovascular disease prevention.

A major limitation of existing public health and healthcare approaches is the fragmented management of cardiovascular risk factors. Diabetes control, lifestyle behaviours, psychological wellbeing, and community -level health education are frequently addressed as isolated components rather than as interconnected determinants of cardiovascular health [8,20,24]. Healthcare systems continue to prioritise pharmacological management and acute clinical care, while behavioural, psychological, and social determinants of health remain under-recognised, under-integrated, and inconsistently implemented within prevention frameworks [20,24,28].

Diabetes mellitus, one of the strongest predictors of cardiovascular disease and stroke, is often managed independently of comprehensive cardiovascular prevention strategies, despite well-established pathophysiological and epidemiological links [8 –12]. Poor integration of diabetes management with lifestyle intervention, psychological support, and community education results in missed opportunities for early prevention, risk reduction, and long-term disease control. As a result, many individuals with diabetes continue to experience progressive cardiovascular complications despite receiving standard medical treatment [9 –12].

Lifestyle modification represents one of the most effective and cost-efficient strategies for reducing cardiovascular risk; however, long-term adherence to healthy behaviours remains poor in real-world settings [13–20]. Individual-level lifestyle interventions frequently fail to account for psychological stress, socioeconomic constraints, cultural practices, and environmental barriers that influence behaviour change. Without supportive community environments and sustained public health engagement, lifestyle interventions often achieve limited and short-lived effects [16,20,28].

Psychological wellbeing is another critical yet under-addressed determinant of cardiovascular health. Chronic stress, depression, and anxiety significantly exacerbate cardiovascular risk through both biological mechanisms and behavioural pathways, including poor treatment adherence and reduced engagement in preventive behaviours [21–24]. Despite strong evidence linking psychological distress to adverse cardiovascular outcomes, mental health screening and psychosocial support remain inadequately integrated into routine cardiovascular and diabetes care, particularly within community and primary care settings [23,27].

Furthermore, community-based health education and public awareness initiatives remain fragmented, inconsistently delivered, and insufficiently evaluated across populations [25 –30]. Low health literacy, limited awareness of cardiovascular risk factors and early warning signs, and poor access to culturally appropriate education contribute to delayed diagnosis, preventable complications, and persistent health inequities [26 –28]. Existing prevention programmes often lack integration across biomedical, behavioural, psychological, and social domains, reducing their effectiveness and sustainability.

Collectively, these gaps indicate a critical need for an integrated public health approach that simultaneously addresses diabetes control, lifestyle modification, psychological wellbeing, and community -based education within a unified prevention framework. There is a particular lack of mixed-methods research that captures not only quantitative cardiovascular risk patterns but also the lived experiences, psychological challenges, and community-level barriers influencing prevention and self-management [22,27].

Therefore, the central problem addressed by this study is the absence of a comprehensive, integrated, and community-informed public health model capable of effectively reducing cardiovascular disease and stroke risk by bridging biomedical, behavioural, psychological, and social determinants of health. Addressing this problem requires a holistic, mixed-methods approach that can inform more effective, culturally responsive, and sustainable cardiovascular disease and stroke prevention strategies.

Significance of the Study

This study is significant as it adopts a comprehensive and integrated public health approach to cardiovascular disease and stroke prevention by explicitly linking biomedical, behavioural, psychological, and community - based determinants of health within a single research framework [19,23,27]. Unlike traditional prevention models that emphasise pharmacological management or isolated lifestyle interventions, this study recognises cardiovascular disease and stroke as complex, multifactorial conditions shaped by interacting biological, psychological, social, and environmental factors.

From a public health perspective, this research contributes important evidence supporting the need for multi-level prevention strategies that extend beyond clinical settings into communities, households, and social environments. By examining diabetes control, lifestyle behaviours, psychological wellbeing, and community health awareness simultaneously, the study provides a more realistic and holistic understanding of cardiovascular risk patterns in real-world populations [1,8,25]. This integrated perspective is particularly relevant for addressing persistent cardiovascular health inequities among socioeconomically disadvantaged and high-risk populations.

The study is also significant for clinical practice, as it highlights the limitations of fragmented care models that

manage diabetes, cardiovascular disease, and mental health as separate entities. The findings are expected to inform more coordinated, multidisciplinary care pathways that integrate glycaemic control, lifestyle counselling, psychological screening, and patient education as standard components of cardiovascular prevention and chronic disease management [12,18,23]. Such integrated care approaches have the potential to improve treatment adherence, reduce recurrent cardiovascular events, and enhance patient quality of life.

In terms of psychological wellbeing, this research reinforces the growing recognition that mental health is a core determinant of cardiovascular outcomes rather than a secondary concern. By explicitly examining stress, emotional distress, coping capacity, and psychosocial support, the study contributes to the evidence base supporting the integration of mental health assessment and intervention within cardiovascular and diabetes care frameworks [21–24]. This has important implications for designing prevention strategies that are both clinically effective and sustainable over time.

The study holds particular significance for community-based health education and health promotion. By exploring levels of community awareness, health literacy, and perceived barriers to prevention, the research provides actionable insights for developing culturally responsive, accessible, and community -driven education programmes [25–30]. These findings can inform the design of public health interventions that are better aligned with community needs, cultural contexts, and lived experiences, thereby strengthening engagement and long-term behaviour change.

From a policy perspective, the study contributes evidence to support integrated non-communicable disease (NCD) prevention strategies that address cardiovascular disease, diabetes, mental health, and lifestyle -related risk factors within unified policy frameworks [1,25,34]. The findings may inform national and regional public health policies by highlighting the value of investing in preventive care, community education, and psychosocial support alongside medical treatment.

Methodologically, this study is significant in its application of a TAP-IT mixed-methods design, which enables the integration of quantitative risk factor analysis with qualitative exploration of lived experiences and community perspectives [22,27]. This approach strengthens the validity, depth, and practical relevance of the findings and addresses a notable gap in cardiovascular prevention research, where mixed-methods studies remain limited.

Overall, this study contributes to advancing public health knowledge and practice by demonstrating the necessity of integrated, people-centred, and community-informed approaches to cardiovascular disease and stroke prevention. By bridging biomedical evidence with behavioural science, psychological insight, and community engagement, the research offers a robust foundation for developing more effective, equitable, and sustainable cardiovascular prevention strategies.

Research Aim

The aim of this study is to investigate, using an integrated public health mixed-methods approach, strategies for reducing cardiovascular disease and stroke risk through diabetes control, lifestyle modification, psychological wellbeing, and community-based health education.

Research Objectives

The specific objectives of this study are:

1. To examine the role of diabetes control in the prevention of cardiovascular disease and stroke, with particular attention to glycaemic management and associated cardiovascular risk factors.
2. To assess lifestyle behaviours associated with cardiovascular risk, including physical activity, dietary patterns, smoking, alcohol consumption, sleep quality, and obesity.
3. To explore the impact of psychological wellbeing on cardiovascular health outcomes, focusing on perceived stress, anxiety, depression, coping capacity, and treatment adherence.
4. To evaluate levels of community awareness and public health literacy related to cardiovascular disease and stroke, including knowledge of risk factors, early warning signs, and preventive strategies.
5. To identify key barriers and facilitators influencing effective community-based cardiovascular disease and stroke prevention, from individual, psychological, social, and environmental perspectives.

Research Questions

How does diabetes control influence cardiovascular disease and stroke risk among adults?

1. Which lifestyle behaviours are most strongly associated with cardiovascular risk reduction, including physical activity, diet, smoking, alcohol consumption, sleep quality, and obesity?
2. How does psychological wellbeing influence cardiovascular disease prevention and management, particularly in relation to stress, emotional distress, coping capacity, and treatment adherence?
3. What is the level of community awareness and public health literacy regarding cardiovascular disease and stroke risk factors, early warning signs, and prevention strategies?
4. What public health strategies can effectively integrate biomedical, behavioural, psychological, and community-based educational interventions to reduce cardiovascular disease and stroke risk?

II. LITERATURE REVIEW

Overview of Cardiovascular Disease and Stroke

Cardiovascular disease (CVD) encompasses a broad group of disorders affecting the heart and blood vessels,

including coronary artery disease, hypertension, heart failure, arrhythmias, peripheral vascular disease, and cerebrovascular disease, most notably stroke [1–3]. Among these conditions, stroke represents one of the most severe and disabling manifestations of cardiovascular disease and remains a leading cause of long-term disability and premature mortality worldwide [3,31,33]. Together, cardiovascular d isease and stroke account for a substantial proportion of global morbidity, mortality, and healthcare utilisation.

According to the World Health Organization, cardiovascular diseases are responsible for approximately 17.9 million deaths each year, representing nearly one-third of all global deaths [1,2]. More than 85% of these deaths are attributable to heart attacks a nd strokes, highlighting the dominant contribution of atherosclerotic cardiovascular disease to global mortality [1]. Despite advances in medical treatment, the global burden of CVD continues to rise, driven by population ageing, rapid urbanisation, sedentary lifestyles, unhealthy dietary patterns, and the increasing prevalence of diabetes, obesity, and hypertension [4 –7]. This trend is particularly pronounced in low- and middle-income countries, where healthcare systems often face limited capacity for early detection, prevention, and long-term disease management [1,5].

Atherosclerosis is the primary pathological process underlying most cardiovascular events [10,15]. It is a chronic, progressive condition characterised by lipid accumulation within arterial walls, endothelial dysfunction, vascular inflammation, plaque formation, and eventual plaque rupture, leading to thrombosis and ischemia of vital organs such as the heart and brain [8,10,15]. These processes are strongly influenced by metabolic abnormalities, including hyperglycaemia, insulin resistance, dyslipidaemia, a nd systemic inflammation, which frequently coexist in individuals at high cardiovascular risk.

From a public health perspective, cardiovascular disease and stroke impose an extensive economic and social burden due to long-term treatment costs, disability, reduced workforce participation, informal caregiving demands, and diminished quality of life [3,25]. The chronic nature of CVD and its frequent coexistence with other non-communicable diseases, particularly diabetes mellitus, further complicate prevention and management efforts. Consequently, cardiovascular disease and stroke are increasingly recognised not only as clinical conditions but also as complex public health challenges requiring integrated, multi-sectoral prevention strategies.

This overview underscores the necessity of addressing cardiovascular disease and stroke through comprehensive approaches that extend beyond acute medical care to include risk factor modification, psychological wellbeing, and community-based prevention. Understanding the epidemiology and pathophysiology of CVD provides the foundation for examining the specific roles of diabetes control, lifestyle behaviours, psychological factors, and public health education, which are explored in the subsequent sections of this literature review.

Diabetes Mellitus and Cardiovascular Risk

Diabetes mellitus is widely recognised as one of the strongest independent risk factors for cardiovascular disease and stroke, substantially increasing both morbidity and mortality across populations [8 –12]. Individuals living with diabetes experience a two- to four-fold higher risk of developing coronary artery disease, myocardial infarction, stroke, heart failure, and peripheral arterial disease compared with non-diabetic individuals [9,10,12]. Importantly, this elevated risk persists even after adjustment for traditional cardiovascular risk factors, underscoring diabetes as a major driver of cardiovascular pathology in its own right.

The relationship between diabetes and cardiovascular disease is mediated through multiple interrelated pathophysiological mechanisms. Persistent hyperglycaemia induces oxidative stress, endothelial dysfunction, chronic vascular inflammation, and abnormal lipid metabolism, all of which accelerate atherosclerotic plaque development and vascular injury [8,11]. Advanced glycation end-products (AGEs) formed under conditions of prolonged hyperglycaemia further impair endothelial function, promote arterial stiffness, and contribute to plaque instability [11,13]. In parallel, insulin resistance promotes hypertension, dyslipidaemia, and pro - thrombotic states, collectively amplifying the risk of myocardial infarction and ischaemic stroke [11 –14].

Beyond direct vascular effects, diabetes is frequently accompanied by a clustering of cardiometabolic risk factors, including central obesity, physical inactivity, hypertension, and dyslipidaemia. This constellation, often described as cardiometabolic syndrome, reflects the complex metabolic milieu that accelerates cardiovascular disease progression in diabetic populations [13–16]. Consequently, cardiovascular disease remains the leading cause of death among individuals with diabetes, accounting for a substantial proportion of diabetes-related mortality worldwide [9,12].

Evidence from large clinical trials and population-based cohort studies consistently demonstrates a strong association between poor glycaemic control and increased cardiovascular morbidity and mortality [9 –12].

Conversely, effective diabetes management has been shown to significantly reduce cardiovascular complications, particularly when glycaemic control is achieved early and sustained over time [10 –12]. Findings from landmark studies such as the United Kingdom Prospective Diabetes Study (UKPDS) and subseq uent longitudinal research highlight the long-term cardiovascular benefits of improved glycaemic regulation,

blood pressure control, and lipid management in individuals with diabetes [9 –11].

In response to this evidence, national and international clinical guidelines emphasise comprehensive cardiovascular risk reduction strategies in diabetic populations, including strict glycaemic control, blood pressure regulation, lipid management, and lifestyle modification [11,12,35]. However, despite clear guideline recommendations, optimal diabetes control remains difficult to achieve in real-world settings due to behavioural, psychological, socioeconomic, and healthcare system barriers. These challenges contribute to persistent cardiovascular risk even among individuals receiving standard medical treatment.

From a public health perspective, diabetes mellitus represents a critical intervention point for cardiovascular disease and stroke prevention. The strong biological, epidemiological, and clinical links between diabetes and cardiovascular disease highlight the necessity of integrated prevention strategies that address metabolic control alongside lifestyle behaviours, psychological wellbeing, and broader social determinants of health. This interconnected risk profile provides a strong rationale for examining lifestyle modification as a complementary and essential component of cardiovascular prevention, as explored in the following section.

Lifestyle Modification in Cardiovascular Prevention

Lifestyle behaviours play a central and modifiable role in the development, progression, and prevention of cardiovascular disease and stroke, making lifestyle modification a cornerstone of cardiovascular risk reduction strategies [13–16]. Major modifiable lifestyle-related risk factors include unhealthy dietary patterns, physical inactivity, obesity, tobacco use, excessive alcohol consumption, and poor sleep quality, all of which contribute independently and synergistically to cardiometabolic dysfunction [13,14,16]. These behaviours influence key biological pathways, including blood pressure regulation, glucose metabolism, lipid profiles, systemic inflammation, and endothelial function, thereby shaping long-term cardiovascular outcomes.

Dietary behaviour is one of the most extensively studied lifestyle determinants of cardiovascular health. Diets high in saturated fats, trans fats, refined sugars, and sodium are strongly associated with hypertension, obesity, dyslipidaemia, insulin resistance, and accelerated atherosclerosis [14,17,19]. Excessive sodium intake contributes to elevated blood pressure, while high refined sugar consumption promotes insulin resistance and central adiposity, particularly among individuals with diabetes and metabolic syndrome [17–19]. In contrast, dietary patterns emphasising fruits, vegetables, whole grains, legumes, nuts, and unsaturated fats—most notably the Mediterranean and Dietary Approaches to Stop Hypertension (DASH) diets—have been consistently associated with significant reductions in cardiovascular events, stroke incidence, and all-cause mortality [19,20]. These cardioprotective effects are mediated through improvements in lipid profiles, glycaemic regulation, blood pressure control, and inflammatory markers.

Physical activity represents another critical pillar of cardiovascular disease prevention. Regular moderate -to-vigorous physical activity improves cardiovascular fitness, enhances insulin sensitivity, promotes weight management, lowers blood pressure, and improves lipid metabolism [15,18]. Large epidemiological studies demonstrate that individuals who meet recommended physical activity levels experience substantially lower cardiovascular morbidity and mortality compared with physically inactive populations [15,18]. Landmark investigations, including the Framingham Heart Study and the Lifestyle Heart Trial, provide compelling evidence that comprehensive lifestyle interventions incorporating physical activity can significantly reduce cardiovascular risk and, in some cases, contribute to regression of atherosclerotic disease [15 –18].

Tobacco smoking remains one of the most powerful and preventable causes of cardiovascular disease globally. Smoking accelerates endothelial injury, promotes oxidative stress, enhances platelet aggregation, and destabilises atherosclerotic plaques, markedly increasing the risk of myocardial infarction, stroke, and sudden cardiac death [13,14]. Similarly, excessive alcohol consumption contributes to hypertension, cardiomyopathy, arrhythmias, and stroke, particularly when combined with other metabolic risk factors such as obesity and diabetes [16,19]. Poor sleep quality and sleep disorders have also emerged as important, though often under-recognised, contributors to cardiovascular risk through their effects on blood pressure, glucose metabolism, inflammation, and autonomic regulation [16,22].

Despite the strong evidence supporting lifestyle modification, sustaining long-term behavioural change remains a major public health challenge. Socioeconomic disadvantage, cultural norms, time constraints, occupational demands, food environments, psychological stress, and limited health literacy significantly undermine adherence to healthy lifestyle behaviours [16,20,22]. As a result, lifestyle interventions delivered at the individual level often achieve limited and short-term success unless reinforced by supportive community environments, health education, and policy-level interventions.

From a public health perspective, effective cardiovascular prevention therefore requires multi-level lifestyle interventions that operate across individual, community, and population contexts. These include health education initiatives, urban design that promotes physical activity, regulation of unhealthy food environments, tobacco and alcohol control policies, workplace wellness programmes, and school-based health promotion strategies [19,20]. Lifestyle modification must be understood not merely as an individual responsibility but as a collective societal

outcome shaped by social determinants of health, environmental infrastructure, economic policies, and cultural practices.

In the context of cardiovascular disease and stroke prevention, lifestyle modification represents a critical behavioural pathway through which cardiometabolic risk can be substantially reduced. However, its effectiveness is closely intertwined with psychological wellbeing, social support, and community engagement. This interdependence underscores the importance of examining psychological factors influencing behaviour change, which is addressed in the following section.

Psychological Wellbeing and Heart–Brain Health

Psychological wellbeing is increasingly recognised as a major determinant of cardiovascular health and disease outcomes, exerting influence across the entire cardiovascular disease (CVD) continuum, from risk factor development to disease onset, progression, recovery, and long-term prognosis [21–24]. The concept of heart–brain health highlights the bidirectional relationship between psychological processes and cardiovascular function; whereby mental and emotional states influence physiological pathways that directly affect cardiovascular risk.

At a biological level, chronic psychological stress activates the hypothalamic–pituitary–adrenal (HPA) axis and the sympathetic nervous system, resulting in sustained elevations in cortisol, catecholamines, heart rate, and blood pressure [21,22]. Prolonged activation of these stress pathways contributes to endothelial dysfunction, oxidative stress, systemic inflammation, insulin resistance, and visceral adiposity—key mechanisms underlying atherosclerosis and cardiovascular instability [22 –24]. Elevated inflammatory markers, including C-reactive protein, interleukin-6, and tumour necrosis factor-α, observed among individuals experiencing chronic stress and depression further reinforce the biological link between psychological distress and cardiovascular disea se [23,24].

Depression and anxiety are highly prevalent among individuals with diabetes and cardiovascular disease and are consistently associated with poorer clinical outcomes [22 –24]. Epidemiological evidence indicates that individuals with depression have a 1.5– to 2-fold increased risk of developing coronary heart disease and stroke compared with those without depression [23,24]. Among patients with established cardiovascular disease, depression is associated with increased rates of recurrent cardiovascular events, higher hospital readmission, reduced quality of life, and significantly elevated mortality [22 –24]. Anxiety disorders similarly contribute to adverse cardiovascular outcomes through heightened sympathetic activation, sleep disturbance, and maladaptive coping behaviours.

Psychological distress also exerts a powerful indirect effect on cardiovascular health by undermining engagement in health-protective behaviours and adherence to medical treatment. Individuals experiencing depression, chronic stress, or anxiety are significantly less likely to engage in regular physical activity, adhere to dietary recommendations, cease smoking, comply with medication regimens, or attend routine follow-up appointments [23–25]. Reduced self-efficacy, low motivation, cognitive fatigue, and hopelessness further impair the capacity to sustain long-term lifestyle modification and effective disease self-management. Consequently, psychological distress becomes both a cause and a consequence of worsening cardiometabolic health, creating a self-reinforcing cycle of risk.

The psychological burden is particularly pronounced among individuals living with diabetes, stroke, and advanced cardiovascular disease. Stroke survivors experience exceptionally high rates of post -stroke depression, anxiety, emotional lability, cognitive impairment, and social isolation, all of which significantly hinder rehabilitation, functional recovery, and reintegration into daily life [6,31]. Similarly, individuals with diabetes frequently experience diabetes-related distress, fear of complications, and treatment fatigue, which further compromise glycaemic control and cardiovascular risk management [21,24].

From a public health perspective, psychological wellbeing is therefore not a peripheral concern but a core component of effective cardiovascular disease prevention and management. International organisations, including the World Health Organization, alongside leading cardiovascular and diabetes societies, increasingly emphasise the integration of mental health screening, psychosocial assessment, stress management, and behavioural counselling into routine cardiovascular and diabetes care pathways [23,27]. Ev idence-based interventions such as cognitive behavioural therapy, mindfulness-based stress reduction, peer-support programmes, and community-based counselling services have demonstrated significant benefits in improving psychological wellbeing, enhancing treatment adherence, and reducing cardiovascular risk indicators [21 –24].

Importantly, psychological health is shaped by broader social determinants, including socioeconomic status, employment conditions, housing security, family support, education, and community cohesion [26 –28]. Social isolation, financial stress, and occupational strain amplify cardiovascular risk through both behavioural and physiological pathways, whereas strong social support networks and community connectedness have been shown to buffer stress responses and improve cardiovascular outcomes [23,28].

In the context of cardiovascular disease and stroke prevention, psychological wellbeing represents a critical psychosocial pathway through which cardiometabolic risk

can be either amplified or mitigated. Integrating psychological considerations into prevention strategies is essential for achieving sustainable behaviour change, improving patient engagement, and addressing cardiovascular disease as a biopsychosocial condition rather than a purely biomedical disorder. This perspective provides a crucial founda tion for the role of community-based education and support systems discussed in the following section.

Community-Based Education and Public Health Promotion

Community-based education plays a crucial role in reducing the population burden of cardiovascular disease and stroke by addressing upstream determinants of health and supporting sustained behaviour change beyond clinical settings [25–30]. Despite advances in medical treatment, low levels of health literacy, limited awareness of cardiovascular risk factors, poor recognition of early warning signs, and persistent misconceptions regarding disease causation remain major barriers to effective prevention across many populations [25–27]. These gaps contribute to delayed diagnosis, inadequate self-care, poor treatment adherence, and suboptimal engagement with preventive health services.

Health literacy is a central mechanism through which community-based education influences cardiovascular outcomes. Individuals with limited understanding of cardiovascular risk, diabetes management, and stroke symptoms are less likely to adopt healthy lifestyle behaviours, seek timely medical care, or adhere to prescribed treatments [25–27]. Low health literacy is particularly prevalent in socioeconomically disadvantaged communities and is compounded by cultural beliefs, language barriers, and limited access to culturally appropriate health information [26,28]. As a result, cardiovascular risk is disproportionately concentrated among populations already facing structural disadvantage.
Community-based health promotion programmes provide an effective strategy for addressing these inequities by delivering education in accessible, culturally responsive, and socially embedded contexts [27 –30]. Evidence demonstrates that well-designed community interventions can significantly improve knowledge of cardiovascular risk factors, enhance recognition of heart attack and stroke warning signs, promote lifestyle modification, strengthen medication adherence, and increase participation in preventive screening programmes [27–30]. Importantly, these programmes are most effective when they integrate biomedical information with practical skills, behavioural support, and psychosocial empowerment.

Community education is particularly important for individuals living with diabetes, who face substantially elevated cardiovascular and stroke risk. Diabetes self-management requires ongoing understanding of diet, physical activity, medication use, blood glucose monitoring, and complication prevention. Community-based education programmes tailored to diabetic populations have been shown to improve glycaemic control, reduce cardiovascular risk behaviours, and enhance self-efficacy, especially when combined with peer support and culturally relevant messaging [27–30].

Public health initiatives delivered through schools, workplaces, religious institutions, community centres, and digital platforms provide scalable and sustainable avenues for cardiovascular health promotion [29,30,34]. Schools offer early opportunities to establish lifelong healthy behaviours, while workplace programmes can address physical inactivity and stress among adults. Faith-based and community organisations play a critical role in reaching high-risk populations by leveraging trust, shared cultural values, and social networks. Digital and mobile health platforms further extend the reach of community education by overcoming geographic, time, and resource constraints, particularly in underserved areas [29,30].

Community engagement is a key determinant of programme effectiveness and sustainability. Interventions that actively involve community members in programme design, delivery, and evaluation demonstrate higher levels of trust, participation, and long-term behavioural change [25,27,30]. Peer-led education, family involvement, and community ownership strengthen social support, reinforce positive norms, and enhance motivation for lifestyle change. These social mechanisms are particularly important in addressing psychological stress, treatment fatigue, and behaviour maintenance, which are central challenges in cardiovascular disease and diabetes prevention.

From a public health perspective, community-based education represents a critical bridge between individual behaviour change and population-level cardiovascular risk reduction. When integrated with healthcare services, policy initiatives, and supportive environments, community education can amplify the impact of clinical interventions and contribute to sustainable reductions in cardiovascular disease and stroke burden. However, despite strong evidence of effectiveness, community-based prevention programmes remain inconsistently implemented and under-resourced across many health systems.

This underscores the importance of examining how community education can be effectively integrated with diabetes control, lifestyle modification, and psychological wellbeing within a unified prevention framework. Understanding these interconnections is essential for developing comprehensive, culturally responsive, and scalable public health strategies, providing the rationale for the knowledge gaps addressed in the following section.

Figure:2.1 Community-Based Cardiovascular Disease Prevention Framework

Community-Based Education
|

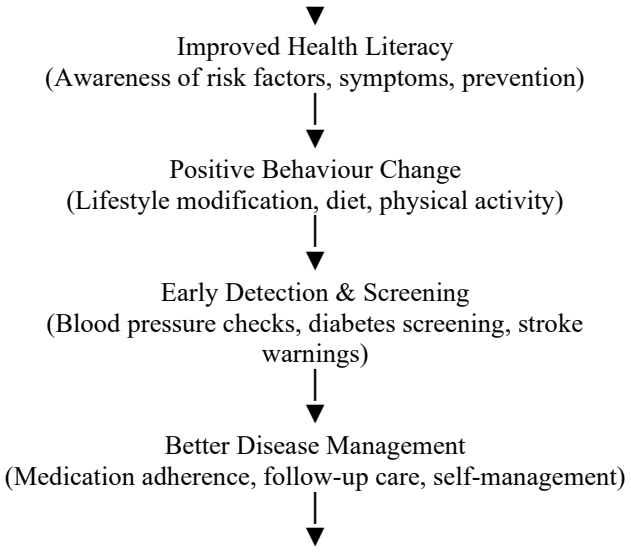

Figure X. Community-Based Cardiovascular Disease and Stroke Prevention Framework. This conceptual model illustrates the pathway from community-based education to improved health literacy, behavioural modification, early detection, and effective disease management, ultimately contributing to a reduced population burden of cardiovascular disease and stroke.

Knowledge Gaps and Rationale for the Study

Despite extensive biomedical and epidemiological research on cardiovascular disease (CVD) and stroke, significant knowledge gaps persist in the integration of diabetes control, lifestyle modification, psychological wellbeing, and community-based education within a unified public health prevention framework [1,8,21,25]. While individual risk factors and disease mechanisms have been well documented, existing research remains largely fragmented, with limited emphasis on the complex interactions between biological, behavioural, psychological, and social determinants of cardiovascular risk.

Contemporary healthcare systems continue to prioritise pharmacological management and acute clinical care, often at the expense of preventive, behavioural, and psychosocial approaches [20,24,28]. Diabetes and cardiovascular disease are frequently managed a s separate clinical entities, despite strong evidence of their pathophysiological interdependence and shared risk pathways [9 –12]. This siloed approach results in missed opportunities for early cardiovascular prevention among individuals with diabetes and contributes to persistent cardiometabolic risk despite advances in medical treatment.

Psychological wellbeing remains under-recognised and insufficiently addressed within cardiovascular prevention and management pathways [21 –24]. Although a substantial body of evidence links psychological stress, depression, and anxiety to adverse cardiovascular outcomes, these factors are rarely integrated into routine cardiovascular risk assessment or prevention strategies. The absence of systematic psychological screening and support limits the effectiveness of lifestyle interventions, undermines treatmen t adherence, and perpetuates cycles of poor cardiometabolic control.

Similarly, community-based prevention initiatives, while shown to be effective in improving health literacy and promoting behaviour change, remain fragmented, inconsistently implemented, and under-resourced across many populations [25–30]. Many existing programmes focus on isolated components of prevention, such as education or screening, without addressing the broader psychosocial and behavioural contexts in which cardiovascular risk is embedded. As a result, the scalability, sustainability, and long-term impact of community-based interventions remain limited, particularly among socioeconomically disadvantaged and high -risk groups.

A further critical gap in the literature is the limited use of integrated mixed-methods research designs that simultaneously examine clinical risk factors, lifestyle behaviours, psychological wellbeing, and community awareness within a single analytical framework [22,27]. Quantitative studies provide valuable population -level insights into risk patterns but often fail to capture the lived experiences, emotional challenges, and contextual barriers that influence behaviour change and disease management. Conversely, qualitative studies offer depth and contextual understanding but are frequently disconnected from clinical and epidemiological data. The absence of integrated mixed-methods approaches restricts the development of comprehensive, patient-centred, and contextually informed prevention strategies.

This study is therefore justified in addressing these critical gaps by adopting a comprehensive public health mixed-methods approach grounded in the TAP-IT framework. By integrating quantitative assessment of diabetes control, lifestyle behaviours, psychological wellbeing, and cardiovascular risk with qualitative exploration of lived experiences and community perspectives, this research seeks to generate a holistic understanding of cardiovascular disease and stroke prevention. The integration of biomedical, behavioural, psychological, and community-based dimensions aims to inform the development of culturally responsive, sustainable, and scalable prevention strategies that extend beyond traditional clinical models.

Through this integrated approach, the study contributes original knowledge by bridging disciplinary silos, strengthening the evidence base for multi-level cardiovascular prevention, and supporting more effective

public health interventions capable of reducing the long-term burden of cardiovascular disease and stroke.

III. METHODOLOGY

Research Design

This study adopts a TAP-IT mixed-methods research design, integrating quantitative and qualitative approaches to generate a comprehensive understanding of cardiovascular disease (CVD) and stroke prevention within a public health context [22,27]. The TAP-IT framework is specifically designed to capture the multidimensional nature of chronic disease prevention, recognising that cardiovascular risk is shaped by the interaction of clinical indicators (T), attitudinal and behavioural factors (A), psychological and psychosocial influences (P), and individual and community lived experiences (IT).

Mixed-methods research is particularly well suited to public health investigations of complex, non - communicable diseases because it enables the integration of numerical data with contextual and experiential insights [25,30]. Quantitative methods allow for the measurement of population-level patterns in cardiovascular risk factors, diabetes status, lifestyle behaviours, psychological stress, and health awareness. However, quantitative data alone are insufficient to explain why individuals adopt or fail to sustain preventive behaviours. Qualitative methods complement this by exploring lived experiences, beliefs, emotional challenges, cultural influences, and perceived barriers to lifestyle modification and disease management [21 –24,27].

In this study, the quantitative component focuses on measurable indicators of cardiovascular and stroke risk, including diabetes control, lifestyle behaviours, psychological stress levels, and community awareness of cardiovascular disease and prevention strategies [8 –16]. These data provide an empirical foundation for identifying risk patterns, associations, and potential predictors of cardiovascular outcomes at the population level.

The qualitative component explores participants lived experiences of diabetes, cardiovascular risk, lifestyle change, psychological wellbeing, and engagement with community health education. Semi-structured interviews are used to capture in-depth narratives relating to emotional burden, motivation, coping strategies, social support, and contextual factors that influence health behaviours [21 –24,27]. This qualitative dimension enables a deeper understanding of how individuals interpret health information, navigate behavioural change, and experience preventive interventions within their everyday lives.

Integration of quantitative and qualitative findings occurs at the interpretive and analytical levels, consistent with the TAP-IT framework. Quantitative results inform the identification of key risk patterns and areas of concern, while qualitative findings provide explanatory insight into the mechanisms, meanings, and contextual influences underlying these patterns. This process of methodological triangulation enhances the credibility, validity, and transferability of the findings by allowing convergence, complementarity, and expansion across data sources [22,25,27].

By adopting a TAP-IT mixed-methods design, this study moves beyond reductionist, single-method approaches and provides a holistic, person-centred, and contextually grounded understanding of cardiovascular disease and stroke prevention. This design supports the development of integrated, culturally responsive, and sustainable public health interventions that address not only biomedical risk factors but also behavioural, psychological, and community-level determinants of cardiovascular health.

Study Setting

The study will be conducted within community-based public health settings, including primary healthcare clinics, community centres, structured health education programmes, and secure online platforms [25,29,30]. These settings were deliberately selected to ensure access to individuals across a spectrum of cardiovascular risk profiles, ranging from those with established diabetes and cardiovascular disease to individuals at elevated risk but not yet diagnosed.

Community-based settings are particularly appropriate for cardiovascular disease and stroke prevention research because they reflect real-world environments in which preventive behaviours are formed, supported, or constrained [25–27]. Unlike hospital-based settings, community contexts allow for the examination of everyday lifestyle behaviours, psychological stressors, social influences, and health literacy, which are critical determinants of long-term cardiovascular outcomes.

Primary healthcare clinics provide access to individuals actively engaged in diabetes and cardiovascular risk management, enabling the collection of clinically relevant and behaviourally grounded data. Community centres and health education programmes facilitate engagement with diverse populations, including individuals who may have limited interaction with formal healthcare systems, thereby enhancing inclusivity and representativeness [29,30]. The inclusion of online pla tforms further supports accessibility, particularly for participants facing mobility, time, or geographic barriers, and reflects the growing role of digital health approaches in public health research.

By situating the study within multiple community-based settings, this research captures the complex interaction between biomedical risk, lifestyle behaviour, psychological wellbeing, and community health education within naturalistic environments. This approach strengthens the ecological validity of the findings and supports the development of scalable, community-relevant cardiovascular disease and stroke prevention strategies.

Target Population

The target population for this study comprises adults aged 30–70 years residing within community settings who are either living with cardiovascular-related conditions or are at elevated risk of cardiovascular disease and stroke. Specifically, the study includes individuals who have been diagnosed with Type 2 diabetes mellitus, hypertension, cardiovascular disease, or stroke, as well as individuals presenting with one or more established cardiovascular risk factors such as obesity, physical inactivity, tobacco use, or a family history of heart disease [8–16].

This population was selected because cardiovascular disease and stroke risk increases substantially after the age of 30 years, particularly in the presence of diabetes, metabolic dysfunction, and adverse lifestyle behaviours [9 – 11]. Focusing on this age range allows the study to capture individuals across different stages of disease progression, including prevention, early disease, and established cardiovascular conditions. This approach is consistent with public health prevention frameworks that emphasise early intervention, risk reduction, and long-term disease management.

Inclusion and Exclusion Criteria Inclusion Criteria

Participants eligible for inclusion in this study must meet the following criteria:

- Adults aged 30–70 years
- Individuals with:
  - A diagnosis of Type 2 diabetes mellitus, hypertension, cardiovascular disease, or stroke ,or
  - At least one major cardiovascular risk factor (e.g., obesity, sedentary lifestyle, smoking, or positive family history)
- Ability to provide informed consent
- Willingness to participate in the quantitative survey and/or qualitative interview Exclusion Criteria

Participants will be excluded if they meet any of the following criteria:

- Individuals below 30 years of age
- Individuals with acute psychiatric illness or severe cognitive impairment that limits the capacity to provide informed consent [21–24]
- Critically ill individuals whose medical condition prevents participation in data collection

These criteria ensure participant safety, ethical integrity, and the collection of reliable and meaningful data relevant to cardiovascular disease prevention.

Sample Size

The study employs a mixed methods sampling strategy, with sample sizes determined based on methodological adequacy, feasibility, and consistency with comparable public health research.

- **Quantitative survey:** approximately 120–200 participants
- **Qualitative interviews:** approximately 15–25 participants

The quantitative sample size is sufficient to enable descriptive analysis, cross-tabulation, and correlation testing of key cardiovascular risk variables, lifestyle behaviours, psychological stress indicators, and community awareness measures. The qualitative sample size is appropriate for achieving data saturation in thematic analysis, allowing for in-depth exploration of lived experiences, emotional challenges, and behavioural barriers [22,25,27].

This sample range aligns with established mixed-methods public health studies examining cardiovascular disease, diabetes, and lifestyle-related risk factors and balances statistical robustness with qualitative depth.

Data Collection Methods

Quantitative Data Collection (Survey Method)

Quantitative data will be collected using a structured, self-administered questionnaire designed to assess multiple domains relevant to cardiovascular disease and stroke prevention. The survey will capture information on:

- Sociodemographic characteristics
- Diabetes and cardiovascular medical history
- Lifestyle behaviours, including diet, physical activity, smoking, alcohol consumption, and sleep patterns
- Psychological wellbeing and perceived stress levels
- Awareness and knowledge of cardiovascular disease and stroke prevention.

Survey-based data collection is widely used in cardiovascular public health research due to its efficiency, scalability, and ability to measure behavioural, clinical, and psychosocial risk factors simultaneously [13 – 16,25]. Participants will complete the questionnaire either:

- In person at community-based health settings, or
- Online via a secure digital platform, enhancing accessibility and participation

Qualitative Data Collection (Interview Method)

Qualitative data will be collected through semi-structured interviews with a purposive subsample of survey participants [22,27]. This sampling approach allows for the inclusion of individuals representing diverse disease statuses, risk profiles, and lived experiences.

The interviews will explore:

- Personal experiences with diabetes, cardiovascular disease, or stroke
- Emotional and psychological challenges related to disease risk and management
- Barriers to lifestyle modification and preventive behaviours
- Perceptions of community-based health education and support
- Coping strategies and sources of social and community support All interviews will be:
- Audio-recorded with informed consent

- Transcribed verbatim
- De-identified to ensure participant confidentiality

Qualitative interviews are essential for capturing the psychosocial, cultural, and contextual dimensions of cardiovascular risk and prevention that are often underrepresented in quantitative research [21 –24,27]. This component provides depth and explanatory insight that complements quantitative findings within the TAP-IT mixed-methods framework.

Data Analysis

Data analysis in this study follows a convergent TAP-IT mixed-methods analytical strategy, integrating quantitative and qualitative findings to provide a comprehensive understanding of cardiovascular disease and stroke prevention through diabetes control, lifestyle behaviours, psychological wellbeing, and community -based education [22,25,27]. The analytical process is structured to ensure methodological rigour, transparency, and meaningful integration across data sources.

Quantitative Data Analysis

Quantitative data collected through structured questionnaires will be analysed using statistical software such as SPSS. Prior to analysis, data will be screened for completeness, accuracy, missing values, and outliers to ensure data quality and validity [13–16].

Descriptive statistics will be used to summarise participant characteristics, including age, sex, ethnicity, education level, diabetes status, cardiovascular history, lifestyle behaviours, psychological stress levels, and community awareness scores. Measures of central tendency (means, medians) and dispersion (standard deviations, ranges) will be reported for continuous variables, while frequencies and percentages will be calculated for categorical variables.

Inferential statistical analyses will be conducted to examine associations between key variables relevant to cardiovascular and stroke risk. These analyses may include:

- Chi-square tests to assess relationships between categorical variables (e.g., diabetes status and cardiovascular disease presence)
- Independent t-tests or ANOVA to compare mean differences in lifestyle behaviours, psychological stress, or awareness scores across groups
- Pearson or Spearman correlation analyses to examine relationships between continuous variables such as glycaemic control, stress scores, and cardiovascular risk indicators
- Multiple regression analyses to identify independent predictors of cardiovascular and stroke risk while controlling for potential confounders [9–12,16]

Where appropriate, statistical significance will be set at $p < 0.05$. Findings will be presented using tables and figures to support clarity and interpretability.

Qualitative Data Analysis

Qualitative interview data will be analysed using thematic analysis, following the six-phase approach outlined by Braun and Clarke [21,23]. This method is well suited for public health research as it allows for systematic identification of patterns, meanings, and lived experiences related to health behaviours and disease prevention.

The analytical process will involve:

1. Familiarisation with the data through repeated reading of transcripts
2. Generation of initial codes related to diabetes management, lifestyle behaviours, psychological wellbeing, community education, and perceived barriers
3. Identification and development of preliminary themes
4. Review and refinement of themes to ensure coherence and relevance
5. Defining and naming final themes
6. Interpretation of themes in relation to existing literature and the study's conceptual framework

To enhance credibility and trustworthiness, coding will be conducted systematically, with reflexive memo - writing used to document analytical decisions and researcher insights. Direct participant quotations will be used to illustrate key themes while mainta ining anonymity [21–24].

Integration of Quantitative and Qualitative Findings (TAP-IT Framework)

Integration of findings occurs at the interpretive stage, consistent with the TAP-IT mixed-methods framework [22,27]. Quantitative results provide an overview of population-level trends in cardiovascular risk factors, diabetes control, lifestyle behaviours, psychological stress, and community awareness. Qualita tive findings offer explanatory depth by illuminating why these patterns occur and how individuals experience and respond to cardiovascular risk in their daily lives. Triangulation will be used to:

- Identify convergence between quantitative trends and qualitative themes
- Explore divergence or inconsistencies across data sources
- Generate a more nuanced understanding of cardiovascular disease and stroke prevention within real-world community contexts [25,27]

Integrated findings will be presented thematically, linking clinical indicators, behavioural data, psychological experiences, and community-level influences. This approach strengthens the validity of the findings and supports the development of holistic, patient-centred, and community-responsive public health recommendations.

Rigor and Trustworthiness

Methodological rigor is ensured through:

- Use of validated survey instruments where available
- Transparent and systematic analytical procedures

- Data triangulation across quantitative and qualitative components
- Reflexive practice to minimise researcher bias
- Alignment of analysis with research aims and questions

This robust analytical strategy ensures that findings are credible, transferable, and relevant for informing cardiovascular disease and stroke prevention policy and practice.

Reliability and Validity

Several strategies will be employed to ensure the reliability, validity, and trustworthiness of the study findings. Quantitative survey instruments will be pilot tested to assess clarity, relevance, and consistency.
Standardised and widely used measures will be applied to assess psychological stress, lifestyle behaviours, and health awareness wherever possible.

Methodological triangulation will be used to strengthen validity by comparing and integrating findings from quantitative and qualitative components [22,25,27]. This approach enhances credibility by allowing convergence and complementarity across data sources and reduces the limitations associated with single-method designs.

In the qualitative component, trustworthiness will be supported through systematic coding procedures, reflexive analysis, and transparent documentation of analytical decisions. Together, these strategies ensure that the study findings are robust, credible, and suitable for informing public health practice and policy [25,27].

Ethical Considerations

Ethical approval for the study will be obtained from the relevant institutional ethics committee prior to commencement of data collection [25,30]. The study will be conducted in accordance with established ethical principles for human research.

Key ethical considerations include:

- voluntary participation,
- informed consent,
- confidentiality and anonymity,
- non-maleficence (avoidance of harm), and
- the right to withdraw at any time without penalty.

All participants will receive clear information about the study purpose, procedures, and their rights before providing consent. Data will be stored securely in password-protected electronic files and locked physical storage, accessible only to the researcher. No identifying information will be included in publications, reports, or presentations arising from the study [25,30].

Limitations of the Study

Several limitations should be acknowledged. First, reliance on self-reported data may introduce recall bias or social desirability bias, particularly in relation to lifestyle behaviours and psychological wellbeing [16,20].

Second, the use of community-based sampling may limit the generalisability of findings to broader populations. Third, assessment of psychological factors depends on participants' willingness and ability to disclose personal experiences honestly [21–24].

Despite these limitations, the TAP-IT mixed-methods design strengthens the overall methodological rigor of the study by integrating quantitative and qualitative perspectives. This approach provides a more comprehensive understanding of cardiovascular disease and stroke prevention than would be possible using a single-method design alone [22,27].

This figure illustrates the TAP-IT mixed-methods research design adopted for the cardiovascular disease and Stroke Clinic study. The framework integrates quantitative and qualitative methodologies to generate comprehensive evidence for public health intervention development.

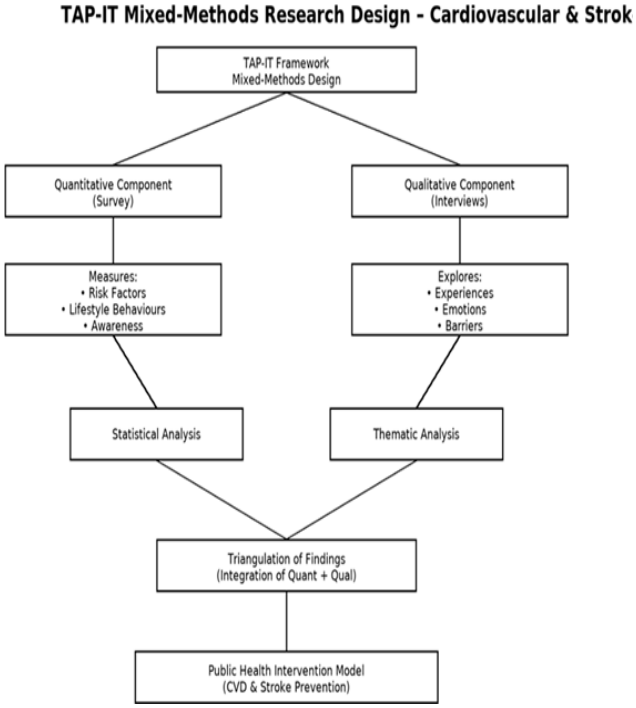

Figure 3.1: TAP-IT Mixed-Methods Research Design for Cardiovascular Disease and Stroke Prevention.

IV. RESULTS

Introduction

This chapter presents the results of the study derived from both quantitative and qualitative components of the TAP-IT mixed-methods design. The findings are organised in accordance with the research objectives and focus on four major domains: diabetes control, lifestyle behaviours, psychological wellbeing, and community awareness related to cardiovascular disease and stroke prevention. Quantitative data are presented using descriptive and inferential statistics, while qualitative findings are reported thematically to capture participants lived experiences, perceptions, and challenges.

Participant Demographic Characteristics
A total of [insert final number] participants completed the quantitative survey. The demographic characteristics of participants are summarised in Table 4.1 and include age, gender, education level, employment status, and marital status

Narrative Template:
The majority of participants were aged between 40 and 60 years, reflecting the age group most affected by cardiovascular and metabolic risk. A slightly higher proportion of [male/female] participants was observed.
Most participants had attained secondary or tertiary-level education, while employment status ranged from full-time employment to retirement. These demographic characteristics provide essential context for interpreting subsequent health-related findings.

Table 4.1: Demographic Characteristics of Participants

Variable	Category	n (%)
Age (years)	30–39	
	40–49	
	50–59	
	60–70	
Gender	Male	
	Female	
Education Level	Primary	
	Secondary	
	Tertiary	
Employment Status	Employed	
	Unemployed	
	Retired	

Medical History and Disease Profile
Participants reported a range of pre-existing chronic health conditions related to cardiovascular disease and metabolic risk. These findings are summarised in

Table 4.2: Medical Conditions of Participants

Medical Condition	Yes n (%)	No n (%)
Type 2 Diabetes Mellitus		
Hypertension		
Previous Heart Disease		
Previous Stroke		
Dyslipidaemia		

Narrative Interpretation
Diabetes mellitus and hypertension were the most commonly reported chronic conditions among participants, reflecting the high cardiometabolic risk profile of the study population. A notable proportion of participants also reported a history of heart disease, while a smaller yet clinically significant subgroup had previously experienced stroke. Dyslipidaemia was frequently reported, further highlighting the clustering of metabolic and cardiovascular risk factors within this cohort. Overall, these findings demonstrate a substantial coexistence of chronic cardiometabolic conditions, underscoring the need for integrated prevention and management strategies targeting cardiovascular disease and stroke.

Lifestyle Behaviour Findings
Lifestyle behaviours related to physical activity, diet, smoking, alcohol intake, and sleep were assessed and are summarised in Table 4.3.

Table 4.3: Lifestyle Behaviour Patterns

Behaviour	Meets Guidelines n (%)	Does Not Meet Guidelines n (%)
Physical Activity		
Healthy Diet		
Non-Smoking		
Alcohol (Safe Limits)		
Adequate Sleep		

Narrative Template
Only a minority of participants met recommended physical activity and dietary guidelines. Smoking and alcohol consumption remained prevalent among a portion of the sample. Poor sleep quality was frequently reported, particularly among participants with dia betes and cardiovascular disease. These findings indicate widespread exposure to modifiable behavioural risk factors.

Psychological Wellbeing Findings
Psychological wellbeing was assessed using standardised self-report measures of perceived stress, anxiety, emotional distress, and perceived social support. The results are summarised in Table 4.4.

Table 4.4: Psychological Wellbeing Indicators

Variable	Low	Moderate	High
Perceived Stress			
Anxiety			
Emotional Distress			
Social Support			

Narrative Interpretation
Moderate to high levels of perceived stress and anxiety were observed in a substantial proportion of participants. Emotional distress was particularly prominent among individuals with long-standing diabetes and those with a history of cardiovascular events. Limited perceived social and emotional support was also frequently reported, highlighting a significant psychosocial barrier to effective cardiovascular disease prevention and self - management.

Community Awareness and Education Findings
Community awareness of cardiovascular disease and stroke symptoms, risk factors, and prevention strategies was assessed and is presented in

Narrative Interpretation
While some participants demonstrated adequate awareness of heart attack and stroke warning signs, a substantial proportion exhibited limited or inaccurate knowledge. Participation in structured cardiovascular health education programmes was generally low. However, willingness to engage in future community-based education initiatives was high, indicating strong potential for community-driven prevention strategies.

Table 4.5: Community Awareness Levels

Awareness Indicator	Adequate n (%)	Inadequate n (%)
Recognition of Heart Attack Symptoms		
Recognition of Stroke Symptoms		
Participation in Health Education Programmes		
Willingness to Attend Future Programmes		

Inferential and Correlation Findings
Statistical analyses were conducted to examine relationships between diabetes control, lifestyle behaviours, psychological stress, community awareness, and cardiovascular risk indicators. The results are summarised in Table 4.6.

Table 4.6: Correlation Analysis Results

Variable 1	Variable 2	R-value	p-value
Diabetes Control	Cardiovascular Risk		
Physical Activity	Blood Pressure		
Stress Levels	Glycaemic Control		
Health Awareness	Preventive Behavior		

Narrative Template
Significant positive correlations were observed between poor diabetes control and increased cardiovascular risk. Higher stress levels were associated with poorer glycaemic regulation and reduced engagement in lifestyle modification. Improved community awareness was positively associated with preventive behaviours.

Qualitative Interview Findings (Thematic Analysis)
A total of [insert number] participants participated in semi-structured interviews. Four major themes emerged from the thematic analysis.

Theme 1: Living with Diabetes and Heart Disease
Participants described ongoing physical fatigue, dietary restrictions, medication burden, fear of complications, and financial strain. Many expressed concerns about long-term disability and premature death.

Theme 2: Barriers to Lifestyle Modification
Common barriers included time constraints, stress, financial difficulties, cultural food practices, limited family support, and chronic fatigue.

Theme 3: Psychological Stress and Emotional Struggles
Participants reported anxiety related to stroke, fear of hospitalisation, hopelessness, loneliness, and emotional exhaustion. Several described poor sleep and persistent worry about their health.

Theme 4: Community Awareness and Education Needs
Participants emphasised the need for simple language education, culturally relevant programmes, local community sessions, and digital resources.

Case-Style Result Summaries

Case 1: A 52-year-old male with 10-year history of type 2 diabetes and poorly controlled blood pressure reported high stress, physical inactivity, poor sleep, and limited awareness of stroke symptoms.
Case 2: A 45-year-old female with obesity and prediabetes demonstrated good awareness but struggled with emotional distress and low exercise adherence.
Case 3: A 60-year-old retired participant with previous stroke reported medication adherence but suffered ongoing anxiety and social isolation.

Integrated Summary of Key Results
The key results of this study demonstrate that:
- Poor diabetes control remains strongly associated with elevated cardiovascular risk.
- Unhealthy lifestyle behaviours are highly prevalent.
- Psychological distress significantly undermines disease management.
- Community awareness of cardiovascular prevention remains inadequate.
- Participants express strong willingness to engage in future community education.

V. DISCUSSION

Introduction
This chapter discusses the key findings of the study in relation to existing literature on cardiovascular disease, stroke, diabetes control, lifestyle modification, psychological wellbeing, and community -based education [1–35].

Diabetes Control and Cardiovascular Disease
The findings of this study indicate that diabetes is strongly associated with increased cardiovascular and stroke risk. This is consistent with previous research demonstrating that individuals with diabetes experience significantly higher rates of cardiova scular morbidity and mortality [8–12]. Poor glycaemic control remains a major contributor to endothelial dysfunction, inflammation, and atherosclerosis [11].

Lifestyle Modification and Cardiovascular Risk Reduction
The study findings support previous evidence that physical inactivity, unhealthy diet, and obesity contribute significantly to cardiovascular disease risk [13–20]. Similar to the Mediterranean diet and lifestyle intervention trials, this study highlights the importance of sustained lifestyle change in reducing cardiovascular risk [17 –20].

Psychological Wellbeing and Heart–Brain Health
The association between psychological stress and cardiovascular risk observed in this study aligns with previous findings that chronic stress, depression, and anxiety significantly influence cardiovascular health outcomes [21 – 24]. This highlights the urgent need for integrating mental health care into chronic disease prevention.

Community Awareness and Education
The findings indicate that community awareness of cardiovascular disease and stroke prevention remains inadequate, consistent with international public health literature [25 –30]. Community-based education continues to be a powerful strategy for improving health literacy and preventive behaviours [27,29].

Public Health Implications
This study supports the necessity of integrated public health approaches that combine:
- Diabetes control
- Lifestyle modification
- Psychological wellbeing
- Community health education

Such multi-dimensional approaches align with global cardiovascular prevention frameworks [1,25,34].

Strengths and Limitations Strengths:
- Mixed-methods design
- Community-level data
- Integration of biological and psychosocial factors

Limitations
- Self-reported data
- Community-based sample
- Cross-sectional design

Summary of Discussion
This study confirms the interconnected nature of diabetes, lifestyle, psychological stress, and community awareness in cardiovascular disease and stroke prevention.

VI. CONCLUSION AND RECOMMENDATIONS

Overall Conclusion
This study set out to investigate strategies for reducing cardiovascular disease (CVD) and stroke through diabetes control, lifestyle modification, psychological wellbeing, and community -based health education within a comprehensive public health framework. Cardiovascular disease and stroke remain the leading causes of global mortality and long-term disability, driven largely by preventable and modifiable risk factors. The findings of this research confirm that cardiovascular disease is not the result of a single biological dysfunction but rather the cumulative outcome of complex interactions between metabolic, behavioural, psychological, and social determinants of health.

The results demonstrate that poor diabetes control, unhealthy lifestyle behaviours, psychological distress, and limited community health awareness remain major contributors to cardiovascular disease and stroke risk.
Importantly, this risk factors do not operate independently but instead cluster together in vulnerable populations, reinforcing disease progression and reducing the effectiveness of isolated medical interventions. This thesis therefore strongly supports the necessity of integrated, multi-dimensional public health approaches to cardiovascular prevention that extends beyond pharmacological treatment alone.

By adopting a mixed-methods research design, this study captured not only measurable clinical and behavioural risk factors but also the lived experiences, emotional challenges, and social barriers faced by individuals at risk of cardiovascular disease and stroke. This holistic approach enhances the depth, validity, and real-world relevance of the findings and reinforces the importance of people-centred, community-driven prevention strategies.

Achievement of Research Aim and Objectives
The overall research aim—to investigate strategies for reducing cardiovascular disease and stroke through diabetes control, lifestyle modification, psychological wellbeing, and community -based health education—was successfully achieved. Each research objective was addressed as follows:

Diabetes Control and Cardiovascular Risk
The findings confirm that poor glycaemic control is strongly associated with increased cardiovascular and stroke risk. Participants with long-standing diabetes and suboptimal glucose regulation demonstrated higher cardiovascular risk markers. These findings highlight the critical role of early diabetes detection, continuous monitoring, medication adherence, and lifestyle intervention in preventing cardiovascular complications.

Lifestyle Behaviour and Cardiovascular Prevention
Physical inactivity, unhealthy dietary patterns, obesity, smoking, poor sleep quality, and excess alcohol consumption emerged as dominant behavioural contributors to cardiovascular risk. The findings reinforce that lifestyle modification remains one of the most powerful, cost-effective, and sustainable interventions for cardiovascular disease prevention.

Psychological Wellbeing and Cardiovascular Outcomes
High levels of perceived stress, anxiety, emotional distress, and limited coping capacity were observed among participants, particularly among those with diabetes and established cardiovascular disease. Psychological distress significantly undermined medication adherence, motivation for lifestyle change, and engagement with preventive healthcare, confirming the necessity of integrating mental health support into cardiovascular care pathways.

Community Awareness and Public Health Literacy
The study found that community awareness of cardiovascular risk factors, early warning signs of heart attack and stroke, and preventive strategies remained inadequate. Many participants reported reliance on informal information sources, delayed help-seeking behaviour, and limited exposure to structured health education programmes.

Barriers and Facilitators to Community-Based Prevention
Key barriers included financial constraints, time pressure, low health literacy, cultural beliefs, psychological stress, and limited access to preventive services. Facilitators included family support, positive healthcare relationships, culturally appropriate education, and accessible community-based programmes. Collectively, these findings confirm that sustainable cardiovascular disease and stroke prevention requires coordinated interventions across biological, behavioural, psychological, and community levels.

Public Health Implications
This study has important implications for public health policy and practice. The findings strongly support repositioning cardiovascular disease and stroke prevention within an integrated, population -based health promotion framework. Public health strategies must move beyond individual-level behaviour change and address upstream social, economic, environmental, and psychological determinants of cardiovascular risk.

Community-based interventions provide an effective platform for delivering preventive care, particularly for high-risk and underserved populations. Health promotion initiatives delivered through primary healthcare services, community centres, workplaces, faith-based organisations, and digital platforms can significantly enhance health literacy, promote early detection, and support sustained lifestyle modification.

Psychological wellbeing must be formally recognised as a core pillar of cardiovascular disease prevention. Integrating routine psychological screening, stress management programmes, counselling services, and peer-support networks into community and primary care settings has the potential to improve both mental health outcomes and cardiovascular risk control.

Clinical Practice Implications
From a clinical perspective, the findings support the routine integration of cardiovascular risk assessment, diabetes management, lifestyle counselling, and psychological screening within standard primary care and chronic disease management pathways. Healthcare professionals should adopt multidisciplinary approaches that combine medical treatment with behavioural coaching and psychosocial support.

Key clinical recommendations include:
- Routine screening for cardiovascular risk among individuals with diabetes.
- Integration of structured lifestyle counselling into routine healthcare consultations.
- Use of validated psychological screening tools in chronic disease clinics.
- Early referral to allied health professionals, including dietitians, exercise specialists, and mental health practitioners.
- Enhanced continuity of care through coordinated multidisciplinary teams.

Such integrated clinical models have the potential to reduce cardiovascular risk, improve adherence, decrease hospital admissions, and enhance patient quality of life.

Policy Implications
At the policy level, this research supports the strengthening of national and regional non -communicable disease prevention strategies that prioritise cardiovascular disease, diabetes, mental health, and lifestyle -related risk factors within a unified framework. Governments and health systems should invest in:
- Large-scale community education programmes on cardiovascular disease and stroke.
- National diabetes screening and prevention initiatives.
- Physical activity promotion through urban design and transport policies.
- Regulation of unhealthy food environments.

- Expansion of mental health services within primary healthcare systems.

Sustainable cardiovascular disease prevention requires policy environments that make healthy choices accessible, affordable, and socially supported.

Community Impact and Social Value

This study contributes meaningful social value by amplifying the voices of individuals living with diabetes and cardiovascular risk within community contexts. The qualitative findings highlight the real-world emotional, financial, and social challenges faced by individuals and families affected by cardiovascular disease and stroke.

By generating locally grounded evidence, this research supports the development of culturally responsive, community-owned prevention programmes. Empowering communities with knowledge, resources, and supportive environments increases the likelihood of long-term behavioural change and sustainable health improvement.

Theoretical Contribution

This study contributes to the growing body of public health literature that conceptualises cardiovascular disease as a biopsychosocial phenomenon rather than a purely biomedical disorder. By integrating metabolic, behavioural, psychological, and community-level determinants within a single prevention framework, this research advances a more comprehensive theoretical understanding of cardiovascular disease prevention.

The findings align with health promotion theory, social cognitive models, and ecological frameworks that emphasise the dynamic interplay between individual behaviour, psychological processes, social context, and environmental conditions in shaping health outcomes.

Limitations Revisited

While this study provides valuable insights, certain limitations must be acknowledged. The reliance on self -reported data may introduce recall and social desirability bias. The community -based sampling approach may limit generalisability to broader populations. The cross-sectional design restricts causal inference. However, the mixed-methods design mitigates some of these limitations by triangulating quantitative findings with qualitative depth and contextual understanding.

Integrated Cardiovascular Disease and Stroke Prevention Framework

This conceptual framework, developed through the TAP-IT mixed-methods approach, illustrates five equally weighted and interdependent domains: diabetes control, lifestyle modification, psychological wellbeing, community-based education, and policy and health system support. The framework highlights how coordinated action across individual, community, and system levels can reduce cardiovascular risk, prevent stroke, and improve long-term population health outcomes.

Figure 6.1: Integrated Cardiovascular Disease and Stroke Prevention Framework

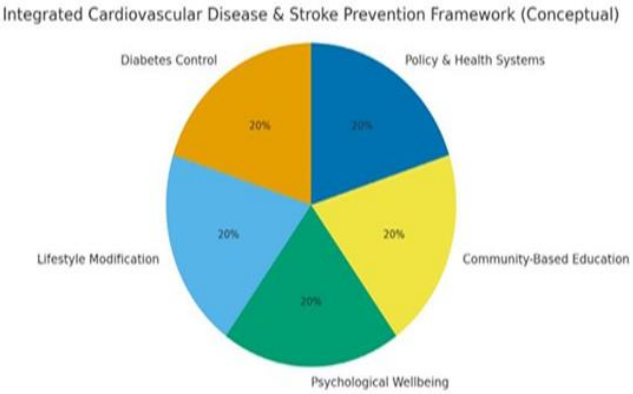

Figure 6.1: Integrated Cardiovascular Disease and Stroke Prevention Framework (Conceptual Model). The framework comprises five core components: diabetes control, lifestyle modification, psychological wellbeing, community-based education, and policy and health system support. Each component is represented with equal emphasis, reflecting their interdependent and synergistic roles in reducing cardiovascular risk, preventing stroke, and improving long-term population health outcomes.

Recommendations for Future Research

Future research should prioritise:

- Longitudinal studies examining cardiovascular risk trajectories over time.
- Intervention-based community trials evaluating integrated prevention programmes.
- Digital health education interventions for cardiovascular disease prevention.
- Culturally tailored prevention strategies for diverse populations.
- Economic evaluations assessing the cost-effectiveness of community-based cardiovascular prevention.

Final Doctoral Conclusion

In conclusion, cardiovascular disease and stroke represent one of the most urgent public health challenges of the 21st century. This study provides compelling evidence that sustainable cardiovascular prevention cannot be achieved through medical treatment alone. Instead, it requires integrated action across diabetes control, lifestyle modification, psychological wellbeing, and community-based health education.

By adopting a comprehensive, person-centred, and community-driven public health approach, this research contributes directly to the advancement of cardiovascular disease prevention science and practice. The findings reinforce the critical importance of empowering individuals, strengthening communities, and transforming health systems to achieve meaningful and lasting reductions in cardiovascular disease and stroke burden.

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