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Patient knowledge, attitudes, and perceptions towards cardiovascular disease, medication compliance and lifestyle modifications in a tertiary hospital in Johannesburg

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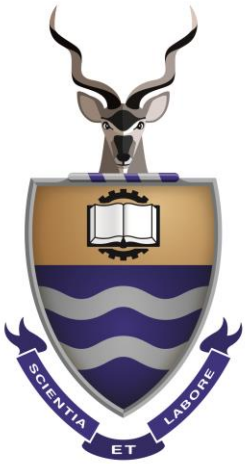
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Ayob, Rumaanah. (2024). Patient knowledge, attitudes, and perceptions towards cardiovascular disease, medication compliance and lifestyle modifications in a tertiary hospital in Johannesburg [Master`s dissertation, University of the Witwatersrand, Johannesburg]. WIReDSpace. https://hdl.handle.net/10539/46366

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Patient knowledge, attitudes, and perceptions towards cardiovascular disease, medication compliance and lifestyle modifications in a tertiary hospital in Johannesburg

Rumaanah Ayob



UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

A dissertation submitted to the Faculty of Health Sciences, Department of Pharmacy and Pharmacology, University of the Witwatersrand, in fulfillment of the requirements for the degree of Master of Pharmacy

Johannesburg, 2024

DECLARATION

I, Rumaanah Ayob (Student No. 1441909), declare that this research project is my own work except as indicated in the references and acknowledgements. I have contributed fully towards the research findings published in the article/s included in my dissertation. It is being submitted for the degree of Master of Pharmacy, at the department of Pharmacy and Pharmacology, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

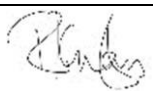
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On the 14th day of July 2024

AGREEMENT OF CO-AUTHORS

Article 1: Title: Disparities in patient understanding of cardiovascular disease management.
Journal particulars: *Cardiovascular Journal of Africa* (published)

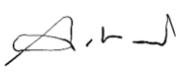
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Authors	Name	Signature	Contribution	Date
Author 1	Rumaanah Ayob		Methodology, review of current literature, preparation of original draft.	7 January 2024
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Article 2: Title: Insights into Cardiovascular Health: Patient Perspectives from a South African Tertiary Hospital
Journal particulars: *Cardiovascular Journal of Africa* (submitted April 2024)

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DEDICATION

Firstly, I would like to dedicate this research study to The Lord, Almighty, for blessing me with the ability, capability, strength, determination, perseverance, and resilience to pursue my ambition, goals and to overcome obstacles.

To my beloved parents for their unconditional love, consistent support, encouragement, and unfaltering confidence in my capabilities. I am blessed to have you as my parents and hope to make you proud.

To my brother who has added humour and joy to my life and helped me see the lighter side of life during difficult and challenging moments.

Lastly, I dedicate this study to my entire family and friends who have always shown a keen interest in my academic activities. You have made a major impact on my life.

In the name of Allah, The Most Gracious, The Most Merciful

PUBLICATIONS ARISING FROM THIS STUDY

Ayob R, Vally M, Khan R, Orchard A. Disparities in patients' understanding of cardiovascular disease management. *Cardiovascular Journal of Africa* 2024 May 23; 34:1-7. doi: 10.5830/CVJA-2024-007. PMID: 38800882.

Ayob R., Cassimjee I., Vally M., Khan R., Mohamed F., Orchard A., (2024). Insights into Cardiovascular Health: Patient Perspectives from a South African Tertiary Hospital. Submitted to *Cardiovascular Journal of Africa*, March 2024.

ABSTRACT

Background and Aim: Cardiovascular disease (CVD) is the leading cause of mortality in sub-Saharan Africa and the leading cause of disability adjusted life years worldwide. The burden of CVD varies across countries with over three quarters of deaths occurring in lower-to-middle-income countries (LMICs). Despite the effectiveness of medication, adherence to therapy is a challenge. The paucity of information of CVD in South Africans and low cardiovascular literacy highlights the knowledge gaps of CVD disorders and the overlooked risk factors which are significant barriers. An analysis of the disparities in the vulnerable communities may guide the prioritization of interventions and allow disadvantaged groups to be reached. Therefore, this study aimed to determine patients' knowledge, attitudes, and perception of their disease as well as the need for regular monitoring, medication compliance and the impact of lifestyle modification, in a public tertiary hospital in Johannesburg, South Africa.

Methods: A cross-sectional study with convenience sampling was conducted in the vascular and diabetic outpatient clinics at a state tertiary hospital. A questionnaire was used to gather responses and a point of care test (POCT), assessing blood pressure, glycated hemoglobin (HbA1c) and lipogram was done to assess patient perception of their disease control.

Results: Of the 191 participants (64%-woman, mean age 54 years), 57% were familiar with the term CVD, and 97% acknowledged the importance of follow-up visits. Level of education, socio-economic status, monthly income, and residential area were associated with CVD knowledge levels. Participants with increased CVD knowledge were more physically active. Although the negative implications of smoking were acknowledged, they were not eager to quit. Participants with higher levels of knowledge were more aware of the indication of their medication. Patient's perceptions of their disease were not aligned with the values measured by the POCTs. One-third of the population achieved target blood pressure levels and a quarter of the population achieved target HbA1c levels.

Conclusion: Low to moderate levels of knowledge of CVD were found; most participants understood the significance of follow- up visits and treatment adherence. Insufficient knowledge of CVDs continues to be important factors in health behavior. Knowledge levels were influenced by the level of education, place of residence and type of employment, therefore targeted educational material may improve level of comprehension and understanding. Awareness strategies should emphasize at end organ damage is preventable and strategies to assist individuals to comprehend and manage the risk factors.

ACKNOWLEDGMENTS

To Dr Ané Orchard, for assigning this research topic to me. Your calm wisdom, insights and guidance has made me soar above all adversity and reminded me to aim for the stars despite difficulties and obstacles. You encouraged and challenged me, never accepting less than my best efforts. By always expecting perfection, you have instilled in my qualities which will allow me to succeed. I will always be grateful for the opportunity you have provided me with.

To Mr. Muhammed Vally, for the incredible support and guidance on my learning journey. I am eternally appreciative for your dedication, professionalism, and persuasion that has made an incredible difference to my research journey.

To Mrs. Razeeya Khan, for her kindness and eagerness to assist me. Thank you for your wisdom, patience, encouragement, honesty, and authenticity.

To Dr Farzahna Mahomed for inspiring me. I am extremely grateful for your unrelenting support and encouragement, as well as your time and willingness to provide direction and assistance. The time and effort you've invested has made this journey much easier. Thank you for going above and beyond to assist me with my research. I will be eternally grateful.

To Prof Yahya Choonara, the Head of the Department of Pharmacy for making the department an efficient and well-synchronized team and offering support and resources wherever possible.

To Dr Cassimjee for being welcoming and allowing me the opportunity to use the vascular outpatient clinic. Thank you for your optimism and encouragement.

To my funders, without whom this research would not have been possible. I would like to extend my gratitude to the National Research Foundation (NRF), Faculty Research Funding (FRC), Clinical Training Grant (CTG), Hetero Laboratories and Ten Ten Planet Dialysis. The scholarships and funding lightened my financial burden beyond measure.

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NOMENCLATURE

CVD	Cardiovascular disease
CVDs	Cardiovascular diseases
DASH	Dietary approaches to hypertension
DM	Diabetes mellitus
MI	Myocardial Infarction
T2DM	Type 2 diabetes mellitus
WHO	World Health Organization

DISSERTATION STRUCTURE

This dissertation comprises of the following:

- **Chapter 1**: Introduction and study design
- **Chapter 2**: Literature review: Publication entitled, ‘Disparities in patient understanding of cardiovascular disease management. *Cardiovascular Journal of Africa*, published.
- **Chapter 3**: Results and discussion: Publication entitled, ‘Insights into Cardiovascular Health: Patient Perspectives from a South African Tertiary Hospital’, submitted to *Cardiovascular Journal of Africa.*
- **Chapter 4**: Final overview of the study.

CHAPTER 1: INTRODUCTION

1.1. Background:

Cardiovascular diseases (CVDs) form the uppermost cause of deaths worldwide, with strokes and heart attacks contributing 85% of these deaths (World Health Organization, 2021). According to the World Heart Federation, non-communicable diseases (NCD) including CVDs account for approximately 43% of deaths in South Africa (World Health Organization, 2017). The burden of CVDs greatly varies across countries with the highest burden occuring in low-to-middle income countries (Hayes *et al.*, 2006). Cardiovascular diseases are one of the most preventable causes of death as majority of its risk factors, such as hypertension, diabetes, dyslipidemia, smoking, obesity lack of physical activity and unhealthy dietary practices, are preventable (Awad & Al-Nafisi, 2014).

Hypertension is noted as one of the most significant risk factors for CVD. Hypertension rarely displays prominent symptoms and can often go undiagnosed in many individuals, and is thus known as the silent killer (Doferri *et al.*, 2019). Approximately 49% of South Africans with hypertension are likely to be undiagnosed (Kamerman, 2022) Despite the high prevalence of hypertension in South Africa, knowledge and awareness of hypertension is found to be low amongst South Africans (Jongen *et al.*, 2019, Woodiwiss et al., 2023). Low levels of knowledge may be attributed to poor communication from healthcare providers (Surka *et al*., 2015), lower levels of education and geographical area (Jongen *et al*., 2019). This is concerning considering that awareness leads to improved blood pressure control, which could potentially decrease morbidity and mortality (Jongen *et al.*, 2019). Further emphasis should be placed on approaches aimed at treating and preventing hypertension through the modification of behavioural risk factors (Noone *et al.*, 2018).

Diabetes mellitus (DM) can be defined as a metabolic disorder where a decrease in the sensitivity or a deficiency of insulin results in hyperglycemia (World Health Organization, 2021). The disease affects approximately 10% of the global population with the number of people with diabetes having quadrupled over the past 30 years (Climie *et al.*, 2019). Type 2 Diabetes Mellitus (T2DM) occurs as a result of insulin resistance and involves an interplay of interactions between behavioural, environmental, and genetic factors (Peter *et al.*, 2022).

Lifestyle factors play an important role in the development of T2DM, these include, diet, smoking, sedentary lifestyle, and alcohol consumption (Peter *et al.*, 2022). Long-term complications of diabetes develop over the years as a result of damage to the blood vessels in the body (Peter *et al.*, 2022)

putting patients with T2DM at an increased risk of damage to target organs (Climie *et al.*, 2019). Knowledge is the most powerful tool against the complications that can arise from CVD as this will enable and motivate patients to seek appropriate treatment and control their disease. Dyslipidemia is a well-documented risk factor for CVD and atherosclerosis. Dyslipidemia can arise due to hereditary factors; however, it is more commonly an acquired condition (Nelson, 2013). Elevated triglyceride levels and dense, small LDL particles are predisposing risk factors for CVD (Huma *et al*., 2012). Elevated cholesterol together with raised triglyceride levels are strong and independent risk factors of future risk of myocardial infarction (MI) because decreased HDL levels and raised triglyceride levels cause metabolic perturbations and subsequent adverse effects (Huma *et al.*, 2012). Despite the availability of effective medication for dyslipidemia control, low adherence limits the benefits. Poor adherence is associated with adverse CVD effects and increased mortality (Alefishat *et al*., 2021). Considering that patients with insufficient knowledge of dyslipidemia show decreased medication compliance (Alahmari *et al.*, 2016), an increase in patient knowledge and awareness of dyslipidemia may have a positive impact on CVD prevention.

Smoking is considered a strong risk factor for CVD and can result in early and sudden cardiac death (Huma *et al.*, 2012). Despite the fact that the harmful effects of smoking are well established and smoking cessation is known to decrease total CVD mortality, many individuals continue to smoke (Mozaffarian *et al.*, 2008). Physical activity can be defined as any bodily movement that requires energy expenditure by the skeletal muscles (Micklesfied *et al.*, 2013). Research suggests that physical activity has displayed beneficial effects on blood pressure levels (Noone *et al.*, 2018), cholesterol levels, and glucose levels (Mozaffarian *et al.*, 2008).

Dietary intake and the quality of foods are associated with the prevalence and risk of obesity (Micklesfied *et al.*, 2013). The dietary approaches to hypertension (DASH) has been recognised as an effectice dietary intervention to reduce blood pressure (Filippou *et al*., 2020). There is evidence that the prevalence of obesity has been increasing in South Africa and can be linked to urbanisation and concomitant behavioural factors, such as physical inactivity and poor dietary practices (Micklesfied *et al.*, 2013). Obese patients are more susceptible to the development of hypertension and diabetes, in addition to being at risk for degenerative diseases, gall bladder diseases and certain forms of cancer (Yuqiu & Wright, 2008).

Medication compliance plays an important role in patient management (Brown & Bussell, 2011), and is the main determinant of treatment success. Non-compliance to medication results in disease progression, and higher levels of morbidity and mortality (Kumar *et al*., 2021). Medication

effectiveness is dependant on both the efficacy of the medication and patient adherence to treatment (Kumar *et al*., 2021). Poor medication adherence results in increased costs due to outpatient care, emergency visits, and hospitalization to manage complications (Yuvaraj *et al*., 2019) Factors contributing to poor medication adherence are myriad and include: scarcity of knowledge, low socioeconomic status, negative attitudes, and lack of family support (Kumar *et al*., 2021). Therefore knowledge of prescribed medication is vital for adherence. The multifactorial nature of medication non-compliance implies that only a sustained, coordinated effort will ensure optimal medication adherence (Brown & Bussell, 2011).

Evidence suggests that a significant proportion of morbidity and mortality due to CVDs can be improved by targeting behavioural risks such as, unhealthy dietary habits, physical inactivity, and smoking. However, these major risk factors are still prevalent, causing a large proportion of the disease burden (Hassen *et al*., 2022). Knowledge of behavioral risks is a central element of lifestyle change with individuals perceiving themselves to be at a higher risk for CVD adopting healthier lifestyles as individuals with higher levels of CVD knowledge are more likely to seek appropriate medical treatment and have better disease outcomes (Muhihi *et al*., 2020).

Behavioral characteristics play an important role in maintaining patient health, as well as in the prevention of a variety of chronic illnesses (Noone *et al.*, 2018). Patient knowledge about CVD and its risk factors is vital in order to change patients' health attitudes, behaviors and lifestyle practices, as good knowledge amongst patients will allow them to be more proactive by controlling the modifiable risk factors (Awad & Al-Nafisi, 2014). Examining CVD disparities in vulnerable communities may serve as a guide in prioritization of intervention components reaching out to disadvantaged groups (Hassen *et al*., 2022). To implement effective prevention programmes, an assessment of baseline CVD knowledge is pertinent.

1.2 Problem Statement

A lack of CVD knowledge can result in insufficient preventative behaviours and suboptimal patient outcomes. There have been limited studies on reasons for non-compliance to CVD medication and lifestyle modifications in Johannesburg, South Africa. Evidence on patients' knowledge of their CVD and its effect on medication compliance has vital importance and can be used to design customized educational interventions.

Thus, this study set out to determine the current levels of education among patients attending tertiary care clinics in Parktown, Johannesburg and to identify factors that are associated with knowledge levels. This study was carried out to assess the level of knowledge of cardiovascular diseases, particularly, hypertension, diabetes, and cholesterol, as well as explore the reasons for non-adherence to medication and the patients views on pharmacists in the management of these diseases. Lastly, patient perceptions of their disease control were examined and correlated with results obtained from a Point of Care Test (POCT).

1.3 Research Question

Do patients with CVD understand their disease, the need for medication compliance, disease monitoring, and lifestyle modifications?

1.4 Aim

To determine patients' knowledge, attitudes, and perception of their disease, as well as the need for regular monitoring, medication compliance, and the impact of lifestyle modification, in a public tertiary hospital, in Johannesburg, South Africa.

1.5 Objectives

This study was divided into four distinct objectives:

1.5.1 To describe cardiovascular patients' knowledge, attitudes and perception of their disease and its underlying risk factors, using a survey instrument.

1.5.2 To determine the knowledge of patients with CVD in relation to the importance of medication compliance and lifestyle modification, using a survey instrument.

1.5.3 To determine the socioeconomic (education, income, residential area) factors relating to knowledge of cardiovascular disease.

1.5.4 To compare the patient's perception of their disease progression to current patient medical records and measurements taken at the site using point of care tests.

CHAPTER 2: LITERATURE REVIEW

Review Article

Disparities in patients' understanding of cardiovascular disease management

Rumaanah Ayob, Muhammed Vally, Razeeya Khan, Ané Orchard

Abstract

Non-communicable diseases, including cardiovascular disease (CVD), are some of the leading causes of mortality worldwide. Despite the effectiveness of early diagnostic and treatment options, patient screening, disease detection and disease progression remain a challenge, resulting in suboptimal outcomes. Consequently, cardiovascular diseases remain underdiagnosed and undertreated, particularly in developing countries. Several barriers, including paucity of recommended cardiovascular health information and low literacy levels, lead to a poor understanding of the importance of intervention in terms of modifiable risk factors as well as treatment adherence. This narrative review focuses on cardiovascular patients' understanding of their disease, and the need for compliance with their medication and lifestyle modifications. Low levels of perception and insufficient knowledge of CVDs among patients continue to be indispensably important factors in health behaviour. Increased awareness of these issues has the potential to improve the effectiveness of the multidisciplinary cardiovascular team and ultimately improve the care provided to these patients.

Keywords: lifestyle modifications, treatment adherence, macrovascular, microvascular, risk factors, complications, hypertension, diabetes, dyslipidaemia

Submitted 1/6/22; accepted 1/9/23
Cardiovasc J Afr 2024; online publication www.cvja.co.za

DOI: 10.5830/CVJA-2024-007

Cardiovascular disease burden

Cardiovascular disease (CVD) is one of the leading causes of death worldwide[1] and the leading cause of disability-adjusted life years globally.[2] CVD is a lifestyle disease that is defined as heart and blood vessel disease, and is related to atherosclerosis.[3] Each year, an estimated 17.9 million people will die from CVDs, mostly from coronary heart disease and stroke, and these are projected to remain the leading cause of deaths worldwide.[1] Of the cardiovascular-related deaths occurring worldwide, 80% of the deaths occur in low- and middle-income countries (LMICs) with an equal preponderance among men and women.[4] Despite improvements made to reduce cardiovascular mortality rates, one in every four deaths is caused by coronary artery disease in the United States.[5]

The World Health Organisation conducted a study on global ageing and adult health (SAGE Wave 1), and an analysis of this data carried out by Ruan *et al*.[6] described the prevalence of the two main CVDs (angina and stroke) and its association with behavioural and socio-economic risk factors. The datasets were obtained from six LMICs, including South Africa, and demonstrated that poor lifestyle choices contribute greatly to the risk of CVD.

In 2007, 41.7% of deaths due to ischaemic heart disease and 49.6% due to stroke in South Africans aged 30 years and older, were attributed to hypertension.[7] The high mortality rates related to hypertension are on an upward trend, and the prevalence of hypertension has doubled over the past two decades (24% in 1998 to 45% in 2016).[8]

The American Heart Association[9] emphasises that young adolescents and adults can live healthier lives by paying special attention to the following seven aspects of life: eating a healthy diet, engaging in daily physical activity, avoiding smoking and tobacco products, maintaining a healthy weight and favourable body mass index (BMI), as well as keeping cholesterol, blood pressure and glucose levels within the healthy recommended range.[9]

Lack of knowledge and awareness of CVD may impede preventative efforts as well as CVD treatment[10] and are associated with poor disease outcomes.[11] Non-adherence to treatment can result in detrimental consequences and markedly reduces the chances of optimal outcomes.[12] A study conducted among Toronto and Vancouver participants found that the main reasons for delay in patient presentation to the emergency room and therefore a delay in patient treatment was the inability of patients to identify the warning symptoms of a cardiovascular emergency.[10] Therefore, increasing knowledge of CVD warning signs and risk factors among communities is imperative to control the disease.[13]

Modifiable and non-modifiable risk factors

Predisposing risk factors for CVD are categorised into

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non-modifiable risk factors such as age, gender, inherited lipoprotein disorders and family history of CVD; and modifiable risk factors such as smoking, diabetes mellitus, hypertension, obesity, dyslipidaemias, lack of exercise, sedentary lifestyle, psychosocial stress, poor oral hygiene and type A personality.[14] The most important risk factors related to an increased risk of coronary artery disease are smoking, followed by hypertension, abdominal obesity and diabetes.[14]

Dyslipidaemia, hypertension and diabetes are risk factors that have become pre-eminent targets for predisposing to CVD.[3] Therefore, treatment modification and the assessment and monitoring of these risk factors are the major focus of clinical care, research, treatment guidelines and measures of hospital performance. Emphasis must be placed on the underlying causes of hypertension, diabetes, and dyslipidaemia.

Lifestyle risk factors such as dietary habits, physical inactivity, obesity and smoking strongly influence the recognised cardiovascular risk factors and affect novel pathways of risk, such as inflammation, oxidative stress, vascular endothelial dysfunction, thrombosis–coagulation and arrythmia.[3] Lifestyle modification may help to reduce age-related increases in aortic stiffness. Patient adherence to intervention measures is therefore crucial to ensure the prevention of deleterious consequences.

Review of patient knowledge, understanding and perception of CVD and their risk factors

The assessment of CVD knowledge and awareness among the general public would provide realistic insights to advance public health policies toward modifiable risk factors for CVD.[11] Looking for novel methods to help cardiovascular patients adhere to their medication has tremendous potential to improve

Table 1. Characteristics and findings of the studies included

Author, country	*Study design*	*Sample size (male:female)*	*Perception and awareness of cardiovascular health*	*Perception and awareness of risk factors and lifestyle modifications*	*Perception and awareness of signs and symptoms*	*Related factors*
CVD						
Aminde *et al.*,[16] Cameroon	Community-based cross-sectional survey	1162 M = 445 F = 717	Low awareness	Cited risk factors: smoking, unhealthy diet, lack of exercise, obesity, stress and high blood pressure	Shortness of breath for heart attacks and sudden numbness for strokes	Level of education, income bracket and family history
Awad and Al-Nafisi,[19] Kuwait	Cross-sectional survey. Quantitative study (census sampling)	816 M = 330 F = 486	Low CVD knowledge	Well-cited risk factors: smoking, obesity, unhealthy diet and physical inactivity	Chest pain 50%, dyspnoea 48%, pain 41%, weakness 25%, confusion 36%	Females had a greater understanding than males
Muhihi *et al.*,[2] Tanzania	Randomised controlled study. Community-based face-to-face interviews	3000 M = 778 F = 2222	Low CVD knowledge	Cited risk factors: Stress, obesity, cholesterol and physical inactivity	Shortness of breath, loss of consciousness, headache, dizziness, vomiting	Geographical location (rural area) and level of education
Oladapo *et al.*,[14] Nigeria	Descriptive, cross-sectional survey	1585 M = 689 F = 896	Low awareness	Cited risk factors: stress, tobacco use, hypertension, diabetes	N/A	Level of education and demographic area
Surka *et al.*,[15] South Africa	Cross-sectional survey. Qualitative study (FGDs). Purposive sampling	28 M = 4 F = 24	Most respondents familiar with CVD terminology but lacked insight into CVD conditions	Cited risk factors: alcohol, smoking, stress and unhealthy diet	N/A	Geographical location (township)
Winham and Jones,[20] USA	Cross-sectional survey. Quantitative study	172 M = 62 F = 110	Low to moderate CVD knowledge	Cited risk factors: smoking, unhealthy diet, physical inactivity	N/A	Level of education
Yuqiu and Wright,[21] South Africa	Cross-sectional survey Quantitative study (Census sampling)	551 M = 302 F = 249	Low CVD knowledge	Cited risk factors: obesity, alcohol, diabetes, stress, lack of physical activity	N/A	Lower education was associated with less knowledge
Heart attack						
Ahmed *et al.*,[9] Malaysia	Cross-sectional, observational study	Total = 393 M = 204 F = 189	Low awareness	Cited risk factors: smoking, obesity, diabetes, unhealthy diet, stress	N/A	Level of education and income bracket
Heart failure and COPD						
Gallager *et al.*,[10] Australia	Prospective, descriptive, interview-based survey	118	Adherent to medication. Low medication knowledge	Higher adherence among females, patients with concurrent conditions, younger age and taking fewer medicines	N/A	Younger patients had higher medication knowledge, gender, additional co-morbidities
Hypertension						
Jongen *et al.*,[18] South Africa	Mixed qualitative and quantitative study	451 M = 222 F = 229	Low-to-moderate CVD knowledge	Cited risk factors: stress, alcohol, salt intake, exercise, smoking, diet, family history	Elevated blood pressure makes you sick	Geographical location (rural area)
Stroke						
Donker *et al.*,[11] Ghana	Cross-sectional study	693 M = 374 F = 319	Low awareness	Cited risk factors: alcohol intake, hypertension, smoking, previous stroke, high cholesterol, heart disease, diabetes	Numbness (unilateral), slurred speech, severe headache, numbness on either side, weakness on either side and dizziness	Level of education and income bracket
Kaddumukasa *et al.*,[17] Uganda	Cross-sectional survey	377 M = 117 F = 260	Low awareness	Cited risk factors: old age, hypertension, diabetes, cholesterol, obesity, stress, unhealthy diet and lack of exercise	Dizziness, diplopia, headache, difficulty speaking, tiredness, fever, sweating, body weakness, paralysis, fainting and numbness	Demographic area, income bracket, age and level of education.

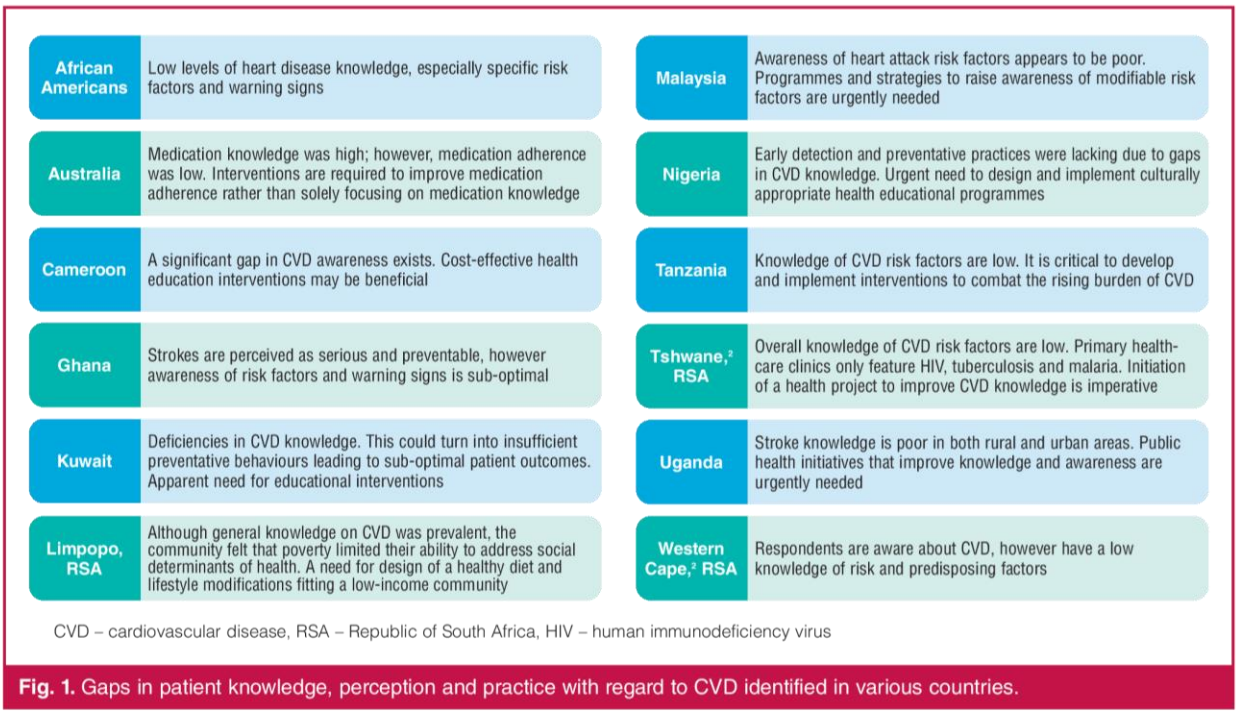


Fig. 1. Gaps in patient knowledge, perception and practice with regard to CVD identified in various countries.

the quality of life of these patients as well as reduce the cost of healthcare.

This narrative review of studies on patient knowledge and perception of CVDs (Table 1) reveals low to moderate levels of knowledge and awareness of CVDs and associated risk factors. This was seen across different populations globally and there appears to be an incongruity in knowledge across the globe (Fig. 1). The knowledge gap is also apparent in the low perception rate of CVD-related deaths. Observations revealed that knowledge and perceptions were not necessarily practiced upon.

In the study conducted by Surka *et al.*,[15] respondents were hesitant and unsure in providing a clear definition of CVD. Some respondents were able to identify hypertension and diabetes as specific conditions related to CVD. Most respondents were uninformed due to poor communication from their respective healthcare providers.

Participants with a higher level of education and formal employment were found to be more knowledgeable about cardiovascular health, its risk factors and warning signs compared to those with lower levels of education. Educated individuals have an increased capability to comprehend information such as health messages delivered through various media channels. Similarly, studies have shown a greater knowledge among individuals residing in urban areas as opposed to those in rural settings (Table 1).[2,15-19]

Although participants were familiar with the terms used to describe CVD, they were found to have limited insight on what these terms mean, as patient knowledge of CVD was dependant on specific terminology[15] or limited to only one or two symptoms, such as shortness of breath as a symptom of a heart attack. Respondents from Cameroon, however, were found to be unaware of classical symptoms of myocardial infarction.[17] The overall knowledge of CVD was low among both the Kuwaiti and Cameroonian populations with 40.7 and 48.4%, respectively, not recognising any symptoms. The most common CVD identified by Kuwaiti respondants was coronary heart disease (29%), followed by congenital heart disease, deep-vein thrombosis and pulmonary embolism.[20]

Young African Americans felt they were moderately well informed about CVD, however, knowledge of preventative behaviours and risk factors were variable and inconsistent.[21] There appears to be a lack of understanding among African American participants that high blood cholestetol levels are associated with consumption of dietary saturated fats. Observations revealed that although 76.6% of participants were aware that a high level of cholesterol is a major cause of heart disease, only 37.4% knew that reduction in animal products in their diet is a preventative behaviour.[21]

Acknowledgement of predisposing factors such as unhealthy diet, obesity, smoking and alcohol consumption were recognised as risk factors for CVD by various studies (Table 1), with stress being the most recognised risk factor in Ga-Rankuwa, South Africa. However, diabetes, high cholesterol level, sedentary lifestyle and hereditary factors were not recognised as risk factors by participants in both the Western Cape and Gauteng, South Africa.[15,22] Respondents in Buea, Cameroon recognised obesity and diabetes as risk factors for CVD, however up to 54.2% of participants thought that family history was unrelated to CVD,[17] and more than 99% of Nigerian participants were unaware that excess weight around the waistline increases the risk for CVD.[16]

Females in Ga-Rankuwa, South Africa were more aware and knowledgeable about risk factors, compared to males.[22] Similarly, CVD knowledge was significantly greater among females compared to males in Kuwait as well as in those aged 50 to 59 years.[20] Higher CVD knowledge among females could be attributed to less working time, and therefore more leisure time to watch and listen to mass media tools.[20] In contrast, Cameroonian

men were found to have an increased awareness of the different types of CVD compared to women,[17] and unexpectedly, the awareness of menopause, low oestrogen levels and hormone replacement therapy was higher in African American men than women[21]

Respondents in a peri-urban, low-income community in South Africa were familiar with the term hypertension yet could not provide a prescise definition or an explanation, even those who were known hypertensives.[15] In Limpopo, South Africa, participants were unfamiliar with the term hypertension due to language barriers, and hypertension was referred to as 'high high' and was defined as 'a sort of stress'.[19] Only two-thirds of known hypertensives in Ga-Rankuwa, South Africa, were familiar with their preceeding blood pressure measurement and the majority of Ga-Rankuwan respondents in all gender and age categories were unaware that a heart attack, angina, heart failure, stroke and kidney failure are complications of hypertension.[22]

In Limpopo, South Africa, genetic predisposition was not an easily accepted risk factor for hypertension due to lack of understanding of the concept of hereditary.[19] IsiZulu and Sepedi translators were used due to participants not being fluent in English, therefore there is a possibility that the translators could have influenced the participants' responses.[19] These findings reveal superficial knowledge of hypertension and more work needs to be done to enforce the dangers of hypertension being the silent killer in communities to raise awareness of the importance of participating in blood pressure screening events.

Only 10% of Nigerian respondants considered hypertension to be a major and potentially life-threatening condition. Approximately 5% knew that hypertension is considered a silent disease, more than half of the study population (59.7%) had never tested their blood pressure prior to the study and less than 1% of respondants knew which blood pressure values were considered high (> 140/90 mmHg).[16] This is most likely due to their blood pressure values not being disclosed to them at the time of measurement, and they were just informed whether the value was normal or high.[16] Other than not visiting the free clinics, the reasons for not testing their blood pressure were that the working hours of their farms coincided with the operating hours of the free clinics.[16] There is therefore an urgent need to make screening sites more accessible. This can be done by setting up screening stations after working hours at various places such as malls, schools, events and various other sites.

Although stroke is one of the leading causes of mortality and morbidity worldwide, with developing countries accounting for 85% of deaths globally, there is a lack of medical information and poor control of CVD risk factors, which contributes to the rising incidence of stroke.[18] Stroke was generally perceived as a serious illness among most respondents. Participants in the Western Cape, South Africa, were familiar with the term stroke and many had had personal encounters with patients who suffered from a cerebrovascular accident. They understood the link between stroke and high blood pressure and some respondents associated the stroke with emotional distress and stressful situations.[15] There was generally poor community awareness of the risk factors and warning signs of stroke, as the most important risk factor for stroke, namely hypertension, could not be recognised by respondents in Ghana.[13] In the cross-sectional survey conducted in Uganda, 76% of the participants did not recognise stroke as a disease related to the brain.[18]

Smoking was the most common risk factor identified by Malaysian respondants (69.9%).[11] On the contrary, in a cross-sectional study conducted in central and urban Uganda, none of the participants identified cigarette smoking as a risk factor for stroke.[18] Only a quarter of Tanzanian participants (25.5%) identified alcohol consumption as harmful for cardiovasclar health,[2] whereas in peri-urban South African communities, the perception of harmfulness differed on the the type of alcohol consumed: alcohol consumed in affluent areas was perceived as less harmful, as it was diluted, compared to alcohol consumed by individuals of other socio-economic backgrounds (without the addition of a diluent or mixer).[15]

In the Ga-Rankuwa study,[22] 30.1% of males and 61.8% of females were considered overweight, obese or severly obese (BMI 25 kg/m^2). In the male cohort, 14.6% were aware of their obesity and the majority acknowledged a connection between obesity and CVD. In the female cohort, only 29.7% perceived that they were obese.[21] An alarming fact was that 59.3% of males and 51.4% of females of the overweight group perceived themselves to be underweight.[22]

Knowledge of certain important risk factors and lifestyle modifications were variable and inconsistent in different regions. In both Tanzania and Nigeria, the main sources of information were through friends, family members (females), radio and television (men).[2,16] Only 9% of Nigerian respondents reported to have obtained medical information from healthcare workers.[16]

The majority (93%) of respondents in the Western Cape, South Africa, did not comprehend the concept of risk, and 7% of respondents misunderstood and conveyed that poor adherence to medication, which placed them 'at risk' of having a stroke.[15] No clear trends in risk factors investigated with regard to educational level could be determined in Ga-Rankuwa, however, it was noted that there was a positive correlation between lack of awareness and increasing age.[22] Similarly in Kuwait and Malaysia, the participants were found to be more knowledgeable about CVD if they attended higher education centres,[11,20] compared to those with moderate and low levels of education.

The need for educational tools and cardiovascular awareness programmes is highlighted in the study by Ahmed *et al.*,[11] which confirmed that patients who received promotional materials, educational leaflets and social media advertisements showed more awareness of risk factors associated with heart attacks compared to those not receiving any promotional information.

The majority of Ga-Rankuwa respondents in all gender and age categories were unaware of the short-term complications of diabetes mellitus, such as hypo- or hyperglycaemia and diabetic keto-acidosis, as well as long-term complications such as cardiac disease, hypertension, kidney disease, eye disease and peripheral neuropathy.[22] Participants from China were found to be more aware of diabetes as a risk factor, as opposed to participants from Malaysia.[11]

As the burden of non-communicable diseases rises in sub-Saharan Africa, there is a need to develop new prevention strategies. These would include propagating accurate information related to the warning signs and risk factors, as better knowledge would lead to early recognition, prompt emergency reaction and a reduction in CVD morbidity rates. Knowledge, awareness and understanding are essential to motivate individuals to adopt lifestyle modifications and prevent CVD. Early intervention and changes to sedentary lifestyles are the best approaches, and

controlling modifiable risk factors is essential to preventing CVD.[23] Community attitudes and knowledge influence identification of risk factors and prevention of CVD.[18]

Understanding the need for lifestyle modification

Population-based studies illustrate that individuals residing in LMICs are predisposed to an increased CVD risk due to their poor socio-economic circumstances. There is some awareness of behavioural factors among South African respondents, and their knowledge was predominantly on salt intake, consumption of fatty foods as well as tobacco smoking.[15,19] Almost three-quarters of Ga-Rankuwan participants enjoyed their food lightly salted and only one-third of participants knew the recommended daily salt allowance for cardiovascular health.[22]

Respondents in the Western Cape, South Africa, were aware that certain meal-preparation techniques made some meat products less unhealthy, such as trimming the fat off and grilling meat, as well as consuming smaller meal portions with decreased oil content.[15] Only a minority of respondents in a Ga-Rankuwa study were aware that at least five fruit and vegetable portions per day should be consumed.[22]

In Limpopo, South Africa, the cognisance of the need for a healthy diet for prevention of hypertension was recognised and the common factor preventing a healthy diet was poverty.[19] The need to consume more fresh fruit and vegetables and less fatty foods was not always possible in low-income communities due to cost factors and general poverty. Healthy living is not seen as affordable to the majority because larger volumes of less healthy products can be purchased for the same value as smaller quantities of the healthier substitutes.[19] On the other end of the spectrum, a group of Limpopo participants believed that even with alleviation of poverty, people will still maintain unhealthy eating habits.[19]

Lower educational level was associated with less knowledge about a healthy diet. The most frequent lifestyle modification suggested in the Ga-Rankuwa study was doing exercise, reducing stress and smoking cessation, however, only 12% considered hypertension control as fundamental and only 14.3% considered weight reduction as a fundamental lifestyle modification.[22] Stress- and anxiety-related factors in Limpopo were recognised as factors that promoted the development of hypertension. This revolved around family fueds, domestic problems and an inability to provide for their family due to unemployment.[19]

Variations in disease prevalence and obesity may be attributed to social inequalities between different ethnic groups. Studies have shown that certain cultural beliefs have led sub-Saharan Africans to believe that obesity is positively related to access to clean water and electricity as well as factors associated with good health and a more affluent lifestyle.[24] Religious and cultural beliefs such as 'dark spirits' or 'deity' were considered by certain communities in the Western Cape, South Africa, as the cause of CVD.[15] There is an urgent and pressing need to design and implement a culturally acceptable and appropriate community awareness, health educational and health promotional programme about CVD risk factors and CVD for the community, which can be modified and adapted for other rural populations.[16]

Men have been shown to be more physically active than women.[25] This could be due to cultural barriers regarding the acceptibility of wearing tight-fitting clothing while exercising or perceptions that participating in physical activity results in less time to complete household chores.[24] Physical activity was shown to be higher in South Africans residing in urban areas where crime was not perceived to be a problem. This was supported by a Nigerian study that also showed that safety, cleanliness and aesthetics were positively associated with physical activity.[24] Barriers to physical activity included lack of time, lack of discipline, as well as depression.[25]

Behavioural changes may be influenced by the perception and knowledge that certain actions may be detrimental and cause harm to their health. Implementing health initiatives will potentially enhance CVD knowledge and awareness, and engaging with healthcare workers to participate in these campaigns is especially important for low-income groups in whom sub-optimal knowledge was identified, yet who carry the largest disease burden.

Understanding medication, the need for compliance and reasons for non-adherence

The consequences of poor adherence to cardiovascular medication have led to an increase in rates of morbidity and mortality, and the cost of healthcare.[26] Although limited in the number of studies available, Kronish and Ye[27] found that there was a lack of patient compliance with their prescribed medications, therefore only one out of every two patients achieved the blood pressure goals. This is limited to only a few studies; further studies on patient compliance are warranted.

Effective management of hypertension with medication is achievable, yet a substantial number of individuals remain untreated or have uncontrolled blood pressure.[8] Management of CVD is impacted on by multiple factors. These include decreased awareness of CVD, lack of motivation to attend clinic visits, lack of adequate screening and educational facilities, large patient numbers, and patients lost to follow up.[28] The high proportion of individuals with CVD highlights the need for surveillance programmes to raise awareness, educational campaigns to encourage patients to comply with and adhere to medical therapy, together with lifestyle modification and regular follow-up visits.

Many South Asian patients recognised the role of medication on a long-term basis and knew the importance of medication to treat CVD.[29] Other factors that have been identified in a few patients include patients taking medication purely as prescribed with no awareness as to why, and some respondents noted that poor adherence to anti-hypertensive medication could lead to a stroke.[15] Nigerian respondents only associated taking medication with when physical symptoms were present, and taking their medication only when they felt unwell.[16]

Patients' concerns of becoming dependant on their medication if taken regularly, as well as perception barriers that convey the notion that a reduction in or absense of physical symptoms is an indication that medication is no longer mandatory, emphasises the need to communicate with patients to overcome the misunderstanding.

Medication knowledge was low among Australian participants with known heart failure and chronic obstructive pulmonary disease (COPD), with only 47.6% of patients understanding what their medication does for them. However, the majority (75.2%) of participants were reported to be compliant with all

medication doses and frequencies.[12] Younger and middle-aged patients with an increased ability for self-management and more co-morbid conditions were found to have higher levels of medication knowledge as opposed to older participants who were taking more medication.[12] The latter could be influened by impaired cognitive function associated with older age as well as increased complexity of medication regimes in the elderly. The increased knowledge of participants with more co-morbid conditions may have been attributed to the choice of the population group, as it focused on heart failure and COPD.

As medication taken for CVD prevention are intended for chronic use, it is extremely important to recognise and address factors that improve adherence to achieve maximum clinical effectiveness as well as cost effectiveness.[30] It is imperative that efforts are made to reduce the global CVD burden. The evaluation and treatment of diet, exercise and smoking should become a routine practice similar to blood pressure, cholesterol and glucose monitoring.

Target areas for intervention

Misconceptions must be meticulously dealt with to avoid bias or cultural stigmatisation. Common themes and key aspects from various studies are summarised in Fig. 2.

There is a gap identified for the need for regular monitoring for cardiovascular health. The consequences that stem from failure to adhere to medical therapy can be addressed by increasing awareness through campaigns and educational programmes. Effective policy measures and surveillance, together with public awareness must be taken into consideration so that behaviours can be developed, enforced and easily implemented. There is a need for a paradigm shift that maximises healthcare workers' potential to increase public knowledge of CVD risk factors and warning signs, especially in rural areas.[2] Awareness programmes that highlight the implication of adverse risk factors relating to CVD cannot be over emphasised. Cost-effective community health educational interventions, taking into consideration socio-economic status and cultural beliefs, may be beneficial.[17]

Community understanding of CVDs has had significant positive consequences,[31] and studies have shown that increasing a patient's knowledge of CVD and its risk factors can lead to success in control and prevention.[2] CVD health programmes can be used to influence attitudes and practices towards a healthy lifestyle, improved treatment compliance and decreased risk of complications.[24] Understanding disparities in patients' perception, knowledge and practice is crucial for designing and implementing appropriate interventions to combat the rising burden of non-communicable diseases.[2]

Conclusion

Overall, low perceptions and insufficient knowledge of CVDs continue to be indispensably important factors in health behaviour. Knowledge perceptions showed variations among different populations, and different ethnic groups were influenced by level of education, place of residence and type of employment. Different population groups require different educational material to improve their level of comprehension and understanding.

Meticulous understanding of the knowledge gaps and perceptions of CVD is critical to inform and lead to the development of appropriate targeted health awareness and promotional campaigns to prevent CVD events in high-risk populations in our setting. Future CVD awareness strategies should emphasise that end-organ damage is preventable, and assist individuals to comprehend and manage the risk factors. A focus on primary and secondary prevention is crucially important. Prompt treatment in improving patient outcome is vitally important during emergency situations, therefore advice must be given to individual

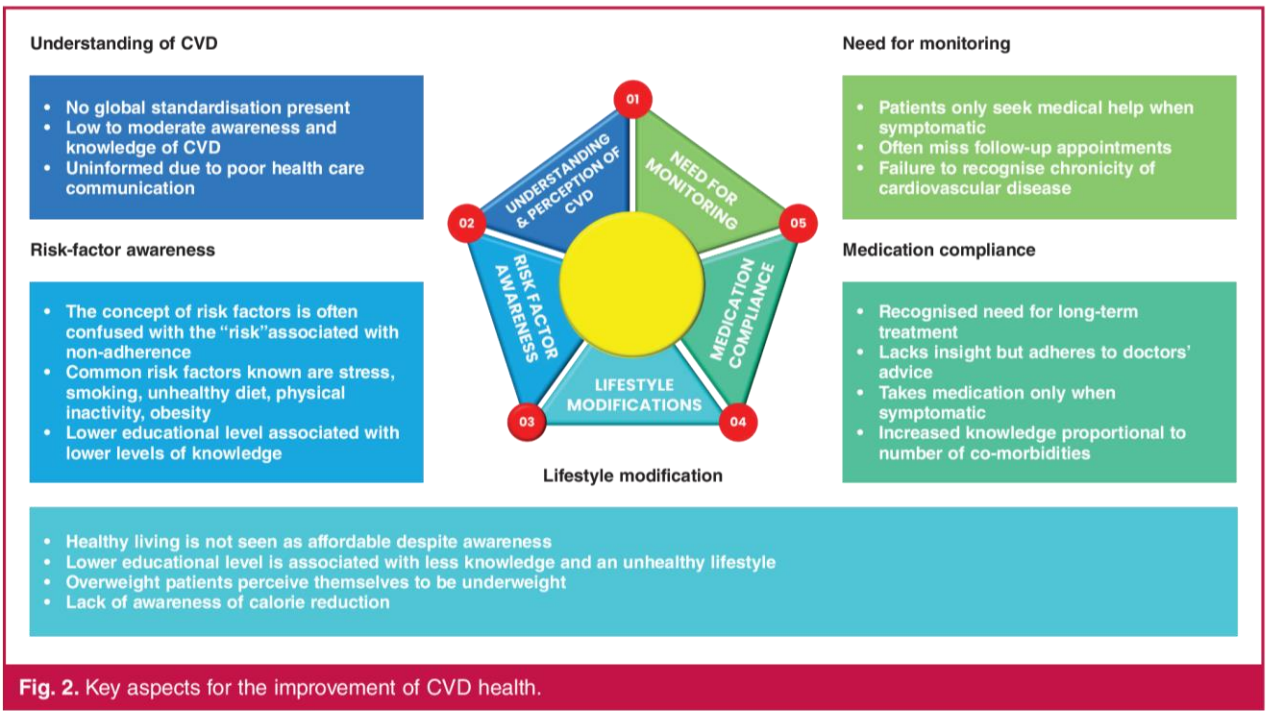


Fig. 2. Key aspects for the improvement of CVD health.

patients and their families as well as communities.

In order to combat the growing burden of CVDs, it is imperative to develop and implement interventions that will improve population knowledge of risk factors. Community outreach programmes by healthcare providers and community healthcare workers as well as media campaigns should be implemented to improve public awareness of CVD and its risk factors, empowering rural communities with knowledge so as to be informed regarding healthy lifestyles.

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CHAPTER 3: SUBMITTED MANUSCRIPT:

INSIGHTS INTO CARDIOVASCULAR HEALTH: PATIENT PERSPECTIVES FROM A SOUTH AFRICAN TERTIARY HOSPITAL

At the time of submission this manuscript was submitted to: Cardiovascular Journal of Africa

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Keywords: 'Cardiovascular disease', 'Lifestyle modification', 'Adherence', 'Knowledge, attitudes and perceptions'. 'South Africa'

Abstract (250 words): Article word limit: 5000 words

Background: Cardiovascular disease (CVD) remains one of the preventable causes of death. Increasing patient knowledge of CVD may lead to success in the prevention and control of CVD, and an improved quality of life.

Aims: The study aimed to assess the knowledge, attitudes and perception of patients with CVD, and the need for regular monitoring and medication compliance at a state tertiary hospital in Johannesburg, South Africa.

Methods: A cross-sectional study was conducted among 191 adults with high CV risk in the vascular and diabetic outpatient clinics. A researcher administered questionnaire was used to gather responses and a point-of-care-test (POCT) assessing glycated hemoglobin (HbA1c) and lipogram was done.

Results: The mean age of the cohort was 54 years, with a female predominance (64.4%), of which 56.5% were familiar with the term 'CVD' and 97.4% acknowledging the importance of attending follow-up visits. Despite having heard of CVD conditions, many participants did not have a sufficient understanding. There was an association of knowledge with medication adherence, socio-economic status, monthly income, and level of education. Patients' perceptions of disease control did not align

with values measured in POCTs. Approximately 30% of participants achieved target blood pressure levels and 25% achieved target HbA1c levels. Healthcare professionals were well recognized in the role of CVD prevention and monitoring.
Conclusion: Although more than half of the study participants had knowledge of CVD, target blood pressure and HbA1c were only achieved in approximately one-third and a quarter of the patients respectively. A significant gap exists between self-perception and knowledge among participants.

Background

Cardiovascular Diseases (CVDs) are the leading cause of death in both developed and developing countries [1]. The World Health Organisation predicts that, globally, an estimated 17.9 million people will die from CVDs (World Health Organization, 2023). Although higher income countries are largely affected by CVD mortality, the incidence and mortality are higher in lower-to-middle-income countries (LMICs), with over three quarters of deaths occurring in LMICs [3]. According to the World Heart Federation, non-communicable diseases (NCD) including CVDs account for approximately 43% of deaths in South Africa [3]. The number of patients living with DM has quadrupled over the past 30 years [4], with diabetes mellitus (DM) accounting for 7.5% of deaths amongst females [5]. The South African population demographic is a complex mixture of both developing and developed areas, with a variety of subgroups, ranging from wealthy and middle-income areas to disadvantaged peri-urban and rural areas.

CVD is one of the preventable causes of death as many of the risk factors leading to CVD, such as hypertension (HT), dyslipidemia, DM, smoking, lack of physical activity (PA), and unhealthy diets, are preventable [1]. The increase in risk factors amongst South Africans can be attributed to rapid urbanization, sedentary lifestyles, and the nutrition transition [6]. Diverse demographic, socio-psychological, and cultural variables influence an individual's perception of risk and affect health-related choices [7]. Individuals with low socio-economic status (SES) carry a large burden of CVD and are more likely to have poorer outcomes [8].

Patient knowledge of CVDs and their risk factors can lead to success in prevention and control by influencing attitudes and practices toward a healthy lifestyle, improved compliance with treatment, and reducing the risk of complications [9]. Low levels of health literacy are associated with poorer health outcomes, decreased use of health services, and less involvement in the management of chronic conditions [7]. The successful development and implementation of a health promotion program depends on the identification of the scope of baseline knowledge amongst the targeted population [10].

Poor medication adherence to cardiovascular medication has led to an increase in morbidity, mortality, and the cost of healthcare [11]. Despite the clear benefits of medication adherence, up to 50% of anti-hypertensive patients do not take their medication as prescribed [12]. As medication taken for CVDs is intended for chronic use, it is important to recognise and address factors that improve adherence to achieve maximum clinical effectiveness as well as cost effectiveness [13]. Adherence to medication in chronic conditions, particularly CVDs, is pertinent and there is a dearth of research in South Africa on the reasons for medication non-compliance and non-adherence.

The quality of life of patients may be improved through patient education on the importance of medication adherence, lifestyle modifications, and direct management of CVD risk factors through regular screening and monitoring. Understanding the knowledge gaps and perceptions of CVD patients is critical to inform and lead the development of appropriate targeted health awareness campaigns to prevent CVD events in high-risk populations. The assessment of CVD knowledge and awareness amongst the public is thought to provide realistic insights that will be useful in advancing public health policies toward modifiable risk factors for CVD [14]. Thus, this study assessed patients' knowledge, attitudes, and perception of their disease, as well as the need for regular monitoring and medication compliance in a public tertiary hospital in Johannesburg, South Africa.

Methods

Study design and setting

This descriptive cross-sectional study was conducted among patients attending the diabetic and vascular outpatient clinics at a state, tertiary hospital in Johannesburg, South Africa from October 2022 to January 2023.

Study population and procedure

An estimated 250 patients and 40 patients are seen monthly in the diabetic and vascular outpatient clinics respectively. The sample size was calculated using probability proportional to size sampling and was based on the number of patients attending the clinic in an average month. Assuming a margin of error of 5%, a confidence interval of 95% and a response distribution of 50%, a sample size of 190 patients was calculated to adequately power this study. The study population included all consenting patients ≥ 18 years presenting at the clinic with DM or confirmed CVD. The participants were selected using a randomized approach and were assured of confidentiality as per the ethical clearance mandated and approved by the University of the Witwatersrand Human Research Ethics Committee (clearance certificate number M220503).

Data collection and clinical endpoints

The knowledge, attitudes, and perceptions of CVD amongst patients with CVD was piloted and conducted using a researcher developed and administered survey captured on the Research Electronic Data Capture (REDCap) Version 12.3.3 data capture tool. A structured questionnaire was developed based on the objectives of the study and relevant literature [1, 9, 15-17]. Articles detailing the knowledge and awareness of CVD were reviewed to enhance the reliability of the questionnaire that was developed. The questionnaire was administered by the researcher in English; a translator was not used. A point of care test (POCT) for glycated hemoglobin (HbA1c) and a lipogram was done for each consenting patient on completion of the questionnaire.

The questionnaire (Appendix A) comprised seven sections, namely, demographic factors (age, sex, race, marital status), SES (highest level of education, employment, residential area, and monthly income), behavioral characteristics (smoking, alcohol, PA, diet), CVD awareness and knowledge of their own disease, general CVD knowledge and its symptoms and risk factors, medication adherence and reasons for non-compliance. The survey consisted of both open-ended and close-ended questions. The close-ended questions were represented as multiple choice questions. Knowledge statements had two possible options to choose from "yes" or "no". Open-ended questions prompted the respondent to give a detailed explanation. Open-ended knowledge questions were grouped into categories (Correct, partially correct, incorrect and don't know). Only participants who understood the term 'risk factors' were asked to identify specific risk factors.

Hypertension was defined as a condition in which the blood vessels have persistently raised pressure (World Health Organization, 2023); DM is a metabolic disorder resulting from defects in insulin secretion, insulin action, or both [18], and dyslipidemia was defined as an imbalance of cholesterol or an elevation of lipids or fats in the blood resulting in atherosclerosis (blockage of the vessels) (World Health Organization, 2023).

The role of healthcare professionals in CVD was investigated and health related anthropometric measurements and POCT biochemical parameters (height, weight, body mass index [BMI], blood pressure (BP), random glucose, HbA1c and cholesterol) were measured. BP was measured using the digital BP machine (Omron M3 HEM-7131-E), HbA1c was measured using the 'pts diagnostics A1c Now^{+} Professional' and glucose and cholesterol was measured using the 'pts diagnostics Cardiochek Plus' device. All relevant devices were calibrated prior to the commencement of the study.

Results obtained from the POCT tests were categorized according to various physiological parameters. BP was categorized according to the European Society of Cardiology (ESC) 2018 target levels described in the South African hypertension guidelines [19]. Glucose, HbA1c and dyspilidemia target levels were classified according to the Society for Endocrinology, Metabolism and Diabetes in South Africa (SEMDSA) guidelines [18], BMI was classified as underweight (<18 kg/m^2), normal (19- 24.9 kg/m^2), overweight (25 – 29.9 kg/m^2) and obese (>30 kg/m^2).

Statistical Analysis

The electronic data was analysed using Microsoft Excel as well as the statistical software, R Core Team version 1.4.0. Descriptive statistics, including frequency, percentages and medians were used to determine the distribution of the variables. Continuous variables were presented as medians with interquartile range (IQR) and categorical were summarised by frequency and percentages. Pearsons chi-squared test was used to determine any association between the variables. A p-value <0.05 was considered statistically significant. Univariate and multivariate logistic regression models were used to explore the relationship between demographic factors to determine predictors of knowledge and were reported as an odds ratio (OR) with a 95% confidence interval (CI).

Results

Sociodemographic characteristics of participants

A total of 191 respondents consented to participate in the study and were included in the analysis. The median age of the participants was 54, ranging from 24 to 76 years. The gender ratio was approximately 1:1.8 in favor of females. Almost 65% of the respondents were female (64.4%), and 60.2% were married while 12% were single. Individuals aged 40 to 60 years old were found to have higher knowledge levels. There was no significant association between knowledge levels and gender, however, females were found to have more CVD knowledge compared to males (*Table 1*).

Africans represented the largest ethnic group within the study cohort (72.2%). Whites and Indians had higher levels of CVD knowledge and Africans were found to have less knowledge of CVD (*Table 1*). Majority of the participants completed high school (matric or NQF 4), with one third being unemployed or employed part time, and having a monthly income of less than R2500 ($130). Participants with a higher level of education were found to have increased CVD knowledge, with participants with a higher certificate found to have the highest levels of knowledge. About two-thirds of the participants (61.8%) were from sub-urban areas and 33% from rural areas. Individuals residing in rural areas demonstrated low levels of CVD knowledge as opposed to those living in Urban and sub-urban areas (*Table 1*).

Table 1: Demographic information of participants

Variable	**n**	***P value***			
N = 191		Hypertension	Diabetes	Hba1c	Dyslipidaemia
Age (years), median (IQR)	54(38 - 70)	**Association with Knowledge Levels**			
Age categories (years), *n (%)*		*0.0151*	*0.0279*	*0.4405*	*0.5316*
< 30	7 (36.6)	5 (2.6)	6 (3.1)	2 (1.0)	3 (1.6)
30 – 39	23 (12.0)	17 (9.0)	19 (9.9)	5 (2.6)	7 (3.7)
40 – 49	45 (23.6)	22 (11.5)	36 (18.8)	3 (1.6)	19 (10.0)
50 – 59	53 (27.7)	33 (17.3)	39 (20.4)	3 (1.6)	28 (14.7)
60 – 69	49 (25.7)	16 (8.4)	30 (15.7)	3 (1.6)	17 (8.9)
> 70	14 (7.3)	1 (0.5)	8 (4.2)	1 (0.5)	3 (1.6)
Sex		*0.9686*	*0.4193*	*0.9649*	*0.4714*
Male	67 (35.1)	35 (18.3)	48 (25.1)	5 (2.6)	30 (15.7)
Female	123 (64.4)	58 (30.4)	90 (47.1)	12 (6.3)	47 (24.6)
Prefer not to say	1 (0.5)	1 (0.5)	0 (0)	0 (0)	0 (0)
Marital Status		*0.0119*	*0.0106*	*0.0282*	*0.0012*
Single	23 (12)	11 (5.8)	15 (7.9)	4 (2.1)	6 (3.1)
Married	115 (60.2)	69 (36.1)	92 (48.2)	9 (4.7)	57 (29.8)
Divorced	6 (3.14)	2 (1)	5 (2.6)	2 (1.0)	4 (2.1)
Widowed	36 (18.8)	8 (4.2)	21 (11.0)	0 (0)	8 (4.2)
Living with partner	11 (5.76)	4 (2.1)	5 (2.6)	2 (1.0)	2 (1.0)
Ethnicity		*0.0058*	*0.1806*	*0.0717*	*0.0182*
Black/African	138 (72.2)	55 (28.8)	91 (47.6)	9 (4.7)	46 (24.1)
White/European	14 (7.3)	12 (6.3)	13 (6.8)	4 (2.1)	8 (4.2)
Mixed ethnicity/ coloured	22 (11.5)	13 (6.8)	18 (9.4)	2 (1.0)	13 (6.8)
South Asian/ Indian	17 (8.9)	14 (7.3)	16 (8.4)	2 (1.0)	10 (5.2)
Highest level of Education		*0.0039*	*0.0003*	*0.0368*	*<0.0001*
Below high school level	56 (29.3)	13 (6.8)	29 (15.2)	2 (1.0)	8 (4.2)
High school (matric or NQF 4)	103 (53.9)	56 (29.3)	80 (41.9)	8 (4.2)	49 (25.7)
Higher certificate	16 (8.4)	14 (7.3)	15 (7.9)	1 (0.5)	9 (4.7)
Diploma	12 (6.3)	9 (4.7)	10 (5.2)	4 (2.1)	8 (4.2)
University degree (bachelor's or Honors)	4 (2.1)	2 (1.0)	4 (2.1)	2 (1.0)	3 (1.6)
Employment		*<0.001*	*0.0020*	*0.9570*	*0.0073*
Unemployed	35 (18.3)	7 (3.7)	18 (9.4)	4 (2.1)	5 (2.6)
Self-employed	8 (4.2)	8 (4.2)	7 (3.7)	0 (0)	5 (2.6)
Regular employment	75 (39.3)	50 (26.2)	60 (31.4)	9 (4.7)	40 (20.9)
Part-time employment	27 (14.1)	17 (8.9)	26 (13.6)	1 (0.5)	15 (7.9)
Student	1 (0.5)	0 (0)	1 (0.5)	0 (0)	0 (0)
Retired	45 (23.6)	12 (6.3)	26 (13.6)	3 (1.6)	12 (6.3)

Variable	n	*P value*			
N = 191		Hypertension	Diabetes	Hba1c	Dyslipidaemia
Residential area		*0.0006*	*0.02184*	*0.5064*	*0.0005*
Urban/City	10 (5.20	6 (3.1)	6 (3.1)	1 (0.5)	5 (2.6)
Sub-urban	118 (61.8)	73 (38.2)	95 (49.7)	13 (6.8)	62 (32.5)
Rural	63 (33)	15 (7.9)	37 (19.4)	3 (1.6)	10 (5.2)
Monthly income		*<0.0001*	*0.0012*	*0.5121*	*0.0012*
Less than R2500 per month (<$130)	94 (49.2)	24 (12.6)	58 (30.4)	7 (3.7)	25 (13.1)
R 2500 to R 10 000 per month ($130 to $525)	85 (44.5)	62 (32.5)	74 (38.7)	7 (3.7)	45 (23.6)
R10 000 to R20 000 per month ($525 to $1047)	10 (5.2)	7 (3.7)	6 (3.1)	3 (1.6)	7 (3.7)
Prefer not to say	2 (1)	1 (0.5)	0 (0)	0 (0)	0 (0)

Knowledge, attitudes and perception of CVD and CV risk factors

Despite participants having heard of the conditions, a substantial number of participants (>50%) had an incorrect understanding or were under a common misconception. Although participants considered themeselves to be well informed many elaborated incorrectly. Even though 70.7% of participants had previously heard of HT, 14.8% believed that HT was synonomous with ‘stress’ and ‘when the heart goes too fast’ or ‘dizziness as a result of too much stress’. Only 26.4% understood that DM is caused by a defect of insulin secretion or insulin action, whereas 60.3% were under the misconception that DM was when there is ‘too much sugar in the blood.’ Only eight respondents understood that the HbA1c is a test done every three months to monitor glucose control. An alarmingly low number (2.1%) of respondents correctly elaborated the definition of dyslipidemia and 78.9% responded that “it is something to do with too much fats and oils’ (*Table 2*).

Table 2: Patient knowledge of cardiovascular diseases (CVD)

Variable	n (n=191)	%
I must attend follow ups at the clinic to monitor my disease progression		
Strongly agree	83	43.45
Agree	103	53.96
Neutral	4	2.1
Disagree	1	0.5
Strongly disagree	0	0
Knowledge of the following:		
Hypertension	**135**	**70.7**
Correct	82	60.7

Variable	n (n=191)	%
Partially correct	12	8.9
Incorrect	41	30.3
Don't know	56	41.5
Diabetes Mellitus	**159**	**83.2**
Correct	42	26.4
Partially correct	94	59.1
Incorrect	21	13.2
Don't know	32	20.1
Dyslipidemia	**95**	**49.7**
Correct	2	2.1
Partially correct	75	78.9
Incorrect	18	18.9
Don't know	0	0
HbA1c	**22**	**11.5**
Correct	8	36.4
Partially correct	9	40.9
Incorrect	5	22.7
Don't know	0	0

Table 2 illustrates respondents knowledge of HT, DM, HbA1c and dyslipidemia (cholesterol). Respondents were asked whether they knew what HT, DM, Hba1c and dyslipidemia is, and were then asked to elaborate on the understading of each condition.

More than half (56.5%) of the participants were familiar with the term 'cardiovascular disease', and only one participant understood the concept of a CV risk factor. Only 43 participants felt they were able to recognize and mention CV risk factors, thus only these participants were asked to identify specific CV risk factors. Stress (79.1%) was the most commonly identified risk factor followed by smoking (69.8%); wheras old age, being overweight (6.9%), and family history (9.3%) were the least identified risk factors (*Table 3).*

Table 3: Cardiovascular risk factors identified by participants.

Cardiovascular Risk Factor	n = 43	%
Stress	34	79.1
Smoking	30	69.8

Dyslipidemia	13	30.2
Excessive alcohol consumption	10	23.3
Physical activity	9	20.9
Hypertension	8	18.6
Diabetes mellitus	7	16.3
Sedentary lifestyle	7	16.3
Family history	4	9.3
Older age	3	6.9
Overweight	3	6.9

Due to the participants being selected from specialised clinics, the majority heard of the term 'Cardiovascular disease' either from their doctors (44.4%) or other healthcare workers (34.3%). Newspapers (15.7%) and the internet (20.4%) were the least noted sources of CVD information.

Knowledge concerning the importance of medication compliance and lifestyle modification

Respondents were asked questions relating to their behavioural habits (smoking, alcohol intake, and exercise) and names of their medications and indications for use. Patient knowledge regarding CVD was compared and correlated to whether an increase in knowledge positively affected lifestyle habits and medication compliance.

Of the participants, 20.9% were smokers and 6.3% had quit smoking one month to 30 years prior, with most patients having quit once a diagnosis was made. More than half (51.3%) of the respondents reported having never consumed alcohol, 40.8% consumed alcohol on occasion, with 70.9% of these participants agreeing or strongly agreeing that they have tried to cut down on their alcohol intake due to negative health effects. There was no association between knowledge of HT ($p= 0.1277$), DM ($p= 0.2581$), and dyslipidemia ($p= 0.2128$) with being a smoker. Hypertensive patients were found to have a better understanding of the limitations of salt intake compared to patients with DM and dyslipidemia only.

Approximately 52.4% of respondents participated in at least 30 minutes of exercise per day, with 7% exercising more than five days a week, 36% exercising three to five days a week and 57% only exercising one to two days per week. The most common exercise performed was walking (79%). Even though almost all participants (99.5%) agreed (63.4%) or strongly agreed (36.1%) that exercise is beneficial for health, 47.6% of respondents did not exercise, with the most common reason preventing them from doing exercise being a lack of energy (31.9%) followed by physical limitations

(22%) (*Table 4*). Patients with higher levels of knowledge about DM (p = 0.0008) (*Table 5*) and HbA1c (p = 0.02039) were found to be more active and exercised more regularly.

Table 4: Physical activity

Physical Activity	**n**	**%**
Exercises participated in: (n = 100)		
Walking	79	79
Running/ Jogging	16	16
Cycling	15	15
Resistance training/ weight lifting	13	13
Swimming	2	2
Reasons for inactivity (n = 191)		
Lack of energy	61	31.9
Physical limitations	42	22
Not enough time	32	16.8
Lack of motivation	28	14.7
Lack of an exercise routine	15	7.9
No exercise partner	10	5.2
Safety concerns	3	1.6

Patients were assesed on whether they knew the names of the medication that was prescribed. They called out the medication and the researcher checked this against the prescription in the patient record. Only patients who listed all medication correctly were desribed as “knowing their medication”. Even though 68.6% of patients knew the names of the medication, only 55.5% knew the indications for use of these medicines. Patients who had more knowledge about HT (p < 0.001), DM (p = 0.0276) and dyslipidemia (p < 0.001), were found to be more familiar with the names of medication; and patients with knowledge of DM (p = 0.0009), HbA1c (p = 0.0009) and dyslipidemia (p = 0.01693) were found to have a better understanding of the uses of the medication (*Table 5*).

Association of socioeconomic factors with knowledge of specific cardiovascular diseases

The relationship between SES (monthly income, residential area, level of education) and knowledge of HT, DM and dyslipidemia was examined (*Table 5*). The level of knowledge was based on patient’s elaborations of the understanding of each condition as outlined in *Table 2*.

Table 5: Factors associated with good knowledge of specific cardiovascular diseases.

	Correct elaboration of Hypertension	**Correct elaboration of Diabetes Mellitus**	**Correct elaboration of Dyslipidaemia**	**n = 191**
Monthly Income	**n(%)**	**n(%)**	**n(%)**	
Less than R2500 per month (<$130)	19 (20)	15 (16)	1 (1)	94
R 2500 to R 10 000 per month ($130 to $525)	55 (65)	24 (28)	0 (0)	85
R10 000 to R20 000 per month ($525 to $1047)	7 (70)	3 (30)	1 (10)	10
Prefer not to say	1 (50)	0 (0)	0 (0)	2
p-value	**<0.0001***	**0.0012***	**0.0012***	
Residential Area				
Urban/City	6 (60)	1 (10)	0 (0)	10
Sub-urban	65 (55)	34 (29)	2 (2)	118
Rural	11 (17)	7 (11)	0 (0)	63
p-value	**0.0006***	**0.02184***	**0.0005***	
Level of Education				
Below high school	10 (18)	5 (9)	0 (0)	56
High school (matric)	49 (48)	23 (22)	1 (1)	103
Higher certificate	13 (81)	4 (25)	0 (0)	16
Diploma	8 (67)	7 (58)	0 (0)	12
University degree (bachelors or honors)	2 (50)	3 (75)	1 (25)	4
p-value	**0.0039***	**0.0003***	**<0.0001***	
Physical Activity				
Yes	40 (40)	30 (30)	0 (0)	100
No	42 (38)	12 (13)	2 (2)	91
P-value	**0.1189**	**0.0008***	**0.3688**	
Familiarity with names of medication				
Yes	72 (55)	35 (27)	1 (1)	131
No	10 (17)	7 (12)	1 (2)	60
p-value	**<0.001***	**0.0276***	**<0.001**	
Familiarity with indication of medication				
Yes	48	34	2	106
No	34	8	0	85
p-value	**0.0681**	**0.0009***	**0.0169***	

*p-value < 0.05 is statistically significant

The evaluation of the relationship between SES and knowledge of CVD showed that there was an association between CVD and education as well as SES. Participants with a higher monthly income demonstrated a better understanding of HT, DM, and dyslipidemia than those with lower incomes (*Table 5*). Respondents living in urban areas were shown to have a better understanding than

participants from rural areas. The study participants with lower levels of education (below high school), however, were less knowledgable of CVD. Although most participants did not have sufficient knowledge on dyslipidemia, particpants earning in the higher income level bracket and those with university degrees were found to have increased knowledge. On the other hand, knowledge of HbA1c was independent of monthly income and area of residence.

On multivariate analysis, Whites and Indians, as well as those in the higher income bracket were seven and five times more likely to have increased HT knowledge respectively (*Table 6*). Univariate and multivariate analysis showed that participants with a higher education were more likely to have knowledge on one of the CVD's, whereby those with a higher certificate, or diploma were 25 times more likely. Being employed, either part-time or full time was more likely to be associated with increased knowledge of CVD on univariate and multivariate analysis, with a 6 to 16-fold increase in knowledge on dyslipidaemia and DM respectively in those employed part-time on multivariate analysis. There was a lower probability of having knowledge of CVD if respondents resided in a rural area (*Table 6*).

Table 6: Univariate and multivariate logistic regression models for knowledge of CVD: hypertension, diabetes mellitus and dyslipidaemia

	CVD, OR (95 % CI)					
	Hypertension		**Diabetes Mellitus**		**Dyslipidaema**	
N=191	**Univariate Model**	**Multivariate model**	**Univariate Model**	**Multivariate model**	**Univariate Model**	**Multivariate Model**
Age	**0.95 (0.92 – 0.98)***	-	**0.96 (0.93 – 0.99)***	-	0.99 (0.97 – 1.02)	-
Sex						
Male	Reference	-	Reference	-	Reference	-
Female	0.82 (0.45 – 1.48)	-	1.08 (0.56 – 2.10)	-	0.76 (0.42 – 1.39)	-
Prefer not to say	0.00 (0.00 - ∞)	-	0.00 (0.00 - ∞)	-	0.00 (0.00 - ∞)	-
Marital Status						
Single	Reference	-	Reference	-	Reference	-
Married	1.64 (0.67 – 4.02)	-	2.13 (0.81 – 5.64)	-	**2.78 (1.02 – 7.57)***	-
Divorced	0.55 (0.08 – 3.59)	-	2.67 (0.26 – 26.92)	-	5.67 (0.82 – 39.27)	-
Widowed	**0.31 (0.10 – 0.97)***	-	0.75 (0.25 – 2.21)	-	0.81 (0.24 – 2.74)	-
Living with partner	0.62 (0.14 – 2.73)	-	0.44 (0.10 – 1.92)	-	0.63 (0.10 – 3.78)	-
Ethnicity						
Black/African	Reference	Reference	Reference	Reference	Reference	
White/European	**9.05 (1.95 – 42.04)***	**6.74 (1.23 – 36.97)***	6.71 (0.85 – 52.90)	3.88 (0.44- 33.98)	2.67 (0.87 – 8.14)	-
Mixed ethniciry/ Coloured	2.18 (0.87 – 5.45)	1.26 (0.45 – 3.49)	2.32 (0.74 – 7.26)	0.74 (0.19 – 2.95)	**2.89 (1.15 – 7.25)***	-
South Asian/Indian	**7.04 (1.93 – 25.65)***	**7.08 (1.67 – 29.72)***	**8.26 (1.06 – 63.24)***	5.80 (0.69 – 49.09)	**2.86 (1.02 – 7.99)***	-
Level of Education						
Below high school level	Reference	-	Reference	Reference	Reference	Reference
High school (matric or NQF 4)	**3.94 (1.90 – 8.19)***	-	**3.24 (1.61 – 6.52)***	1.81 (0.74 – 4.45)	**5.44 (2.34 – 12.64)***	**3.14 (1.06 – 9.27)***

	CVD, OR (95 % CI)					
	Hypertension		**Diabetes Mellitus**		**Dyslipidaema**	
N=191	**Univariate Model**	**Multivariate model**	**Univariate Model**	**Multivariate model**	**Univariate Model**	**Multivariate Model**
Higher certificate	**2.18 (0.87 – 5.45)***	-	**13.97 (1.73 – 113.02)***	**23.66 (1.23 – 455.24)***	**7.71 (2.23 – 26.64)***	**5.35 (1.09 – 26.35)***
Diploma	**7.04 (1.93 – 25.65)***	-	4.66 (0.93 – 23.20)	12.04 (0.76 – 192.10)	**12.00 (2.92 – 49.37)***	**24.73 (3.46 – 176.69)***
University degree (Bachelors or honors)	**3.31 (0.42 – 25.84)***	-	0.00 (0.00 - ∞)	0.00 (0.00 - ∞)	**18.00 (1.66 – 195.21)***	16.12 (0.98 – 265.82)
Employment						
Unemployed	Reference	Reference	Reference	Reference	Reference	Reference
Self-employed	0.00 (0.00 - ∞)	0.00 (0.00 - ∞)	6.61 (0.73 – 59.52)	3.80 (0.13 – 112.96)	**10.00 (1.79 – 55.63)***	3.72 (0.53 – 26.37)
Regular employment	**8.00 (3.07 – 20.84)***	1.59 (0.31 – 19.03)	**3.78 (1.58 – 9.03)***	1.07 (0.18 – 6.58)	**6.86 (2.40 – 19.59)***	3.04 (0.87 – 10.66)
Part-time employment	**6.80 (2.18 – 21.23)***	3.81 (0.96 – 15.09)	**24.56 (2.99 – 201.41)***	**15.97 (1.70 – 150.45)***	**7.50 (2.23 – 25.24)***	**5.8 (1.48 – 22.74)***
Student	0.00 (0.00 - ∞)	0.00 (0.00 - ∞)	0.00 (0.00 - ∞)	0.00 (0.00 - ∞)	0.00 (0.00 - ∞)	0.00 (0.00 - ∞)
Retired	**1.45 (0.50 – 4.20)***	1.20 (0.37 – 3.93)	1.29 (0.53 – 3.14)	1.07 (0.41 – 2.80)	2.18 (0.69 – 6.92)	0.79 (0.21 – 3.01)
Residential Area						
Urban/City	Reference	-	Reference	-	Reference	Reference
Sub-urban	1.08 (0.29 – 4.04)	-	2.75 (0.72 – 10.57)	-	1.11 (0.30 – 4.03)	1.40 (0.30 – 6.48)
Rural	**0.21 (0.05 – 0.84)***	-	0.95 (0.24 – 3.70)	-	**0.19 (0.05 – 0.77)***	0.29 (0.05 – 1.62)
Monthly income						
Less than R2500 per month (<$130)	Reference	Reference	Reference	Reference	Reference	-
R 2500 to R 10 000 per month ($130 to $525)	**7.86 (4.04 – 15.31)***	**5.05 (1.34 – 19.03)***	**4.18 (1.96 – 8.91)***	1.95 (0.34 – 11.31)	**3.11 (1.66 – 5.80)***	-

	CVD, OR (95 % CI)					
	Hypertension		**Diabetes Mellitus**		**Dyslipidaema**	
N=191	**Univariate Model**	**Multivariate model**	**Univariate Model**	**Multivariate model**	**Univariate Model**	**Multivariate Model**
R10 000 to R20 000 per month ($525 to $1047)	**6.81 (1.63 – 28.43)***	5.98 (0.89 – 40.32)	0.93 (0.25 – 3.53)	**0.08 (0.00 – 1.52)***	**6.44 (1.54 – 26.85)***	-
Prefer not to say	**2.92 (0.18 – 48.46)***	5.37 (0.29 – 99.94)	0.00 (0.00 - ∞)	0.00 (0.00 - ∞)	0.00 (0.00 - ∞)	-

*P<0.05; statistically significant. OR: Odds Ratio. CI: Confidence Interval

Perception of disease progression to current medical records and point of care tests

The study also assessed participant's self-perception and concern about their disease control. Patients were asked whether they were concerned about the control of their disease and if they felt their readings were low, high, or normal and these responses were compared with physical measurements taken by the researcher.

Despite 80% of participants measuring their BP within the three months prior to the visit, 54% of participants who perceived their BP as normal, were found to have a high systolic BP reading, and 72% of participants had a high diastolic BP reading (*Table 7*). Sixty eight participants who had high systolic BP (36%) and 65 participants with high diastolic BP (34%) were not concerned about the control of their BP. The mean systolic BP was 140 mmHg (125 – 156 mmHg). Approximately 30% of participants achieved target BP levels (<130 mmHg) and only 25% achieved target HbA1c levels (< 7%) and 45 % were found to have uncontrolled HbA1c (> 9%) (*Table 7*).

Although 69.6% of participants had good knowledge of HT, 34% of participants with good knowledge had high BP levels and only 14% had normal BP levels. Similarly, although patients answered correctly regarding glucose levels, 44% and 21% of patients were found to have impaired glucose levels and high glucose levels respectively. Most patients did not know what an HbA1c test is and 41% of patients had uncontrolled HbA1c levels and 22% with controlled HbA1c levels despite not knowing. Albeit dyslipidemia being the least known condition, 63% of participants had controlled total cholesterol levels. However, the LDL cholesterol levels were uncontrolled in 69% of participants.

Table 7: Patient perception of their blood pressure vs. measurements taken on site.

	Patient perception of hypertension control				
Systolic blood pressure measurement (n = 175; mean = 140mmHg)	**Low n(%)**	**Normal n(%)**	**High n(%)**	**Not sure n(%)**	**N n(%)**
High blood pressure (≥ 140 mmHg)	1 (0.5)	31 (17.7)	41 (23.4)	8 (4.6)	81 (46.3)
High normal (130 – 139 mmHg)	1 (0.5)	19 (10.9)	9 (5.1)	12 (6.9)	41 (23.4)
Normal blood pressure (120 – 129 mmHg)	0 (0)	9 (5.1)	1 (0.5)	1 (0.5)	11 (6.3)
Optimal blood pressure (<120 mmHg)	1 (0.5)	33 (18.9)	1 (0.5)	7 (4.0)	42 (24.0)
p-value		*< 0.0001*			
Diastolic blood pressure measurement (n = 175; mean = 91mmHg)					
High blood pressure (≥ 90 mmHg)	0 (0)	36 (20.6)	44 (25.1)	14 (8.0)	94 (53.7)
High normal (85 – 89 mmHg)	1 (0.5)	21 (12.0)	4 (2.3)	7 (4.0)	33 (18.9)

Normal blood pressure (80 – 84 mmHg)	2 (1.1)	13 (7.4)	2 (1.1)	2 (1,1)	19 (10.9)
Optimal blood pressure (< 80 mmHg)	0 (0)	22 (12.6)	2 (1.1)	5 (2.9)	29 (16.6)
p-value		*< 0.0001*			
	Patient perception of glucose control				
Random glucose measurement (n = 176; mean = 8.55mmol/L)	**Low n(%)**	**Normal n(%)**	**High n(%)**	**Not sure n(%)**	**N n(%)**
High glucose levels (≥ 11 mmol/L)	1 (0.6)	17 (9.7)	27 (15.3)	1 (0.6)	46 (26,1)
Impaired glucose levels (5.7 – 10.9 mmol/L)	1 (0.6)	76 (43.2)	22 (12.5)	6 (3.4)	105 (59.7)
Normal glucose levels (< 5.6 mmol/L)	1 (0.6)	16 (9.1)	3 (1.7)	4 (2.3)	24 (13.7)
p-value		*< 0.0001*			
HbA1c measurement (n = 165; mean = 8.53 %)					
Excellent control (< 7%)	0 (0)	33 (20.0)	4 (2.4)	5 (3.0)	42 (25.5)
Good control (7 – 8.9%)	1 (0.6)	38 (23.0)	7 (4.2)	4 (2.4)	50 (30.3)
Uncontrolled (> 9%)	3 (1.8)	32 (19.4)	37 (22.4)	2 (1.2)	74 (44.8)
p-value		*< 0.0001*			
	Patient perception of lipid control				
Total Cholesterol (n = 143; mean = 4.73 mmol/L)	**Low n(%)**	**Normal n(%)**	**High n(%)**	**Not sure n(%)**	**N n(%)**
Controlled (≤ 4.5 mmol/L)	0 (0)	42 (29.4)	7 (4.9)	41 (28.7)	90 (62.9)
Uncontrolled (> 4.5 mmol/L)	0 (0)	27 (18.9)	18 (12.6)	8 (5.6)	53 (37.1)
p-value		*< 0.0001*			
Low density lipoprotein (LDL Cholesterol) (n= 111; mean = 2.42 mmol/L)					
Controlled (≤ 1.8 mmol/L)	0 (0)	21 (18.9)	2 (1.8)	12 (10.8)	35 (31.5)
Uncontrolled (> 1.8 mmol/L)	0 (0)	32 (28.8)	22 (19.8)	22 (19.8)	76 (68.5)
p-value		*0.0201*			
High Density Lipoprotein (HDL Cholesterol) (n= 143; mean = 1.58 mmol/L)					
High (Males: ≥ 1.0; Females: ≥ 1.2 mmol/L)	0 (0)	50 (34.9)	21 (14.7)	34 (23.8)	105 (73.4)
Low (Males:< 1.0; Females: < 1.2 mmol/L)	0 (0)	19 (13.3)	4 (2.8)	15 (10.5)	38 (26.6)
p-value		*0.3916*			
Triglycerides (n= 143)					
High (≥ 1.7 mmol/L)	0 (0)	20 (13.9)	19 (13.3)	12 (8.4)	51 (35.7)
Low (< 1.7 mmol/L)	0 (0)	49 (34.3)	6 (4.2)	37 (25.9)	92 (64.3)
p-value		*< 0.0001*			
	Patient concern of their blood pressure level				
Systolic blood pressure measurement (n = 175)	**Yes n(%)**	**No n(%)**			
High blood pressure (≥ 140 mmHg)	13 (7.4)	68 (38.9)			

High normal (130 – 139 mmHg)	26 (14.9)	15 (8.6)
Normal blood pressure (120 – 129 mmHg)	6 (3.4)	5 (2.9)
Optimal blood pressure (< 120 mmHg)	35 (20.0)	7 (4.0)
p-value	*< 0.0001*	
Diastolic blood pressure measurement (n = 175)		
High blood pressure (≥ 90 mmHg)	29 (16.6)	65 (37.1)
High normal (85 – 89 mmHg)	19 (10.9)	14 (8.0)
Normal blood pressure (80 – 84 mmHg)	9 (5.1)	10 (5.7)
Optimal blood pressure (< 80 mmHg)	23 (13.1)	6 (3.4)
p-value	*< 0.0001*	
	Patient concern of their glucose level	
Glucose measurement (n = 176)	**Yes n(%)**	**No n(%)**
High glucose levels (≥ 11 mmol/L)	2 (1.1)	44 (25)
Impaired glucose levels (5.7 – 10.9 mmol/L)	19 (10.8)	86 (48.9)
Normal glucose levels (< 5.6 mmol/L)	8 (4.5)	17 (9.7)
p-value	*0.0087*	
HbA1c measurement (n = 165)		
Excellent control (< 7%)	18 (10.9)	24 (14.5)
Good control (7 – 8.9%)	8 (4.8)	42 (25.5)
Uncontrolled (> 9%)	0 (0)	74 (44.8)
p-value	*< 0.0001*	
	Patient concern of their lipid level	
Total Cholesterol (n = 143)	**Yes n(%)**	**No n(%)**
Controlled (< 4.5 mmol/L)	45 (31.5)	45 (31.5)
Uncontrolled (> 4.5 mmol/L)	28 (19.6)	25 (17.5)
p-value	*0.8778*	
Low density lipoprotein (LDL Cholesterol) (n=111)		
Controlled (≤ 1.8 mmol/L)	12 (10.8)	23 (20.7)
Uncontrolled (> 1.8 mmol/L)	42 (37.8)	32 (28.8)
p-value	*0.0643*	
High Density Lipoprotein (HDL Cholesterol) (n=143)		
High (Males: ≥ 1.0; Females: ≥ 1.2 mmol/L)	50 (34.9)	55 (38.5)
Low (Males:< 1.0; Females: < 1.2 mmol/L)	23 (16.1)	15 (10.5)
p-value	*0.2402*	
Triglycerides (n=143)		
High (≥ 1.7 mmol/L)	32 (22.4)	19 (13.3)
Low (< 1.7 mmol/L)	41 (28.7)	51 (35.7)
p-value	*0.0563*	

Due to majority of participants having scheduled visits to the diabetic clinic at least every three months, 79.6% of the participants had a blood glucose level checked within three months prior. Furthermore, 52.9% of the participants who perceived their glucose reading to be normal, were found to have high random glucose levels and 19.4% were found to have levels indicative of uncontrolled DM (*Table 7*). Additionally, 56.8% of participants with elevated blood glucose levels were not concerned about the DM control and only 10.9% of participants who were concerned about the control of their DM, had HbA1c readings less than 7% and were found to be controlled (*Table 7*). Majority (65%) of respondents had their blood lipid levels checked through conventional blood tests within 6 months, however, they were not familiar with their cholesterol readings. In contrast to HT and glucose control, most participants were found to have normal total cholesterol readings.

Although it was not statistically significant, a concerning number of participants felt that their weight was normal for their height, however, 60% of participants perceiving their BMI as normal were found to be overweight (28%) or obese (16%) after actual measurements were taken (*Table 8*). Only two out of the 46 obese participants perceived that they were obese. Using Levenes test for homogeniety, there were no differences in mean weight for age, however, variations were present for males as compared to females.

Table 8: Patient perception of their weight vs. BMI calculated with measurements taken on site

	Patient perception of weight			
BMI (n = 173; mean = 27.74); n(%)	**Underweight**	**Normal**	**Overweight**	**Obese**
Obese (≥ 30)	2 (1.2)	28 (16.2)	14 (8.1)	2 (1.2)
Overweight (25 – 29.9)	6 (3.5)	49 (28.3)	18 (10.4)	0 (0)
Normal (18 – 24.9)	2 (1.2)	46 (26.6)	6 (3.5)	0 (0)
p-value		*0.3165*		

Participants perception of the role of healthcare professionals other than medical doctors in prevention and management of CVD

Table 9 shows the respondents views on the role of pharmacists and nurses in CVD prevention and management. Majority of the respondents chose to visit a doctor, followed by a pharmacist as a first resort when falling sick. Eight-in-ten responders indicated that the pharmacist, should help patients manage their medications as well as assist with smoking cessation. Even though participants in these specialised clinics consulted with dieticians, they still believed that pharmacists and nurses were easily accessible, and participants would seek dietary advice from both pharmacists and nurses in addition to the dietician. Both the pharmacist and the nurse were well recognised in the role of CVD prevention through BP monitoring, blood glucose and cholesterol monitoring, dietary advice and

exercise plans. Three quarter of participants reported that they will use CVD prevention services if they become available in the pharmacy. The services of choice included BP measurement (95.3%), blood glucose measurement (95.3%), cholesterol measurement (94.8%), weight measurement (94.8%), BMI monitoring (93.7%), dietary advice (75.9%), exercise regimes (75.9%), and councelling for smoking cessation (87.9%).

Table 9: Respondents views on the role of healthcare professionals in CVD prevention and management

Role	n (n = 191)	%
When you get sick, where do you go first for medical care?		
Dispensary (Pharmacy)	104	54.4
Health centre/ doctor	108	56.5
Hospital	35	18.3
Clinic	1	0.5
Traditional healer	0	0
Blood pressure measuring & monitoring		
Pharmacist	151	79.1
Nurse	122	63.9
Neither	18	9.4
Blood glucose measuring & monitoring		
Pharmacist	151	79.1
Nurse	123	64.4
Neither	19	9.9
Blood cholesterol measuring & monitoring		
Pharmacist	150	78.5
Nurse	124	64.2
Neither	18	9.4
Dietary Advice		
Pharmacist	123	64.4
Nurse	96	50.3
Neither	38	19.9
Exercise Plan		
Pharmacist	123	64.4
Nurse	94	49.2
Neither	40	20.9
Smoking cessation guidance		
Pharmacist	154	80.6
Nurse	91	47.6
Neither	23	12.0

Role	n (n = 191)	%
Management of prescribed medication		
Pharmacist	162	84.8
Nurse	88	46.1
Neither	18	9.4

Discussion

This study aimed to assess patients' knowledge of CVD and investigated the factors associated with awareness and understanding of CVD. To the best of our knowledge, this study is the first to conduct a comprehensive assessment of CVD knowledge and self-perceived risk and practices toward CVD in two specialized units in a tertiary hospital in Johannesburg. Aligned with the lower-to-middle-income (LMIC) status, the study found poor CVD awareness amongst respondents and knowledge levels of CVD were sub-optimal.

Knowledge gaps were found in the association between HT, DM and dyslipidemia, and the complications of these diseases. Most participants recognized only two risk factors for CVD. This finding is consistent with a previously conducted study [14]. Stress followed by smoking were recognized as the principal cause of CVD, by participants in this study. Smoking has been identified as a risk factor in previous studies [14, 17, 20]. Tobacco smoking is a preventable cause of CVD mortality [21]. Although participants had substantial knowledge about the negative effects of smoking, they continued to smoke, which could be attributed to the tedious processes related to smoking cessation after becoming addicted, and difficult life situations [22].

There were low levels of knowledge of CVD risk factors amongst participants with less than a quarter of participants (22.5%) being able to list at least one risk factor, indicating a low cardiovascular health literacy, even in affected individuals, and comparable with a Nigerian study [23]. Only 2% of the study population had a university degree, possibly contributing to participants with a higher certificate having higher levels of CVD knowledge amongst this population. Individuals with higher levels of education were found to demonstrate increased levels of knowledge, comparable with what was previously reported for Malaysian participants [14]. Sufficient knowledge may assist individuals to adopt better lifestyle behaviors to prevent CVD, effectively manage the condition and prevent complications. Individuals should have a thorough understanding of CVD risk factors and primary prevention to mitigate the morbidity of CVD [20].

Most of the study population (49%) had relatively good knowledge of HT. One of the most common misconceptions relating to HT was that it is 'a sort of stress' or 'dizziness', similarly reported in a

previous South African study conducted in the Limpopo province [17]. Hypertensive patients were found to have a better understanding of the limitations of salt intake compared to patients with DM and dyslipidemia only, which may be attributed to healthcare professionals informing hypertensive patients of the risks of a high salt intake and it's association with an increase in BP, aligned with a study in Lebanon, where implementation of a low-salt diet increased by 20% post educational intervention [24].

Although participants were familiar with the terms used to describe CVD, many participants were unable to correctly elaborate on the definition of these conditions. A worrisome finding was that despite dyslipidemia being an important risk factor, only two participants had knowledge of dyslipidemia, and this lack of knowledge is consistent with studies in Saudi Arabia and Nigeria [23] [25], emphasizing the vital role of health education. The asymptomatic nature of dyslipidemia is a possible reason for this lack of knowledge, as participants only become aware of the implications after complications occur.

In this study, socio-demographic factors were associated with increased knowledge of CVD and were found to be increased in participants with higher income, higher levels of education, and residing in sub-urban areas, implying that special attention needs to be provided to those with lower levels of education. Educated individuals have increased capabilities and reasoning ability to comprehend educational information. The relationship between knowledge and level of education is aligned with studies done in African Americans and Saudi Arabians [10, 25]. Individuals residing in Urban and sub-urban areas were found to have higher levels of knowledge as opposed to participants in rural areas, comparable with studies in Tanzania and Ethiopia [9, 26]. Participants residing in sub-urban areas were found to have increased knowledge about DM and dyslipidemia, possibly due to the study being conducted in a public hospital where majority of the respondents resided in sub-urban areas.

Although participants had higher levels of knowledge of HT, target BP levels were only achieved in a quarter of the population. Raised BP levels may be due to BP levels being affected by various external factors, such as, caffeine intake, stress and exercise; this could be avoided by bladder emptying, sitting in a chair for at least five minutes and not eating or drinking anything for at least 30 minutes before BP is measured [27]. Although participants had low levels of knowledge of HbA1c and dyslipidemia; the total cholesterol levels were found to be optimal in more than two-thirds of the study population. This could be attributed to influence by the dietician regarding healthy eating as well as the use of statins for primary prevention in patients with DM. Furthermore, high intensity statins, specifically atorvastatin, is the statin of choice that was prescribed at the tertiary hospital

where the study was conducted. A worrisome finding is that LDL levels were uncontrolled in more than two-thirds of the population, which could be due to sub-optimal dosing of statins or dietary related patient factors. Although participants are being advised by a dietician, they may not necessarily be complying with their recommended diet.

The main sources of knowledge were from doctors followed by other healthcare professionals, and the least used sources were newspapers and the internet, possibly due to the study having taken place in specialized clinics, where patients see their doctors regularly. A study conducted in a rural area in Tanzania found that relatives/ neighbors and the radio were the most common sources of information [9]. Although healthcare professionals were identified as the main source of information in this study, healthcare professionals are not providing adequate education; as majority of the participants did not have adequate knowledge of their disease. It could also indicate that the primary focus of healthcare professionals is treatment and not the provision of information and preventive behavior. Despite healthcare professionals counselling regarding risk factors and lifestyle modifications, CVD management requires a multidisciplinary approach. Healthcare professionals should ensure that they educate their patients and promote positive health behaviors explaining the link between positive lifestyle modifications and the decrease in morbidity and mortality. Health promoters may also be utilised in overburdened settings to actively engage in activities that encourage communities to take care of their health and well-being and should focus on disease prevention rather than merely treatment [28].

In contrast to a study in Kuwait [1], participants in this study recognized the role of pharmacists in CVD prevention and were eager to use screening services as well as the provision of information regarding healthy lifestyles, provided by pharmacists. Community pharmacists are easily accessible and through screening, counselling, and education, they can assist with the reduction of CVD risk factors. Our study found that doctors, followed by pharmacists were listed as the first stop for medical intervention upon falling ill. Primary care pharmacists can provide primary prevention services through screening programs as well assist with pharmacist-initiated therapy, whereby weight management, smoking cessation and advice regarding lifestyle modifications, nutritional guidance and medication management can be offered.

Behavioral change is influenced by knowledge and perception. Lack of energy and physical limitations were perceived as the leading factors hindering PA as a lifestyle modification. A higher BMI is associated with an increased risk of developing CVD. Sharma, et al., found that there was a high prevalence of overweight individuals in South Africa [29]. Similarly, the majority of our study

population was overweight. Early prevention strategies and changes to sedentary lifestyle approaches are imperative to attenuate the risk for adverse outcomes and improve CVD risk factors [14]. PA has shown to improve myocardial perfusion and increase HDL cholesterol levels, which reduce cardiac stress levels [30].

Smoking status was independent of cardiovascular knowledge indicating that knowledge and perceptions are not necessarily practiced upon. Participants in this study underestimated their disease control and risk for CVD complications as most participants perceived their disease to be controlled and were not concerned about complications. Low health literacy results in adverse health outcomes, decreased quality of life and a higher mortality rate. Improving health literacy could potentially improve CV outcomes, reduce CV complications and ameliorate morbidity and mortality rates, in addition to improving the quality of life for individuals with CVD [31].

A targeted approach taking into consideration the knowledge gaps and patient perceptions is required to raise awareness and improve the knowledge of CVD. This may combat the rising burden of CVD in South Africa, as knowledge and awareness are essential to ensure behavioural changes pertaining to CVD prevention and control. Awareness and screening campaigns targeted at the youth may be beneficial, as opposed to only initiating education interventions once a diagnosis is made. Education interventions should inculcate a comprehensive understanding of specific recommendations to allow for informed lifestyle modifications. In countries with underdeveloped healthcare systems, a community centered approach should be adopted.

Limitations

Findings cannot be extrapolated to other communities due to the single centre study design. However, the socio-demographic factors were aligned with other parts of the country. There was potential selection bias in the study cohort as the study was conducted at specialised clinic where patients, due to regular clinic visits, may possess a greater awareness of health issues related to CVD. This could lead to knowledge levels that may not accurately reflect those of the general population. The survey was conducted in English, and all participants were not fluent in English, therefore were excluded. Further studies are recommended with a large sample size conducted in different languages covering a more diverse geographical locations and random sampling.

Conclusion

Knowledge amongst participants were found to be moderate to low. Even though participants displayed moderate knowledge of CVD, awareness of its risk-factors were sub-optimal. It is critical

to develop and implement interventions that will increase patient knowledge of CVDs. Although participants acknowledged the significance of adhering to treatment and follow-ups, they did not reach the recommended target levels. Healthcare professionals should continue to advise patients on the importance of medication adherence, behavioral modifications, and the interpretation of their results. Addressing the CVD burden in South Africa will require targeted interventions that create awareness as well as promote early detection and control of these conditions, focusing on the lower-income high risk individuals. This can be accomplished through community-based campaigns in rural communities to empower individuals in these communities to make informed decisions regarding their health.

Funding

This study was funded by the National Research Foundation (NRF) (Grant Number: MND210410593678), University of the Witwatersrand Faculty Research Funding (FRC) and, Ten Ten Planet Dialysis Centre.

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CHAPTER 4: FINAL OVERVIEW

This study provided insights into the levels of knowledge of CVD in patients attending two specialized outpatient clinics in Johannesburg, South Africa. Overall, sub-optimal levels of CVD knowledge and its risk factors continue to be indispensably important factors in South Africa. Knowledge levels varied based on level of education, ethnicity, and residential area. Common misconceptions of CVD should be addressed in a way that enhances understanding without stigmatizing cultural backgrounds.

Knowledge levels of CVD were found to be sub-optimal, and although participants had some knowledge of CVD, majority of participants did not understand what is meant by CV risk factor and less than a quarter of participants were able to identify risk factors. Although many participants previously heard of the terms used in CVD, most participants were unable to correctly elaborate on the definitions and had a limited understanding.

More than half the population knew the names of their medication as well as the uses of their medication. Most participants stated that they were compliant with their medication. There was a statistically significant association ($p=0.0008$) between levels of knowledge and medication compliance as well as physical activity. Although participants were aware of the implications of smoking, they were not eager to quit smoking.

There was an association between levels of CVD knowledge and socioeconomic factors. Increased levels of CVD knowledge were demonstrated by participants with higher levels of education, higher income levels, ethnicity (South Asians > Sub-Saharan Africans), and residential area (Sub-urban > rural). Knowledge levels were higher in females compared to males.

Although participants had moderate levels of CVD knowledge, more than half of the participants did not reach their target levels for their POCT test readings. Furthermore, many participants who expected their readings to be within normal range, were found to have high or impaired readings.

4.1 Limitations and future recommendations

Due to limitations in both financial resources, this research was centered on a single hospital, utilizing convenience sampling techniques. Despite this, the socio-demographic factors were representative of other regions in the country. The study cohort might exhibit potential selection bias since it was conducted in a specialized clinic where patients, owing to regular visits, may possess heightened

awareness of health issues related to cardiovascular disease (CVD). This could result in knowledge levels that might not accurately represent those of the general population. The survey was conducted in English, and participants lacking fluency in English were excluded, which could introduce a language-based bias. Future studies are recommended to involve a larger and more diverse sample size, conducted in various languages, and spanning different geographical locations, employing random sampling techniques.

4.2 Conclusion

Overall, CVD patients had a moderate understanding of their disease. Majority of participants understood the importance of medication compliance, and more than half of the population were aware of the names and uses of their medication. Participants also understood the importance of lifestyle modifications and many participants implemented positive changes to their diet and physical activity routine.

Awareness campaigns, on the adverse implications of CV risk behaviors', such as smoking, excessive alcohol intake and lack of physical activity cannot be overemphasized. Engaging healthcare workers in health initiatives may be beneficial, particularly in lower socio-economic groups who carry the greatest disease burden. Screening programs should incorporate more talks on awareness of the disease.

The results of this study emphasises the need for early commencement of targeted interventions aimed at alleviating the CV burden by improving levels of knowledge and awareness of the conditions as well as risk factors in the community from the level of the youth, as opposed to after diagnosis.

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APPENDICES

Appendix A: Questionnaire

Cardiovascular Health Check Questionnaire

To determine patient knowledge, perception, and awareness of cardiovascular disease as well as the associated risk factors, the need for medication compliance, monitoring, and lifestyle modifications amongst cardiovascular patients in Gauteng, South Africa

PLEASE FILL IN OR TICK (þ) THE APPROPRIATE ANSWER

A.Demographic Information		
	Question	*Response*
1	Age	_____
2	Biological sex	☐ Male ☐ Female ☐ Prefer not to say
3	Marital status	☐ Single ☐ Married ☐ Divorced ☐ Widowed ☐ Living with partner
4	Ethnicity	☐ Black/African ☐ White/European ☐Mixed Ethnicity/ Coloured ☐ South Asian/ Indian ☐ East Asian ☐ Other
5	Level of education	☐ Below high school level ☐ High school (matric or NQF 4) ☐ Higher certificate ☐ Diploma ☐ University degree (Bachelors or Honors) ☐ Postgraduate degree (Masters or PhD)
6	Employment	☐ Unemployed ☐ Self-employed ☐ Regular employment ☐ Part-time employment ☐ Student ☐ Retired
7	Residential area	☐ Urban/ City ☐ Sub-urban ☐ Rural

		☐ I don't know
8	Monthly income	☐ Less than R2500 per month ☐ R2500 to R10000 per month ☐ R10000 to R20000 per month ☐ More than R20000 per month ☐ Prefer not to say
B. Information regarding your medical status		
9	What medical condition are you coming to the clinic for?	☐ Hypertension ☐ Diabetes ☐ Cholesterol
10	I must attend follow ups at the clinic to monitor my disease progression	☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
Raised blood pressure (Hypertension)		
11	Do you know what hypertension is?	☐ Yes, elaborate_____ ☐ No
12	Do you have high blood pressure (hypertension)?	☐ Yes ☐ No ☐ Not sure
13	Do you think your blood pressure is:	☐ Low ☐ Normal ☐ High ☐ Not sure
14	Are you concerned about the control of your blood pressure?	☐ Yes ☐ No
15	When was the last time you checked your blood pressure?	☐ Within the last 1 – 3 months ☐ Within the last 4 – 6 months ☐ Within the last 7 – 12 months ☐ More than a year ago ☐ I don't know/ can't remember ☐ Never
Raised blood sugar (Diabetes)		
16	Do you know what diabetes is?	☐ Yes, elaborate_____ ☐ No
17	Do you know what an HbA1c test is?	☐ Yes, elaborate_____ ☐ No
18	Do you suffer from high blood sugar levels (diabetes)?	☐ Yes ☐ No

		☐ Not sure
19	Do you think your blood sugar level is:	☐ Low ☐ Normal (well controlled) ☐ High ☐ Not sure
20	Are you concerned about the control of your blood sugar levels?	☐ Yes ☐ No
21	When was the last time you checked your sugar levels?	☐ Within the last 1 – 3 months ☐ Within the last 4 – 6 months ☐ Within the last 7 – 12 months ☐ More than a year ago ☐ I don't know/ can't remember ☐ Never
	Raised blood lipids (Dyslipidemia)	
22	Do you know what dyslipidemia or high cholesterol is?	☐ Yes, elaborate_____ ☐ No
23	Do you suffer from high cholesterol levels (dyslipidemia)?	☐ Yes ☐ No ☐ Not sure
24	Do you think your cholesterol level are?	☐ Low ☐ Normal ☐ High ☐ Not sure
25	Are you concerned about the control of your cholesterol levels?	☐ Yes ☐ No
26	When was the last time you checked your cholesterol levels?	☐ Within the last 1 – 3 months ☐ Within the last 4 – 6 months ☐ Within the last 7 – 12 months ☐ More than a year ago ☐ I don't know/ can't remember ☐ Never
C.Behavioural Characteristics		
	Smoking status & alcohol habits	
27	Do you smoke ?	☐ Yes ☐ No ☐ I quit, when _____
28	I have tried to stop smoking, due to the fact that smoking has a negative impact on my health	☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree

29	How often do you consume alcohol?	☐ Never ☐ Occasionally/ rarely ☐ Daily ☐ Weekly ☐ Monthly
30	I have tried to decrease my alcohol consumption due to alcohol having a negative impact on my health?	☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
	Physical Activity	
31	Do you do exercise	☐ Yes ☐ No
32	How often do you do exercise for at least 30 minutes?	☐ 0 – 2 days a week ☐ 3 – 5 days a week ☐ 5 days or more ☐ I don't perform exercise
33	What exercise do you participate in?	☐ Walking ☐ Running/ Jogging ☐ Cycling ☐ Swimming ☐ Resistance Training/ Weight-lifting
34	Do you think tha exercise is beneficial for your health?	☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
35	What prevents you from doing exercise?	☐ No time ☐ Lack of energy/ fatigue ☐ Physical limitations (body pain) ☐ Safety concerns ☐ Lack of an exercise routine ☐ No exercise partner ☐ Lack of motivation ☐ Other
	Diet	
36	How do you perceive your weight?	☐ Underweight ☐ Normal ☐ Overweight ☐ Obese
37	Has anyone explained the importance of healthy foods to you?	☐ Yes, who _____ ☐ No

38	I select foods containing less salt because salt affects my blood pressure	☐ Strongly agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly disagree
39	In your opinion, which of these foods are healthy for the prevention of cardiovascular diseases?	
	Green leafy vegetables	☐ Yes ☐ No ☐ I don't know
	Fruits	☐ Yes ☐ No ☐ I don't know
	Salty foods	☐ Yes ☐ No ☐ I don't know
	Fish	☐ Yes ☐ No ☐ I don't know
	Chicken	☐ Yes ☐ No ☐ I don't know
	Mutton	☐ Yes ☐ No ☐ I don't know
	Beef/Steak	☐ Yes ☐ No ☐ I don't know
	Pork	☐ Yes ☐ No ☐ I don't know
	Processed meat (wors,sausages,polony)	☐ Yes ☐ No ☐ I don't know
	Canned food	☐ Yes ☐ No ☐ I don't know
	Fast foods	☐ Yes ☐ No ☐ I don't know
	Artificial sweetener	☐ Yes ☐ No ☐ I don't know
	Sweetened drinks	☐ Yes ☐ No ☐ I don't know
	Whole grain foods	☐ Yes ☐ No ☐ I don't know
	White bread	☐ Yes ☐ No ☐ I don't know
	Rice	☐ Yes ☐ No ☐ I don't know
	High fat diet (deep fried foods)	☐ Yes ☐ No ☐ I don't know
D. Overall knowledge and awareness of CVD		
	General	
40	Have you ever heard of cardiovascular disease?	☐ Yes ☐ No
41	Where did you hear from?	☐ Radio ☐ Television (TV) ☐ Newspaper/ Magazine ☐ Neighbours, relatives and friends ☐ Internet/ Social media ☐ Doctor ☐ Healthcare worker
42	Which of the following conditions do you consider to be forms of Cardiovascular Diseases?	☐ Coronary heart disease ☐ Congenital heart disease ☐ Cerebrovascular disease (stroke) ☐ Transient ischaemic attack (TIA) ☐ Peripheral arterial disease ☐ Rheumatic heart disease ☐ Valvular heart disease ☐ Arrythmias ☐ Deep vein thrombosis ☐ Pulmonary embolism

	Risk Factors	
43	What does the term "Cardiovascular Risk Factors" mean to you?	_____
44	Do you know the risk factors for CVD?	☐ Yes ☐ No
45	Can you mention the risk factors for CVD? *(Patient will mention the risk factors and researcher will tick)*	☐ Older age ☐ Overweight ☐ Hypertension ☐ Diabetes mellitus ☐ Dyslipidemia ☐ Smoking ☐ Excessive alcohol consumption ☐ Physical inactivity ☐ Family history ☐ Stress ☐ Sedentary lifestyle
E. Medication compliance and reasons for non-compliance		
46	Do you know the names of the medication that you are you currently taking ? *(Check patient's script with the response from patient)*	☐ Yes ☐ No
47	Do you know what each of your medication is used for?	☐ Yes ☐ No
48	What causes you to miss a dose of medication?	☐ I can't afford my medication ☐ I can't get time off to fill my prescription ☐ I forget to take my medication ☐ I feel better so I do not need to take my medication ☐ My medication makes me feel worse ☐ I prefer herbal and traditional medication ☐ I have recovered ☐ I don't ever miss a dose of medication
49	Have you been counselled on the importance of taking your mediction?	☐ Yes ☐ No
50	Do you implement the measures you were counselled on?	☐ Yes ☐ No, why not _____
F.The role of healthcare professionals in prevention and management of cardiovascular disease (other than medical doctors)		
51	When you fall sick, where do you go first for medical care?	☐ Dispensary ☐ Health centre/ doctor ☐ Hospital ☐ Essential drug store ☐ Traditional healer ☐ Don't know ☐ Other

52	Would you consider visiting the nurse and/or pharmacist instead of your medical doctor for any of the services listed below?	
	Blood pressure measuring and monitoring	☐ Pharmacist ☐ Nurse ☐ I don't know
	Blood glucose measuring and monitoring	☐ Pharmacist ☐ Nurse ☐ I don't know
	Blood cholesterol measuring and monitoring	☐ Pharmacist ☐ Nurse ☐ I don't know
	Dietary advice	☐ Pharmacist ☐ Nurse ☐ I don't know
	Exercise plan	☐ Pharmacist ☐ Nurse ☐ I don't know
	Smoking cessation guidance	☐ Pharmacist ☐ Nurse ☐ I don't know
	Management of prescribed medicine	☐ Pharmacist ☐ Nurse ☐ I don't know
53	If the following services are offered in the community pharmacy as well as wellness days, would you utilise the service?	
	Blood pressure measurement	☐ Yes ☐ No ☐ I don't know
	Blood glucose measurement	☐ Yes ☐ No ☐ I don't know
	Blood cholesterol level measurement	☐ Yes ☐ No ☐ I don't know
	Body weight measurement	☐ Yes ☐ No ☐ I don't know
	BMI monitoring	☐ Yes ☐ No ☐ I don't know
	Dietary plans and advice	☐ Yes ☐ No ☐ I don't know
	Exercise and physical activity regimes	☐ Yes ☐ No ☐ I don't know
	Smoking cessation counselling	☐ Yes ☐ No ☐ I don't know
G. Physical and biochemical measurements		
	Height	_____cm
	Weight	_____kg
	Waist Circumference	_____cm
	BMI	_____
	Blood Pressure	_____ (sys/dia) _____ (pulse)
	Glucose	_____mmol/L

	HbA1c	_____ %
	Lipid Profile S-Cholesterol S-LDL S-HDL S-Triglyceride	 _____mmol/L _____mmol/L _____mmol/L _____mmol/L

Appendix B: Patient Information Sheet

Department of Pharmacy and Pharmacology
Faculty of Health Sciences I 7 York Road Parktown, 2193 I Johannesburg I South Africa I Tel: +27 11 717 2552

PARTICIPANT /SITE INFORMATION SHEET

PATIENT KNOWLEDGE, ATTITUDES, AND PERCEPTIONS TOWARDS CARDIOVASCULAR DISEASE, MEDICATION COMPLIANCE AND LIFESTYLE MODIFICATIONS IN A TERTIARY HOSPITAL IN JOHANNESBURG

Good Day,

Introduction

I, Rumaanah Ayob, am currently registered as a Master of Pharmacy student at the University of the Witwatersrand. I am conducting research relating to the knowledge, perceptions, and attitudes of cardiovascular patients towards their disease, medication compliance and lifestyle modifications in Johannesburg, South Africa. In this study, I would like to explore the knowledge attitude and perceptions of cardiovascular patients towards their disease.

Invitation to participate

I invite you to participate in this survey to help me gather the information I require. Your participation is entirely voluntary. Refusal to participate will involve no penalty or loss of benefits to the you. You are free to withdraw from this study at any stage, and there will be no penalties should you discontinue participation at any point of the study.

The research project and the survey

Your participation will entail the completion of a survey. The survey is comprised of a demographic information section and five sections that will assess your knowledge, attitude and perception on cardiovascular disease and reasons for non-compliance. The researcher or one of our data collectors will complete the survey for you by asking you the questions. Once completed you will be guided to a private area where a complimentary wellness screening will take place. This is entire voluntary and you may complete the questionnaire and refuse the wellness screening. Completion of the survey will take approximately thirty minutes.

Confidentiality

Please note that all information will remain confidential. No names or identifying information will be recorded in this study. Raw data will be available to only the researcher and the supervisors.

Risks

There are no risks associated with participating in this study.

Benefits

You will not receive any direct benefits from participating in this study, and there are no disadvantages or penalties for not participating.

Outputs:
The findings of the study or a summary of the findings may be requested after the study is completed. The study is expected to be completed in December 2022. We look forward to your participation and to sharing the results of the survey

Ethics Clearance:
This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research. If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Dr Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

For further information regarding this study, you may contact:
1) Rumaanah Ayob (Principle Investigator), email: Rumaanah.Ayob1@students.wits.ac.za
2) Dr Ané Orchard (Primary Supervisor), email: Ane.Orchard@wits.ac.za
3) Mr Muhammed Vally (2nd Supervisor), email: Muhammed.Vally@wits.ac.za
4) Mrs Razeeya Khan (3rd Supervisor), email: Razeeya.Khan@wits.ac.za

Thank you for taking the time to consider participation.

Kind Regards,
Rumaanah Ayob
MPharm candidate, Department of Pharmacy and Pharmacology, University of Witwatersrand.

Appendix C: Consent Form (Questionnaire)

Department of Pharmacy and Pharmacology
Faculty of Health Sciences I 7 York Road Parktown, 2193 I Johannesburg I South Africa I Tel: +27 11 717 2552

PARTICIPANT CONSENT FORM - QUESTIONNAIRE

PATIENT KNOWLEDGE, ATTITUDES, AND PERCEPTION TOWARDS CARDIOVASCULAR DISEASE, MEDICATION COMPLIANCE AND LIFESTYLE MODIFICATIONS IN A TERTIARY HOSPITAL IN JOHANNESBURG

Principle Investigator: Rumaanah Ayob (MPharm candidate, University of Witwatersrand)
Supervisors: Dr Ané Orchard, Mr Muhammed Vally & Mrs Razeeya Khan

I hereby confirm that I have read and understood the information sheet provided by the researcher, and I understand the following:

- I understand that participation is voluntary, and that I will not be penalised for non-participation
- I understand that I may withdraw from the study at any time and that withdrawal at any stage does not incur any harm or penalty
- I understand that the researcher will use my responses for furthering research, education and training
- I understand that I have the right to not answer any questions I do not feel comfortable answering
- I understand that my privacy will be respected, and that my personal identifiable details will not be made available

I hereby agree that I have understood the requirements of this project and I am willing to participate in the survey.

_____ _____

Signed by participant Date

Appendix D: Consent Form (POCT)

Department of Pharmacy and Pharmacology
Faculty of Health Sciences I 7 York Road Parktown, 2193 I Johannesburg I South Africa I Tel: +27 11 717 2552

PARTICIPANT CONSENT FORM - POCT

PATIENT KNOWLEDGE, ATTITUDES, AND PERCEPTION TOWARDS CARDIOVASCULAR DISEASE, MEDICATION COMPLIANCE AND LIFESTYLE MODIFICATIONS IN A TERTIARY HOSPITAL IN JOHANNESBURG

Principle Investigator: Rumaanah Ayob (MPharm candidate, University of Witwatersrand)
Supervisors: Dr Ané Orchard, Mr Muhammed Vally & Mrs Razeeya Khan

I hereby confirm that I have read and understood the information sheet provided by the researcher, and I understand the following:

- I understand that participation is voluntary, and that I will not be penalised for non-participation.
- I understand that I may withdraw from the study at any time and that withdrawal at any stage does not incur any harm or penalty.
- I understand that the researcher will use my responses for furthering research, education, and training.
- I understand that I have the right to not answer any questions I do not feel comfortable answering.
- I understand that my privacy will be respected, and that my personal identifiable details will not be made available.

I hereby agree that I have understood the requirements of this project and I consent for the following tests to be measured.

_____ _____

Signed by participant Date

Appendix E: HOD Approval (Diabetic Outpatient Clinic)

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL
DIVISION OF ENDOCRINOLOGY AND METABOLISM
AREA 551, DEPARTMENT OF MEDICINE
7 YORK ROAD, PARKTOWN
2193, JOHANNESBURG
SOUTH AFRICA

+27 11 488 3538(t) +27 11 643 -2935 (f)
Frederick.raal@wits.ac.za

15th February 2022

Mrs Gladys Bogoshi
CEO, Charlotte Maxeke Academic Hospital

RE: Support for a research study in the Division of Endocrinology & Metabolism, Charlotte Maxeke Johannesburg Academic Hospital

This letter serves as proof of my support for the research study entitled ***"Patient knowledge, attitudes, and perception towards cardiovascular disease, medication compliance and lifestyle modifications in a tertiary hospital in Johannesburg "***

This project will be conducted by **Rumaanah Ayob** under the supervision of Dr Ané Orchard, Mr Muhammed Vally and Mrs Razeeya Khan, for the degree of Master of Pharmacy (MPharm). I have agreed that this study may be conducted in the Diabetes Outpatient Clinic in area 356 at CMJAH hospital, once Ethics approval has been obtained.

Yours sincerely,



Professor Frederick Raal

Appendix F: HOD Approval (Vascular Clinic)

GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

University
of the Witwatersrand
Johannesburg

Department of Surgery:

Charlotte Maxeke Johannesburg Academic Hospital

- Telephone +27 (0)11 488-3373 • Email:Thembekile.mthembu@wits.ac.za

18 March 2022

Dear Mrs Gladys Bogoshi,

CEO, Charlotte Maxeke Academic Hospital

RE: Support for a research study in the Division of Vascular Surgery, Charlotte Maxeke Johannesburg Academic Hospital

I approve of this study that will be conducted in the Vascular Outpatient Clinic at CMJAH hospital, once ethics approval has been obtained.

"Patient knowledge, attitudes, and perception towards cardiovascular disease, medication compliance and lifestyle modifications in a tertiary hospital in Johannesburg."

This project will be conducted by Rumaanah Ayob under the supervision of Dr Ané Orchard, Mr. Muhammed Vally and Mrs. Razeeya Khan, for the degree of Master of Pharmacy (MPharm)

Yours sincerely,

Dr I. Cassimjee

Consultant Vascular Surgeon
CMJAH
Division of Vascular Surgery

Appendix G: CMJAH Hospital Approval



GAUTENG PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL (CMJAH)
OFFICE OF THE SENIOR CLINICAL MANAGER

Enquiries: *Ms N. Mzila*
Email: Nolwazi.Mzila@gauteng.gov.za
Tel: *011 488 3365*
Ref: *1/7/2*
Date: 28 August 2022

GP_202208_057

Dear Miss Rumaanah Ayob

RE: FINAL APPROVAL OF STUDY

TITLE: PATIENT KNOWLEDGE, ATTITUDES, AND PERCEPTION TOWARDS CARDIOVASCULAR DISEASE, MEDICATION COMPLIANCE AND LIFESTYLE MODIFICATIONS IN A TERTIARY HOSPITAL IN JOHANNESBURG

Permission is granted for you to conduct the above-mentioned study as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic Hospital will not in any way incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall always be observed.
4. Informed consent shall be solicited from patients participating in your study.

Please liaise with the HOD and Unit Manager or Sister in charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Supported/~~Not Supported~~

Signed by:Jayshina Punwasi
Signed at:2022-08-29 22:56:14 +02:00
Reason:Witnessing Jayshina Punwasi

Dr J. Punwasi
Senior Clinical Manager

Approved/~~Not Approved~~

Signed by:Gladys Magugudi Bogoshi
Signed at:2022-08-30 04:41:35 +02:00
Reason:Witnessing Gladys Magugudi Bo

Ms. G Bogoshi
Chief Executive Officer

Appendix H: Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Miss Rumaanah Ayob

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M220503

NAME: (Principal Investigator)	Miss Rumaanah Ayob
DEPARTMENT:	Pharmacy and Pharmacology Charlotte Maxeke Johannesburg Academic Hospital (CMJAH)
PROJECT TITLE:	*Patient knowledge, attitudes, and perception towards cardiovascular disease, medication compliance and lifestyle modifications in a tertiary hospital in Johannesburg*
DATE CONSIDERED:	27/05/2022
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr A. Orchard, Mr M. Vally and Mrs R. Khan
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	22/08/2022

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the Third Floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions.Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. I **agree to submit a yearly progress report.** The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed in **May** and will therefore be due in the month of **May** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

23 August 2022
Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix I: Protocol Approval Letter

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

24 June 2022
Person No: 1441909
PAG

Miss R Ayob
PO Box 2186
Extension 1
Lenasia
1820
South Africa

Dear Miss Rumaanah Ayob

Master of Pharmacy: Approval of Title

We have pleasure in advising that your proposal entitled *Patient Knowledge, attitudes, and perception towards cardiovascular disease, medication compliance and lifestyle modifications in a tertiary hospital in Johannesburg* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix J: TurnItIn Report

Rumaanah MPharm

ORIGINALITY REPORT

13%	11%	6%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Hamid Yimam Hassen, Mark Bowyer, Linda Gibson, Steven Abrams, Hilde Bastiaens. "Level of cardiovascular disease knowledge, risk perception and intention towards healthy lifestyle and socioeconomic disparities among adults in vulnerable communities of Belgium and England", BMC Public Health, 2022 Publication	1%
2	www.researchsquare.com Internet Source	1%
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