

**NON-COMMUNICABLE DISEASES AMONG PEOPLE LIVING WITH HIV AT  
CHITUNGWIZA CENTRAL HOSPITAL IN ZIMBAWE**

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in fulfilment of the requirements for the degree of Doctor of Philosophy in Medicine (Public Health  
Medicine)

**Durban**

**2022**

## **Preface**

This thesis is submitted to the University of Kwa-Zulu Natal, College of Health Sciences in fulfilment of the requirements for the degree of Doctor of Philosophy in Public Health, under the supervision of **Dr Boikhutso Tlou**.

## Declaration 1

I **Alexander Cheza**, declare that:

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## **Declaration 2**

This is to certify that the contents of this PHD Thesis are the original research work of Alexander Cheza.  
As the candidate's supervisor, I have approved this Thesis for resubmission.

Supervisor

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Date: 7<sup>th</sup> September 2022

### **Declaration 3**

List of publications arising from the thesis and contribution statements.

1. Cheza A, Tlou B, Zhou DT (2021) Incidence of non-communicable diseases (NCDs) in HIV patients on ART in a developing country: Case of Zimbabwe's Chitungwiza Central Hospital -A retrospective cohort study (2010–2019). PLoS ONE 16(5): e0252180. <https://doi.org/10.1371/journal.pone.0252180>

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2. Cheza, A. & Tlou, B (2021). A qualitative exploratory study of selected physicians' perceptions of the management of non-communicable diseases at a referral hospital in Zimbabwe. Globalization and Health 17, 82. <https://doi.org/10.1186/s12992-021-00730-3>

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Alexander Cheza, the Principal Investigator responsible for providing overall direction and oversight of the study at all stages fully engaged from the project design, protocol development and obtaining of ethical approvals to the study conduct, data analyses and dissemination of the study outcome. Boikhutso Tlou, Supervisor and Co-Investigator, responsible for technical direction, supervised and provided advice for all steps from the project design, protocol development and obtaining of ethical approvals to the study conduct, data analyses and dissemination of the study outcome. Reviewed the final article. The authors read and approved the final manuscript.

3. Cheza A & Tlou B. Knowledge and Perceptions about Non-Communicable Diseases by people living with HIV: A descriptive cross-sectional study from Chitungwiza Central Hospital Zimbabwe. The manuscript has been accepted for publication with the African Health Sciences journal and is in the production phase.

#### **Author Contributions**

Alexander Cheza, the Principal Investigator responsible for providing the overall direction and oversight of the study at all stages and was fully engaged from project design to protocol development and obtaining ethical approvals, study conduct, data analyses and the dissemination of the study outcome. Boikhutso Tlou, Supervisor and Co-Investigator, was responsible for technical direction, supervised and provided advice for all steps from project design to protocol development, and obtaining ethical approvals, study conduct, data analyses and the dissemination of the study outcome. All authors reviewed and approved the final article.

**Dedication**

I dedicate this thesis to my mother Shylet Gura Cheza who has been a pillar in my education journey from day one, my wife Precious Cheza, daughter Ropafadzo Cheza, my family and friends. I also dedicate this work to all the medical professionals working hard to manage the various types of non-communicable diseases and above all to everyone suffering from any chronic illness. It is my desire to see equal effort put in the fight against non-communicable diseases especially in people living with HIV.

## **Acknowledgements**

My sincere gratitude goes to my supervisor Dr Boikhutso Tlou for the support and guidance throughout. His determination and encouragement fuelled me each day. I also want to applaud Professor Tivani Thompson-Mashamba for making me realise the possibility of kick starting this study and Dr Danai Tavonga Zhou for collaborating with us in some parts through this journey.

Special appreciation goes to the Zimbabwe Ministry of Health and Child Care together with the Chitungwiza Central Hospital for the permission granted to carry out this study.

Most importantly, I acknowledge my wife and daughter for being the source of inspiration during the vicissitudes of this journey.

Many thanks to my friends and colleagues, I will not list you all but I really appreciate your encouragements from different angles.

Thank you



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## **Abbreviations**

<b>AIDS:</b>	Acquired Immune Deficiency Syndrome
<b>ART:</b>	Anti-Retro viral Therapy
<b>BREC:</b>	Biomedical Research Ethics Committee
<b>CCH:</b>	Chitungwiza Central Hospital
<b>HIV:</b>	Human Immunodeficiency Virus
<b>LMICs:</b>	Low to Medium Income Countries
<b>MRCZ:</b>	Medical Research Council of Zimbabwe
<b>NCDs:</b>	Non-Communicable Diseases
<b>OI:</b>	Opportunistic Infections
<b>PLHIV:</b>	People Living with HIV
<b>SDG:</b>	Sustainable Development Goal
<b>SSA:</b>	Sub-Saharan Africa
<b>TB:</b>	Tuberculosis

## ABSTRACT

### Background

The incidence of non-communicable diseases (NCDs) has been reported to be on the rise in the years preceding 2010. Over the years, NCDs have become a global public health burden and a leading cause of premature death, mainly in low to middle-income countries (LMICs). Additionally, sub-Saharan Africa has shown a rise in morbidity and mortality due to NCDs. In Zimbabwe, only a few studies have been conducted to examine the incidence of NCDs in people living with HIV (PLHIV). The study objectives included determining the incidence of NCDs in PLHIV on ART over a ten-year period and the associated risk factors. Furthermore, the study explored physicians' perceptions on the availability and quality of clinical care for the management of NCDs, in addition to evaluating the knowledge and perceptions of PLHIV towards NCDs.

### Methods

The study encompassed a mixed methods approach using both quantitative and qualitative methods. The thesis is based on three different articles each built from a different study design. Reliability of the questionnaire and the data collection sheet were determined by calculating the Cronbach alpha which exceeded 0.8 in both cases. In addition validity of the tools went through a panel of experts before being approved and also pilot studies were conducted to validate the tools before actual data collection.

The title of the first article was: *Incidence of non-communicable diseases (NCDs) in HIV patients on ART in a developing country: Case of Zimbabwe's Chitungwiza Central Hospital—A retrospective cohort study (2010–2019)* and it addresses the first two objectives of the thesis. This was a retrospective analysis of data from ongoing longitudinal population-based cohorts from Chitungwiza Central Hospital (CCH) in Zimbabwe, focusing on PLHIV receiving antiretroviral therapy (ART) at the opportunistic infections clinic (OIC) housed at CCH, covering the period 2010-2019. This was crucial for long-term follow-ups and determining the associated risk factors. The intention was to first establish the incidence of NCDs in PLHIV, as well as the association of the incidence with several factors such as age, geographic location of residence of the study participants and their gender. The incidences of NCDs namely cancers, cardiovascular diseases, diabetes mellitus and hypertension were determined and generalized estimating equations (GEE) were used to estimate the association between NCDs and the selected risk factors. Article 2 which addresses objective 3 was published in the Globalization and Health

Journal and was entitled: *A qualitative exploratory study of selected physicians' perceptions of the management of non-communicable diseases at a referral hospital in Zimbabwe*. This was a qualitative exploratory study meant to obtain expert perceptions of care delivery for NCDs in one Zimbabwean referral hospital setting. Data was collected from participants who consented. A four-point Likert scale was used to categorize different levels of perceived satisfaction and analysis was done using Stata version 13. The third article making up the thesis and addresses objective 4 is entitled: *Knowledge and Perceptions about Non-Communicable Diseases by people living with HIV: A descriptive cross-sectional study from Chitungwiza Central Hospital Zimbabwe*. The article has been accepted by the African Health Sciences Journal and is pending publication. This was a cross-sectional explanatory study using a mixed methods approach to describe the participants' responses. The study explores and descriptively documents the perceptions and knowledge of PLHIV on their exposure to the NCDs burden.

## **Results**

Data collected at the study's baseline (2010) showed that the most prevalent NCD was hypertension, found in 8.9% (18/203) of the study participants, followed by diabetes (6.9%), then cardiovascular diseases (CVD) (3.9%). The least common NCD was cancer (1.9%). Incidences of all of these NCDs showed an increasing trend as the time of follow-up progressed. The associated risk factors found to be significantly associated with the development of NCDs were gender, with females being 2 times more likely than males to develop NCD ( $p = 0.002$ ) and follow-up time ( $p < 0.001$ ). Moreover, geographical location was a significant risk factor as urban patients were more likely to develop hypertension as compared to peri-urban patients ( $p = 0.001$ ). Nineteen of the doctors were general practitioners, whilst four were specialists. The findings indicated that both general and specialists perceived some shortfalls in clinical care for NCDs. Moreover, the perceptions of general practitioners and specialists were not significantly different. Doctors perceived cancer care to be lagging far behind the other three NCDs under study. Care for cardiovascular diseases (CVDs) and diabetes showed mixed perceptions amongst participants, with positive perceptions almost equalling negative perceptions. Furthermore, hypertension was perceived to be clinically cared for better than the other NCDs under study. Reasons for the gaps in NCD clinical care were attributed by 33% of the participants to financial challenges; a further 27% to patient behavioural challenges; and 21% to communication challenges. The study also found a moderately good level of knowledge (65%) and very high levels of positive perceptions (81%) on NCDs. Participants <40 years of age were more knowledgeable ( $p = 0.003$ ) and a history of NCD in

the family had a positive influence on knowledge ( $p=0.001$ ). Females showed a more positive perception ( $p=0.043$ ), whilst both increasing age and low education negatively impacted perceptions ( $p<0.001$ ) as well as knowledge ( $p=0.020$ ).

## **Conclusion**

The study concluded that NCDs and HIV comorbidity is common with women, who are more likely than men to develop NCDs as they advance in age. There is need to devise targeted intervention approaches to the respective NCDs and risk factors since they diversely affect people with different demographic characteristics. Moreover, the care delivery for the selected NCDs under study at CCH need to be improved. It is crucial to diagnose NCDs before patients show clinical symptoms. This helps disease prognosis to yield better care results. The evaluation of doctors' perceptions indicates the need to improve NCD care at CCH in order to control NCD co-morbidities that may increase mortality. Patients' knowledge and perceptions were moderately high but reduced with decreasing levels of education and increasing age. The study recommends educational campaigns to disseminate information about NCDs in PLHIV, targeting the least educated population groups and those older than 40 years of age.

**Keywords:** Non-Communicable Diseases (NCDs), HIV, Healthcare, Cancers, Diabetes, Cardiovascular disease (CVD), Hypertension, Knowledge, Perceptions, Comorbidity.



## CHAPTER ONE

### 1.1 Introduction

The disease burden in most developing countries including those located south of the Sahara Desert in Africa, collectively known as sub-Saharan Africa, was conventionally comprised of communicable diseases such as malaria, tuberculosis and the human immunodeficiency virus (HIV) for decades [1]. This has however changed, as non-communicable diseases have become the leading cause of death and a major disease burden [1]. The chapter gives a general overview of the problem under study and then focuses on a study conducted at Chitungwiza Central Hospital (CCH) situated in one dormitory town of Zimbabwe's capital city, Harare. This introductory chapter therefore highlights the focus of the study which was conducted and resulted in three accepted publications in three journals.

Non-communicable diseases (NCDs) are now a leading cause of death worldwide, with an estimated 41 million people dying from these diseases each year, which is approximately 71% of deaths globally, and with nearly 85% of these fatalities occurring in Low- and Middle-Income Countries (LMICs) [2]. The leading killer NCDs according to the World Health Organisation (WHO) are cardiovascular diseases (CVDs), leading the pack and accounting for approximately 17.9 million deaths each year, followed by cancers causing about 9 million deaths; respiratory diseases accounting for nearly 3.9 million deaths; and lastly diabetes causing 1.6 million deaths each year [2].

Globally, more attention and resources have been devoted to fighting HIV/AIDS, TB and malaria over the past few decades and significant progress has been achieved, as evidenced by improved health preparedness for these infectious diseases [3]. In 2010, TB and malaria killed almost two million people worldwide, whilst in the same year various cancers killed eight million people, with similar numbers across other NCDs such as CVDs, hypertension and diabetes [4]. Haregu et al. estimated that at least 36 million people die globally each year from NCDs [5]. The most prevalent NCDs, which account for at least 80 percent of global NCD deaths, share four common risk factors, namely hereditary, environmental, ageing and socio-economic status, and the effects thereof can be severe for people living with HIV (PLHIV) [6].

## **1.2 Background to the study**

The sub-Saharan African region is the worst affected by HIV/AIDS, accounting for more than 67% of all people living with HIV in 2020 [7]. Nweze et al. found that HIV infections are prevalent amongst people in LMICs, with a greater number coming from sub-Saharan Africa [8]. The introduction of antiretroviral therapy (ART) has averted more than 12.1 million HIV-related deaths between 2010 and 2019 [9]. However, challenges in further reduction of HIV-related deaths have been partly attributed to increase in NCDs, as some PLHIV are naturally ageing whilst some face side effects of ART medication. In 33 patient cohort studies in sub-Saharan Africa, NCDs accounted for 56% morbidity and 40% mortality, and it has been shown that there is an increasing cumulative incidence of NCDs with each year of taking ART in sub-Saharan African cohorts [10].

Zimbabwe has a population of about 14 million and is amongst the countries in sub-Saharan Africa worst affected by the HIV and AIDS epidemic, with an estimated prevalence rate of 14% at the end of 2017 [11]. The adult HIV prevalence has been declining since the turn of the millennium from 27.2% in 1998 to 14.0% in 2017 [12]. The emergence of ART has also enhanced efforts to lower the devastating effects of the HIV/AIDS epidemic in Zimbabwe. The average adult HIV prevalence is 1.2 percent worldwide, and it is 9.0 percent in sub-Saharan Africa, showing that HIV prevalence is still high for Zimbabwe when compared to these averages [7]. Furthermore, NCDs threaten to reverse reductions in HIV prevalence and the benefits of ART in terms of reduced HIV mortality rates [10].

### **1.2.1 Management of NCDs in low-income countries (LICs)**

NCDs are the leading causes of death worldwide, with an estimated 40 million people dying from such diseases each year, that is, roughly two out of three deaths globally, and 80% of these fatalities occur in LICs [13]. The statistics are stark, yet they hide the human toll of such disease burdens. There had been greater attention and resources given to HIV/AIDS, TB and malaria over the past decades and the dramatic progress has been evidenced by the improved healthcare preparedness for such infectious diseases [2]. A range of programs and interventions has been considered and some innovative efforts are underway, but positive outcomes have often been difficult to secure because of global inequities in healthcare access; the globalisation of risk factors – many of which originate from outside the health sector; and the costs of implementing interventions. In LMICs, where the disease burden is transitioning from communicable to non-communicable diseases, many populations are currently suffering from a double-burden, which has prompted the study of NCDs in HIV-infected individuals [3].

The management of NCDs in LMICs faces several challenges such as poor laboratory facilities; frequent medicine stock-outs; a limited and poorly distributed health workforce and pharmaceuticals; and poor access to financial resources for caregivers and clients, amongst many other challenges [14, 15]. These highlighted challenges also affect the management and control of NCDs in Zimbabwe. The improvement of the management and control of NCDs by the Ministry of Health and Child Care (MoHCC) in Zimbabwe, in cooperation with the WHO, has been a strategic priority since 2016 [16]. The management of NCDs in Zimbabwe includes several personnel who are either directly or indirectly involved in the daily management of different NCDs.

### **1.2.2 HIV/AIDS and NCDs**

In 2020, there were about 38 million people living with HIV worldwide [17]. In addition, there were 0.84 males per female living with HIV in 2019; 0.99 male infections for every female infection; and 1.02 male deaths per female death [18]. Globally, the number of HIV incident cases and deaths decreased during the period 2010-2019, while the gap between incident cases and deaths in males and females shrank. The decrease in incident cases and deaths did not achieve a 75% decrease between 2010 and 2019, which had been set as a target by member states of the UN through the UNAids [18]. Moreover, in 2019, the global incidence-to-prevalence ratio was 0.05 and the global incidence-to-mortality ratio was 1.94 [17]. Due to the high prevalence of HIV amongst females in sub-Saharan Africa, the number of people living with HIV remained higher in females than in males globally, with 54% of PLHIV being female. On the other hand, NCDs represent a threat to global health and socioeconomic development. The World Health Organization (WHO) estimates that approximately 40 million deaths occur annually due to NCDs [19]. More than 80% of these deaths occur in low- and middle-income countries (LMICs) and a third occur among individuals younger than 60 years of age, while in high-income countries, this proportion is 13% [19]. Premature deaths (30 to 69 years) due to NCDs usually affect individuals with lower income and education who are more exposed to risk factors and have reduced access to information and health services [19]. Although there are well-documented declines in the generalised sub-Saharan African HIV epidemic, case studies highlight an acceleration of HIV incidence in key populations, including men who have sex with men, sex workers and people who inject drugs [18]. These populations are currently neglected in most developing countries including in Zimbabwe, as they are not accepted as sexual orientations.

The disease burden of NCDs in Africa has been on the rise and Zimbabwe has similarly been seeing a rise in mortality due to NCDs [17]. Of this population, UNAIDS estimated that as at the end of 2019, 12.7% of the people aged 15 years and above in the country were living with HIV/AIDS. In terms of the adult HIV prevalence in the country, the Zimbabwe Demographic and Health Survey showed a slightly higher HIV prevalence rate in urban areas than in rural areas, which ranged by province from 13% in Harare Metropolitan province to 21% in Matabeleland South province [20].

People living with HIV (PLHIV) are also susceptible to opportunistic diseases owing to a weakened immune system by HIV resulting in numerous deaths over the years, mainly prior to the introduction of ART. According to Haregu et al., people living with HIV (PLHIV) are estimated to be at least 35 million of the total world population, with a greater number being in sub-Saharan Africa and other developing countries [4]. However, the discovery of highly active anti-retroviral therapy (HAART) in the late 1990s significantly improved the life expectancy of people infected with HIV [21].

Research has shown that efforts to curb the impact of the HIV/AIDS pandemic in developing countries could potentially be obstructed by the rise of non-communicable diseases (NCDs, which have caused a 15% rise in mortality rates since 2010 [22]. NCDs such as diabetes, obesity, cardiovascular diseases, and a variety of cancers have traditionally been known to be diseases of the rich and a concern for more developed countries. This has dramatically changed, with cases of these diseases now common in developing countries' healthcare institutions, and research has indicated that most deaths amongst PLWHIV result from non-communicable diseases than communicable diseases [23]. This is in line with a World Health Organization report that of the 57 million global deaths in 2008, 36 million, or 63%, were due to non-communicable diseases (WHO, 2010). The four main NCDs identified were diabetes, cancers, cardiovascular diseases and chronic lung disease, with a greater burden of these diseases disproportionately rising amongst low-income countries, and HIV-infected people then suffer from a disease double burden [23].

Despite the devastating effects of NCDs on PLHIV, an integrated approach focusing on developing countries remains unexplored as much evidence of NCDs still concentrates on developed countries [24]. An integrated approach enhances the synchronization of key actors and their actions to address health needs. It is thus imperative to examine the multiplier effect of the double burden of NCDs on PLHIV in developing countries, focusing on NCDs such as diabetes mellitus, hypertension, cancers, and CVDs

[24]. These NCDs propel mortality in Southern Africa and the world over, and this study seeks to devise and present ways to mitigate the devastation arising from these diseases, mainly focusing on HIV-infected people in Zimbabwe receiving treatment at Chitungwiza Central Hospital.

### **1.3 NCDs disease burden**

The burden of NCDs now outweighs the burden of infectious diseases in almost every country [24]. Furthermore, the urgency of the NCD problem led to the adoption of the Sustainable Development Goals (SDGs) and their target 3.4: “By 2030, reduce by one-third premature mortality from NCD through prevention and treatment and promote mental health and well-being.” Universal health coverage (UHC) is a related SDG target (3.8). Thus, NCDs also constitute a major disease burden with a significant economic impact, especially in LMICs. Zimbabwe is classified in this category and therefore the leading NCDs in terms of mortality and morbidity in 2019 were: CVDs (ischaemic heart disease, stroke and chronic obstructive pulmonary disease); trachea, bronchus and lung cancers; as well as diabetes mellitus [25]. Diabetes and kidney diseases are especially burdensome in southern sub-Saharan Africa, where the crude DALY rate (1927.2 DALYs [1693.8–2191.9] per 100 000 population) is more than double that found in other regions of sub-Saharan Africa (1233.3 [1047.6–1432.8] in central, 887.4 [771.0–1016.7] in western, and 915.2 [811.3–1029.2] in eastern sub-Saharan Africa). Ischaemic heart disease was the leading cause of cardiovascular disease burden among males (4 857 246.3 DALYs [4 417 087.3–5 429 459.4]), whereas cerebrovascular disease was most prominent among females (4 034 703.6 DALYs [3 699 338.3–4 378 417.9]) [1]. Therefore, Zimbabwe has seen rapid increases in NCD burden in terms of both absolute DALYs and DALY rates, in contrast to other countries in sub-Saharan Africa, where age-standardised DALY rates have decreased [1]. Of late, PLHIV have been more likely to have single or multiple morbidities in comparison to uninfected persons. About 14% of HIV-negative people have been diagnosed with at least one NCD in 2015 as compared with 33% of PLHIV [26]. These NCDs are highlighted in the following sections.

#### **1.3.1 Cardiovascular diseases (CVDs)**

Cardiovascular disease (CVD) is an umbrella term for several linked pathologies, commonly defined as coronary heart disease (CHD), cerebrovascular disease, peripheral arterial disease, rheumatic and congenital heart diseases, and venous thromboembolism [27]. CVDs contribute about 31% to global mortality, estimated to be about 17.9 million deaths each year, the majority of this being in the form of CHD and cerebrovascular accidents [28]. CVDs led to over 17 million deaths, 330 million years of life

lost and 35.6 million years lived with disability in 2017 worldwide [29]. Meanwhile, it was projected that CVDs would be the cause of more than 23 million deaths in 2030 around the world [29]. CVD has traditionally been known to be a major and ever-growing public health problem in developed countries, with statistics from the United Kingdom indicating that it would cause almost one-third of all deaths in the UK [29]. The rate of CVD worldwide has been increasing as the prevalence of risk factors for CVD rises in previously low-risk countries, such as developing countries, where about 80 percent of CVD deaths occur [19]. The key CVD risk factors include dyslipidaemia, smoking, hypertension, diabetes, and abdominal obesity [21]. Therefore, CVD is a substantial concern in terms of global mortality and morbidity, whereby the prevalence of cardiovascular disease is increasing whilst treatment modalities improve survival [21]. With an ageing population and increasing costs of chronic medical care, the primary prevention of CVD is an important target for public healthcare providers.

Countries in sub-Saharan Africa (SSA) face a growing CVD burden, which is attributed to economic, nutritional, demographic and epidemiological transitions [30]. These factors increase the prevalence of CVD risk factors, and the CVD burden overlaps with a high prevalence of infectious diseases. Zimbabwe is also affected by similar risk factors. The risk factors for CVDs are associated with lifestyle changes attributable to a high urbanisation rate, with about 32% percent of the Zimbabwean population estimated to be residing in urban areas and cities [31]. Zimbabwe is also affected by epidemiological transitions with PLHV's life expectancy increasing, and the population is also ageing [30]. Therefore, it is imperative to assess the contribution of CVDs to the national disease burden in Zimbabwe as NCDs are becoming a major public health challenge.

### **1.3.2 Cancer**

Cancer is a serious public health problem in all populations, regardless of wealth or social status. The global cancer burden is estimated to have risen to 18.1 million new cases and 9.6 million deaths in 2018 [32]. However, the global response to cancer has been uneven and inequitable. Most LMICs started to address the cancer burden late, having made hard choices to concentrate limited resources on an enormous burden of infectious diseases. In 2018, 18.1 million people around the world had cancer, and 9.6 million died from the disease. By 2040, those figures are expected to nearly double, with the greatest increase in LMICs, where more than two-thirds of the world's cancers will occur. Cancer causes approximately 30% of all premature deaths from NCDs amongst adults aged 30-69 [33]. The most

frequently diagnosed cancer is lung cancer (11.6% of all cases), followed by female breast (11.6%) and colorectal cancers (10.2%). Lung cancer is the leading cause of death from cancer (18.4% of all deaths), followed by colorectal (9.2%) and stomach cancers (8.2%) [34]. The most common cancer types vary amongst countries, with certain cancers, such as cervical cancer and Kaposi sarcoma, much more common in countries at the lower end of the human development index (HDI) than in high-HDI countries.

Zimbabwe is one of the countries in sub-Saharan Africa with the highest HIV burden, which was also found to be a major risk factor for about 60% of cancers recorded in the country [35]. The most common cancers in Zimbabwe are cervical cancer and Kaposi sarcoma, which are also the leading causes of cancer mortality. In children, the most common cancers are Kaposi sarcoma, Wilms tumour, retinoblastoma, soft and connective tissue tumours, and tumours of the central nervous system [35]. Other major cancer risk factors include unhealthy lifestyles, nutritional and environmental factors. In Zimbabwe, cervical cancer accounts for more than a third of all cancers amongst women of African descent [36]. Furthermore, in Zimbabwe, there is a lack of awareness and comprehensive knowledge about breast and cervical cancer. In addition, there is low self-risk perception, a low uptake of cancer early detection services and a low capacity of the local health institutions in offering cancer services [36]. It is important therefore to enhance the general understanding of NCDs, including cancer, in order to effectively deal with its associated morbidity and mortality.

### **1.3.3 Diabetes Mellitus**

Diabetes mellitus is recognized as being a syndrome, a collection of disorders that have hyperglycaemia and glucose intolerance as their hallmark, due either to insulin deficiency or to the impaired effectiveness of insulin's action, or to a combination of these [38]. Reviews of several diabetes epidemiological studies confirm that diabetes is one of the most prevalent non-communicable diseases globally, and it is the fourth or fifth leading cause of death in most developed countries [40]. Diabetes prevalence ranges from nearly 0% in New Guinea to 50% amongst the Indians of Arizona [37]. No modifiable risk factors have been clearly established in persons with Type 1 diabetes, but major environmental determinants have been suggested. Impaired glucose tolerance, gestational diabetes, insulin resistance, obesity and a lack of physical activity have been consistently identified as risk factors for Type 2 diabetes [38].

The prevalence of diabetes increases with age, but a sex-specific tendency has not been consistent. In addition, the prevalence of diabetes is higher in African-Americans and Hispanics when compared to other ethnic groups [39]. Type 2 diabetes is the most common type of diabetes, and its prevalence has

been rising in developing countries [38]. For instance, diabetes and its complications are a major cause of morbidity and mortality in India, and the prevalence of Type 2 diabetes is on the rise [40]. Additionally, the prevalence of diabetes is rapidly increasing in Africa. Type 2 diabetes may remain undetected for many years, leading to severe complications and healthcare costs [41]. Diabetes affects almost all organs of the body and is the leading cause of blindness and amputations of legs, imposing both clinical and economic costs to patients and society. Currently, there is no cure for diabetes, but it can be managed through controlling blood sugar levels through a healthy diet, exercise, and medication, which helps mitigate the risk of long-term diabetes complications. To address the growing health challenge caused by diabetes, world leaders have committed to reducing the burden of diabetes as one of four priority non-communicable diseases (NCDs) [42]. Co-morbidities, including Diabetes Mellitus, pose a higher risk of infection by COVID-19, and these vulnerabilities were revealed by the COVID-19 pandemic, especially for people living with non-communicable diseases (NCDs) [43].

A three-fold increase in reported cases of diabetes occurred during the 1990s in Zimbabwe [44]. In Zimbabwe, lifestyle changes caused by urbanisation and the westernisation of diets have been contributing to increases in Type 2 diabetes [45]. Development of combined antiretroviral therapy has led to the increase in the life span of PLHIV with treatment, similar to the expected age of the general population. With longevity, however, PLHIV are developing other chronic medical conditions, and one of these chronic comorbidities is diabetes mellitus [46]. Lifestyle-related risk factors which account for about 5.8% of all-cause mortality in sub-Saharan Africa are modifiable, unlike genetic-related risk factors [45]. Thus, the identified risk factors associated with the development of diabetes in PLHIV that are similar to persons without HIV, such as older age, heredity, higher Body Mass Index [BMI], higher triglyceride and hypertension. However, PLHIV have additional risk factors of HIV and HIV medicines [46]. Exposure can be managed by eating traditional dietary foods, which have been vigorously promoted especially for PLHIV as a way of improving their immunity [47]. However, other risk factors are not well studied in Africa, including Zimbabwe, and therefore, their effects in contributing to the disease burden associated with diabetes has limited literature.

### **1.3.4 Hypertension**

Globally, NCDs are a leading cause of mortality and according to the WHO, hypertension is estimated to cause 12.8% of all deaths [48]. It has been long recognized that hypertension is an important risk factor for cardiovascular disease (CVD) and mortality. Traditionally, a high burden of hypertension and its



adverse consequences has been mistakenly thought to be an affliction of only economically developed countries. However, recent studies have reported that most people in many economically developing countries have developed hypertension above the levels considered optimal, with a high prevalence of hypertension [49]. Hypertension has become a major public health concern in many developing countries due to its rising prevalence and adverse impact on ailing health systems [50]. Although a high prevalence of hypertension in all world regions has been previously reported, a publication from the Global Burden of Disease (GBD) Study has placed a renewed global focus on the heavy toll of hypertension. The disease burden of hypertension is substantial in certain countries. For instance, a national survey conducted in China revealed that 33.7% of Chinese adults were hypertensive patients [51]. For developing countries such as Ghana, about 50% of all adults are hypertensive [29]. The hypertension risk factors include obesity, physical inactivity and unhealthy diets and its prevalence is expected to keep growing further in the absence of broad and effective preventive measures [52]. Therefore, hypertensive and many other NCDs which have been highlighted above should be properly managed and/or prevented in order to reduce the associated mortality and fatality rates.

The incidence of hypertension in PLHIV has been studied in Zimbabwe, with a study by Chireshe, Naidoo and Nyamakura finding a prevalence of 29.9% [53]. Factors associated with hypertension in Zimbabwe were found to be advanced age; the use of HAART for longer than 10 years; being overweight; a family history of hypertension; and smoking [52]. Increased life expectancy due to the usage of ART is known to be related to diseases associated with ageing, such as hypertension. Zimbabwe has not yet implemented an integrated management intervention of HIV-NCD comorbidity. However, the gains already made in controlling HIV might be lost if the magnitude of other emerging and potentially life-threatening conditions like NCDs remain unknown [54]. Indications of the increasing prevalence of NCDs in PLHIV call for the integrated management of HIV and NCDs. This will allow active NCD case findings and eventually improve treatments for HIV-NCD comorbidity.

#### **1.4 Problem Statement and Rationale**

There is a convergence of NCDs with infectious diseases in many low- and middle-income countries (LMICs), which poses novel challenges and opportunities to enact responsive changes in policy and research. Most LMICs still have significant dual disease burdens of NCDs such as cardiovascular disease, hypertension, diabetes, and cancer on one hand, and infectious diseases including tuberculosis, HIV/AIDS, and parasitic diseases on the other. Moreover, there has been significant effort and progress

towards mitigating the infectious diseases burden, including the introduction of ART for HIV/AIDS. The NCDs burden is exacerbated in LMICs due to co-morbidities with the HIV burden [55]. On the contrary, the NCDs burden is still growing and there are significant knowledge gaps. Efforts to reduce the disease burden of NCDs in PLHIV, especially in developing countries, were hampered by a lack of access to finance, despite the millennium development goals (MDGs) having set targets without having clear NCD indicators [56]. These have since been addressed by the sustainable development goals (SDGs), whose Target 3.4 is to reduce NCD-related premature deaths by a third by 2030 [57].

HIV/AIDS continues to greatly impact on the social and economic arena of poor and developing countries, despite the extensive ART rollout programme [58]. Some studies have attributed this to rising NCDs in the developing countries [54, 56, 57]. Apart from the high mortality and co-morbidity of NCDs and HIV, healthcare systems in most LMICs are generally ill-prepared, fragile, under-resourced and face infrastructural limitations in dealing with the epidemiological and economic costs associated with NCDs [59]. Studies investigating the impact of NCDs, especially for PLHIV, have mainly focused on developed nations, while a few have considered the developing countries. Those studies conducted on NCDs tend to be qualitative and cross-sectional in nature, and focus has not been given to PLHIV in developing countries [4]. Therefore, combined strategies are necessary for surveillance and disease control. Moreover, experts, institutions and policies that support the prevention and control of NCDs, given the significant substantial progress and results, are in place in most LMICs including Zimbabwe. This study will examine the scenario in the African context using mixed methods over a ten-year period in order to obtain the genesis of NCDs and proffer lasting solutions on integrating the management of NCDs amongst PLHIV.

### **1.5 Research questions and objectives**

The aim of the study is to evaluate the burden of NCDs in HIV-positive patients at Chitungwiza Central Hospital over a decade, including NCDs' associated risk factors, establish physicians' perceptions of NCD care delivery at CCH and examine people diagnosed with NCDs' knowledge and perceptions about NCDs development and management.

The research questions are:

- 1) What is the burden of NCDs in HIV patients on ART at CCH between 2010 and 2019?














- 2) What were the factors associated with the NCD incidence at Chitungwiza Central Hospital between 2010 and 2019?
- 3) How do physicians perceive the care delivery systems in place for NCDs at Chitungwiza Central Hospital?
- 4) To what extent are patients knowledgeable on non-communicable diseases?

The study objectives are:

- 1) To determine the burden of NCDs in HIV patients on ART at CCH between 2010 and 2019.
- 2) To evaluate the factors associated with the NCD incidence at Chitungwiza Central Hospital between 2010 and 2019.
- 3) To explore physicians' perceptions on the care delivery systems in place for NCDs at Chitungwiza Central Hospital.
- 4) To determine the knowledge and perceptions of non-communicable diseases amongst PLHIV.

## **1.6 Thesis Framework**

Theoretically the study was guided by the 4x4 framework for NCDs and the structural approach. The 4x4 framework identifies the main NCDs focused on by the WHO as being cardiovascular diseases, diabetes, chronic respiratory diseases, and cancers [60]. The framework also identifies 4 key shared modifiable risk factors resulting in NCDs. However, the four NCDs identified in the framework are prevalent in developed countries and therefore the author modified the 4 NCDs by removing chronic respiratory diseases and replacing it with hypertension, which is considered one of the diseases for the poor, since it can be managed in well-resourced countries but continues to be a challenge for LMICs [61]. Figure 1 summarises the 4x4 framework:

Noncommunicable Diseases 4 Diseases, 4 Modifiable Shared Risk Factors				
	Tobacco Use	Unhealthy diets	Physical Inactivity	Harmful Use of Alcohol
Cardio-vascular				
Diabetes				
Cancer				
Chronic Respiratory				

**Figure 1: NCDs' 4x4 Framework** (Source: Schwartz, Shaffer & Bukhman, 2021)

The identification of the 4 major NCDs and the 4 common risk factors increasing the disease burden of NCDs as shown in Figure 1, is fundamental in this study and for the development of the thesis framework presented later which guided the areas of focus for the thesis.

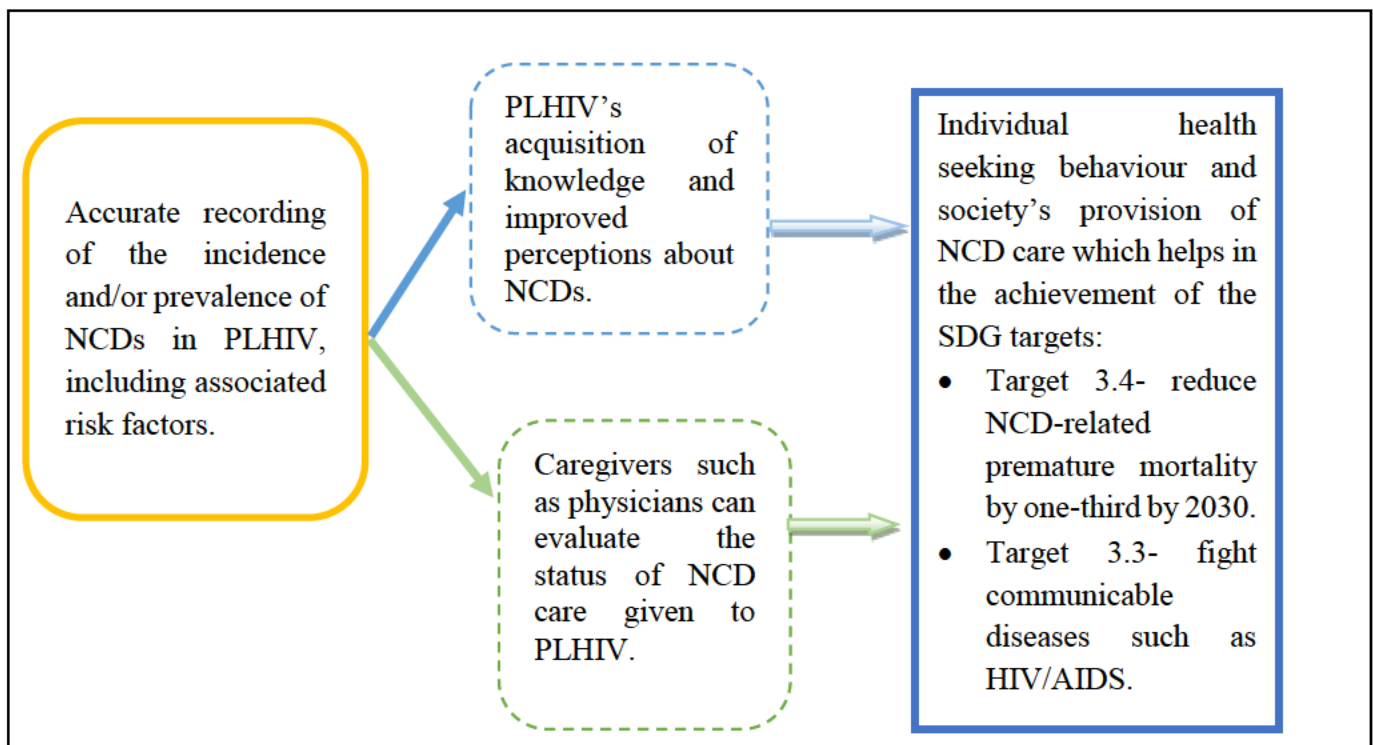
Given the fact that NCDs account for more than two-thirds of deaths worldwide, and global efforts to address NCDs have accelerated, with prevention and control efforts relying mainly on individual behaviour and lifestyle approaches that place responsibility for health on individuals [60]. These approaches, however, have not stopped the increasing trend of NCDs worldwide. Therefore, there is need for exploring alternative approaches necessary to attain the aim of reducing global premature NCDs mortality by 25% by 2025 and meeting the NCD reduction objective in the Sustainable Development Goals [62]. Therefore, in addition to the focus of the 4x4 framework the study also considered suggestions from the structural approach to NCDs which focuses on enduring social arrangements that determine the pattern and distribution of NCDs and their risk factors in a society. Thus, structuralism views society as a complex system with interlocking parts that work together to ensure social stability but is independent of the action of individuals [60]. Public health systems should therefore manoeuvre these complexities and understand NCDs' risk factors and how their effects can be mitigated.

Yang et al. (2018) suggests that a structural approach views the NCD epidemic as the byproduct of changes to domestic and international systems that have dramatically changed modes of living and created environments that encourage the adoption of harmful patterns of behavior [62]. The structural changes have been facilitated by several factors, such as industrialization, urbanization, globalization, and rapidly changing technology amongst many others.

The researcher identified two themes which adequately address the research questions and objectives of the study. These themes are guided by the literature scanned during the study:

- i) Documentation of the incidence and/or prevalence of NCDs in PLHIV in Zimbabwe.
- ii) Knowledge and perceptions of comorbidity and the management of HIV and NCDs.

Figure 2 outlines the interaction between these themes and is hence the framework guiding the thesis.



**Figure 2: Thesis Framework (Source: compiled by author (2022) guided by literature review)**

Figure 2 presents the framework that guided the logical flow of studies which culminated in this thesis. Firstly, it is noted that accurate and up-to-date record-keeping of the NCD cases in PLHIV is fundamental to determine the burden and also identify the associated risk factors which can give help to give a guide in giving a targeted intervention. Thus, based on the incidence and prevalence of NCDs, caregivers can

evaluate the quality of care given to persons affected by NCDs, whilst PLHIV are encouraged to enhance their health-seeking behaviour to reduce the comorbidity of HIV and NCDs. This can directly emanate from how the patients are knowledgeable and perceive the NCDs in general. This influences the help seeking behaviour as well and if patients are well knowledgeable and have positive perception they will likely adhere to the prescribed medication and constant screening of these conditions, and it will help in achieving the health-related SDG targets. The thesis framework therefore shows the interlinkage between these various aspects of improving the health status of PLHIV, given their exposure to NCDs.

The purpose of the study is firstly to ascertain the incidence of NCDs in PLHIV to determine the burden of the various NCDs and the associated risk factors to these conditions. The study further determines the perceptions of the doctors who take care of the NCD patients to avail any gaps that might be existing during care delivery, moreover the patients' knowledge and perceptions were assessed as this directly affects the health care seeking behaviour and treatment adherence. Patients' knowledge and perceptions are known to be contributors to health-seeking behaviours. Therefore, the ascertainment of the level of knowledge and perceptions is critical in the design of apt interventions. At the same time, it is fundamental to assess the quality of NCDs care from caregivers' perspective. Quality of care is evaluated from the perspective of physicians offering clinical care at CCH.

### **1.6.1 Definition of Key terms**

Key terms relevant to the study as depicted in the thesis framework presented in Figure 2 are defined below in the context of the current study:

- i) Non-communicable Disease (NCD) - these are diseases which are not passed from one person to another by contact and are of longer duration, they include: cancers, cardiovascular diseases, diabetes mellitus and hypertension.
- ii) Knowledge- awareness or familiarity gained by experience of a fact, condition or situation
- iii) Perception- the way in which something is regarded, understood, or interpreted
- iv) Incidence- the occurrence, rate, or frequency of a disease
- v) Prevalence- the total number of individuals in a population who have a disease or health condition at a specific period of time
- vi) Risk factors- Behavioural and lifestyle factors that increases the chance of developing a disease and in the case of this study NCDs.

- vii) NCD Care- support and treatment given to people with diagnosed NCD conditions
- viii) Health seeking behaviour- any action or inaction undertaken by individuals who perceive themselves to have a health problem or to be ill for the purpose of finding an appropriate remedy.

The interaction between the variables as depicted in Figure 2 shows the flow of the study in terms of the outline of the thesis as presented in the following section.

## **1.7 Outline and Structure of thesis**

The research for this thesis was conducted through separate but related studies as guided by the objectives presented in Section 1.5. Therefore, the thesis comprises five chapters, which are outlined hereunder.

**Chapter 1-** introduced and provided a collective overview of the thesis and the studies conducted. The chapter highlighted the challenge in relation to the growth in the NCDs disease burden and the challenges affecting the provision of care, especially in resource constrained countries such as Zimbabwe. The chapter also highlighted the overall contribution of the study to practice and to the academic discourse.

**Chapter 2-** presents an article published with PloS ONE journal entitled: “Incidence of non-communicable diseases (NCDs) in HIV patients on ART in a developing country: Case of Zimbabwe’s Chitungwiza Central Hospital – retrospective cohort study (2010–2019)”. The study assessed the incidence of NCDs in PLHIV at CCH, a referral hospital, and focused on four NCDs. The incidence of NCDs in PLHIV was determined, as well as the associated risk factors.

**Chapter 3-** focuses on physicians’ perceptions of the quality of NCD clinical care for PLHIV at CCH. This is presented in the form of a published article entitled; “A qualitative exploratory study of selected physicians’ perceptions of the management of non-communicable diseases at a referral hospital in Zimbabwe”, published with the Globalization and Health Journal. The article assesses the adequacy and quality of various NCDs’ clinical care for PLHIV.

**Chapter 4-** presents a manuscript that has been accepted for publication with the African Health Sciences journal entitled: “Knowledge and Perceptions about Non-Communicable Diseases by people living with HIV: A descriptive cross-sectional study from Chitungwiza Central Hospital Zimbabwe”. The paper outlines PLHIV’s perceptions and knowledge about HIV and NCDs comorbidity, and the associated challenges they are facing in the management of the various NCD conditions.

**Chapter 5-** synthesises the findings from the three manuscripts. The chapter highlights the key findings from the articles and proffers recommendations for improving the management of NCDs in PLHIV. The findings from the study can still be applied for the management of NCDs in any other populations as the NCDs disease burden is on the increase and requires concerted efforts to manage morbidity and mortality.

## **1.8 Methods**

The thesis research was conducted through related studies that culminated into three articles that were at different levels towards being published with different publishers and used different methods. Presented in this section is a summary of the methods for each of the three articles. However, overall, the study used mixed methods, with both qualitative and quantitative methods being applied separately and/or jointly in the articles. Although the methods presented hereunder are detailed separately in the three manuscripts. The summary presented here deals with each article separately.

### **1.8.1 Article 1 Research Methods summary**

Presented hereunder are the research methods applied in article 1 which addressed the first two objectives of the thesis. The title of the article was: *Incidence of non-communicable diseases (NCDs) in HIV patients on ART in a developing country: Case of Zimbabwe's Chitungwiza Central Hospital—A retrospective cohort study (2010–2019).*

#### **1.8.1.1 Study Design**

This was a retrospective analysis of data from ongoing longitudinal population-based cohorts from Chitungwiza Central Hospital (CCH) in Zimbabwe, focusing on PLHIV receiving antiretroviral therapy (ART) at the opportunistic infections clinic (OIC) housed at CCH, covering the period 2010-2019. This was crucial for long-term follow-ups and determining the associated risk factors for the NCDs over a period. The intention was to first establish the incidence of NCDs in PLHIV, as well as the association of the incidence with several factors such as age, geographic location of residence of the study participants and their gender. This laid the basis for setting up the longitudinal study design to investigate the cause and effect. Application of the longitudinal study design was performed as data was extracted at different points from the records of patients undergoing the ART and management of NCDs at CCH. The longitudinal study design provided a chance for the researcher to augment data obtained from the hospital. This was performed in a manner such that the researcher did not interfere with the records of the subjects of this study. The longitudinal study design enabled the collection of data through conducting several



observations of the records of the same subjects over a long period, estimated for up to ten years, between 2010 and 2019. The timeframe of the study was long enough to allow the researcher to effectively address all the objectives of the study.

#### **1.8.1.2 Study Setting**

Zimbabwe has a population of approximately 14 million people and is amongst the countries in sub-Saharan Africa worst affected by the HIV and AIDS epidemic. Of this population, UNAIDS estimated that as at the end of 2017, 14% were people living with HIV/AIDS, with the HIV prevalence amongst adults 15 years and above being at 13.7% [63]. The adult HIV prevalence has been showing a declining trend since the turn of the millennium from 27.2% in 1998 to 14.0 in 2017 [18]. The adult HIV prevalence observed in the Zimbabwe Demographic and Health Survey showed a slightly higher HIV prevalence in urban areas than in rural areas and ranged by province from 13% in Harare to 21% in Matabeleland South [59]. The study was conducted at Chitungwiza Central Hospital's opportunistic infections clinic (CCH OIC), located in Zimbabwe's capital city Harare metropolitan province, with a catchment area including urban and peri-urban settings. Chitungwiza has an estimated population of 1.5 million people and is in the Mashonaland East province of Zimbabwe, with coordinates 18.0174° S, 31.0629° E [63]. The CCH serves patients from the Harare Metropolitan province as well as Mashonaland East Province and as a result, the population served includes the urban, peri-urban, and rural population [63]. The main source of livelihoods for the people served by the CCH includes a few who are formally employed, and the majority are informally employed in vending and small manufacturing stalls for the urban population; whilst for the peri-urban and rural population, they survive on agricultural and horticultural activities.

#### **1.8.1.3 Recruitment of Study Participants**

The recruitment and selection of participants in the study is outlined in the following section. This includes the sampling strategy and sample size determination criteria.

### i) Sampling strategy

The recruitment of participants followed multi-stage sampling techniques where firstly purposive sampling was used to screen the sampling frame using the researcher's experience, as well as guidance and experience of the resident clinicians/nurses at the CCH OI clinic for all the registered patients on ART. The second stage used a simple random selection of participants' records from the listed patients in the sampling frame. Sample Size

The Krejcie-Morgan Sample-Size-Tables designed by Krejcie and Morgan in 1970 were used to calculate the sample size for the study. This is based on the following formula (Krejcie & Morgan, 1970):

$$n = \frac{X^2 \times N \times P(1-P)}{(ME^2(N-1)) + [X^2 \times P(1-P)]} \quad \text{[Equation 1]}$$

Where: n=Sample size

$X^2$ =Chi-square for the specified confidence level at 1 degree of freedom

N=population size

P=population proportion (0.5 in this table)

ME=desired Margin of Error (expressed as a proportion)

A 95% confidence level was used with a tolerable sampling error of 5% (0.05) on the population of two thousand (2000) participants. A sample size of three hundred and twenty-two (322) participants was obtained and used in the study.

#### 1.8.1.4 Study data

CCH OIC is a referral clinic for four primary clinics and 10 rural/district hospitals. The data was collected from the following locations within the CCH catchment area: Chitungwiza, Dema, Seke North, Seke South, St Marys and Zengeza. Representiveness of participants was ensured by purposive selection of referral patients who were coming from rural/district hospitals whilst the peri-urban participants were drawn from the Dema clinic. However, more participants were drawn from urban clinics. The data was therefore representative and reliable since it was collected from across the catchment area of the CCH. The following are the specifics of the data collected:

**i) Unit(s) of analysis**

A total population of 2 000 patients seen at the CCH OIC for the ten-year period under study was the unit of analysis.

**ii) Inclusion criteria**

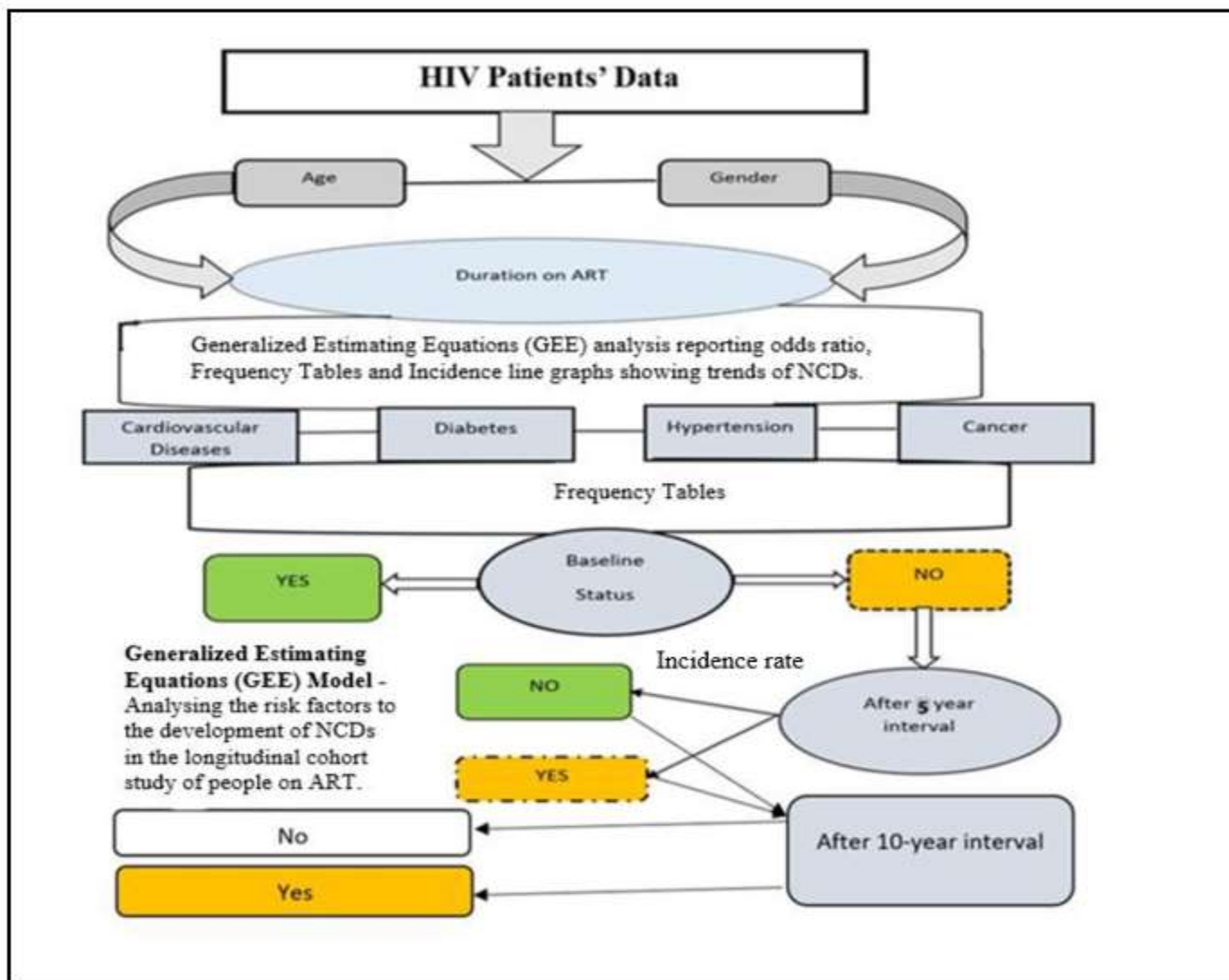
- a) Patients enrolled on the ART programme and who were on the data sheets of CCH;
- b) Only records covering the period from January 2010 to 2019 were included; and
- c) Only records of living patients who consented to the study were used.

**iii) Exclusion criteria**

- a) Participants who were once on lipid modifying therapies during the period were excluded; and
- b) Persons who could not or did not consent to their records being used in the study were excluded.

**1.8.1.5 Data collection procedures**

For this study, only records from living patients who were reached to give their consent and completed consent forms were recruited. The participants were reached out to by resident clinicians at the CCH OIC as they visited the institution for their routine hospital visits and for medication replenishment. A designed questionnaire together with a data collection sheet with thematic headings on the duration of ART, age of the patient, any NCDs on the initiation of ART and any that developed during the treatment was used to gather patient data for analysis. Figure 3 provides an overview of the study protocols from the baseline and the subsequent follow-ups done to achieve the objectives of the study. The methodological aspects are highlighted in the diagram below.



**Figure 3: Methodology Framework** (Source: Developed by author, 2020)

The methodology framework shows that the data collected from HIV clients is analysed by gender, age and duration on ART. This analysis is guided by literature on the possibility of a causal relationship between gender, age, and duration on ART and NCDs. The study applied a Generalised Estimating Equations (GEE) model to establish the incidence of NCDs and associations of the incidence of various NCDs with the independent variables. The NCDs under consideration in this study are cardiovascular diseases, hypertension, cancer, and diabetes. The risk factors (independent variables) under consideration in the study are gender, age, geographic location of residence and duration on ART. For participants who test negative for any of the specific NCDs at the study baseline, the records are preserved for re-examination after two five-year intervals. The incidence of NCDs in PLHIV was assessed at baseline,

after the first five years and after the subsequent five years. The study was meant to assess the burden of NCDs in PLHIV with a view to ascertain if there is an association between ART and their susceptibility to NCDs, establishing the incidence of NCDs in PLHIV on ART at the CCH OIC. There was no direct observation of patients by the researcher as data was collected by resident clinicians who attended to the patients at the CCH OIC.

#### **1.8.1.6 Statistical analyses**

The researcher used the Stata version 13 package for the statistical analysis of data. P-values less than 0.05 were deemed statistically significant in the study. The study collected data on demographic characteristics, that is, gender, age, and duration on ART. The demographic characteristics are summarised in tables presented in each of the manuscripts making up this thesis. The analysis was logically conducted as shown in Figure 3. Descriptive statistics, specifically the mean, standard deviation, and range (minimum–maximum) were used to summarise continuous data. Medians and interquartile ranges are presented for skewed data. Frequency tables were useful for presenting categorical data. The incidence of the NCDs was statistically determined by expressing the number of participants who were diagnosed with specific NCDs at each observation during the study period as a percentage of total study participants, and the GEE model was used to assess the association between NCDs and the various risk factors for people on ART treatment. Therefore, the study established the NCDs burden on PLHIV on ART at CCH. Article 2 Research Methods

### **1.8.2 Article 2 Research Methods**

Article 2 was published the Globalization and Health Journal and was entitled: *A qualitative exploratory study of selected physicians' perceptions of the management of non-communicable diseases at a referral hospital in Zimbabwe*. The research methods used in this article presented hereunder:

#### **1.8.2.1 Study design**

This was a qualitative exploratory study meant to obtain expert perceptions of care delivery for NCDs in one Zimbabwean referral hospital setting. Data was collected from participants who consented and was analyzed using Stata version 13.

### **1.8.2.2 Study setting**

The study was conducted at CCH, which is a referral hospital with a catchment area including urban, peri-urban, and rural locations. There are about 15 hospitals in Mashonaland East Province surrounding CCH. In addition, CCH serves an estimated population of 1.5 million people, spread over an estimated 32,230 km<sup>2</sup> area. CCH attends to an average of 80 NCD patients in the outpatients' department and 20 in the inpatients' department daily. The economic status of the population within the catchment area of the CCH is generally poor, with the majority living below the national poverty line, averaging US\$220 monthly for a family of five, a common feature for most settings in Zimbabwe due to high unemployment levels. The population is therefore mostly unemployed or self-employed, embarking on livelihood sustenance projects such as market gardening, vending and other informal economic activities.

### **1.8.2.3 Recruitment of participants**

From a total population of 43 medical doctors engaged by CCH on a part-time or full-time basis, 26 doctors, including specialists, were recruited to participate in the study based on the inclusion/exclusion criteria provided below. Only doctors who consented to the study were included in the study, while doctors who do not provide clinical care for NCD-related conditions were excluded from participating in the study, for example, dental surgeons.

#### **i) Inclusion Criteria**

- Medical doctors employed by the CCH, both on a full-time or part-time basis, who provide clinical care to patients with NCD-related conditions.
- Only doctors who consented to participate in the study were included.

#### **ii) Exclusion Criteria**

- Other hospital staff who are not medical doctors.

### **1.8.2.4 Data collection procedures**

Data was collected from both sessional and resident doctors at CCH through a self-administered questionnaire. To ensure that there was minimum bias regarding the respondents' perceptions, the anonymity of the participants was assured in both data collection and analysis. The questionnaires were distributed electronically through the Survey Monkey platform. The participants included general practitioners and specialists providing clinical care for NCD-related conditions.

The selection of study participants was based on their knowledge and experience in the management of NCDs. Therefore, doctors who do not provide clinical care for NCDs or any related conditions were excluded from the study. All the participants who met the inclusion criteria were communicated with to obtain their consent and thereafter, a link to the online questionnaire was distributed via email to the 26 participants who consented.

To assess the quality of clinical care, the World Health Organization's definition of quality was used as the basis for assessing quality, that is, "the extent to which the healthcare services provided to individuals and patient populations improve desired health outcomes. To achieve this, healthcare must be safe, effective, timely, efficient, equitable and patient-centered". The quality of healthcare is a collaborative effort involving the patient, physician, patient's family, and the community. Therefore, it can be assessed from the perspectives of any of these. Accordingly, physicians' perceptions of quality were assessed based on the features highlighted in the above definition, measured using a four-point Likert scale with the following options:

Not satisfactory	Somehow satisfactory	Satisfactory	Very satisfactory
1	2	3	4

The Likert scale was used to quantify the qualitative evaluations of physicians' perceptions of clinical care with the following meanings: *Not satisfactory* means that physicians perceived the clinical care to be unable to meet the healthcare service expectations; *Somehow satisfactory* means that physicians were indifferent about the NCD clinical care, that is, it was meeting doctors' expectations to a lesser extent; *Satisfactory* means that the physicians perceived the clinical care to be just meeting basic healthcare needs; and *Very satisfactory* means that the physicians perceived the clinical care to be world-class and going beyond expectations.

#### **1.8.2.5 Data analysis procedures**

Data was analysed using Thematic Analysis. Since some of the questions were open-ended, open coding was done, capturing the frequency of the major themes which are presented in tables and bar graphs. Stata version 13 was used for the statistical analysis of data and to plot bar graphs. Qualitative data was open coded first and subsequently axial coded before presentation and analysis. The analysis of data was guided by themes that emerged from the data and related responses were analyzed together.

#### **1.8.2.6 Ethical consideration**

Ethical approvals for the study were received from the Biomedical Research Ethics Committee of the University of KwaZulu-Natal (BE057/19) and the Medical Research Council of Zimbabwe (MRCZ/A/2441). Participants provided informed consent prior to data collection.

### **1.8.3 Article 3 Research Methods**

The third article making up the thesis is entitled: *Knowledge and Perceptions about Non-Communicable Diseases by people living with HIV: A descriptive cross-sectional study from Chitungwiza Central Hospital Zimbabwe*. The article has been accepted by the African Health Sciences Journal and is pending publication. Hereunder are the methods used in this study.

#### **1.8.3.1 Study Design**

This was a cross-sectional explanatory study using a mixed methods approach to describe-the participants' responses. The study explores and descriptively documents the perceptions and knowledge of PLHIV on their exposure to the NCDs burden.

#### **1.8.3.2 Study Setting**

The study was conducted at CCH (OIC), located in the town of Chitungwiza which is in Zimbabwe's capital city metropolitan province of Harare with an estimated population of about 1.5 million, serving circa 400 000 patients annually, in both its inpatient and outpatient divisions. The CCH's catchment area spans 45 square kilometres in urban and peri-urban areas, and about 30 000 square kilometres in rural areas. The main sources of income for the patients served at CCH include self-help jobs such as street vending for those in towns, and market gardening for the peri-urban and rural populations. The CCH has been certified by the International Standards Organisation (ISO) since 2008.

#### **1.8.3.3 Sampling and Recruitment of Participants**

Simple random sampling was used to select the patients who were receiving ART at the CCH OIC. Using the sample calculation tables by Krejcie and Morgan [64], a sample of 333 was approved from the population of about 2500 patients seen by the CCH OIC during the six-month long data collection period. A 95% confidence interval was used. The inclusion and exclusion criteria for the recruitment of the participants for the study are outlined below.



**i) Inclusion Criteria**

- Participants who consented.
- Participants aged 18 years or above. These were able to give their consent.
- Participants who were diagnosed with at least one NCD.

**ii) Exclusion Criteria**

- Patients who did not consent to participating in the study.

#### **1.8.3.4 Data Collection Procedures**

Data was collected by a trained resident nurse at the CCH OIC during the six-month period between August 2019 and January 2020. Consent was obtained from the respondents before their participation in the study. A questionnaire designed and distributed using the KoBo Toolbox was used for data collection. The questionnaire comprised of closed and open-ended questions. Participants provided their knowledge and perceptions regarding their conditions, and how they perceived the nature of the NCDs affecting them through the questionnaire. In a situation where direct and specific responses were required, closed-ended questions were used, whilst, to allow an infinite array of responses, open-ended questions were also used.

#### **1.8.3.5 Study Variables**

Outcome variables: Knowledge and Perception

Explanatory variables: Demographic risk factors

To determine the extent of how knowledgeable the participants were about NCDs, the authors adopted a subjective approach. This was adopted from the paper by Ojo, Hawley and Desai [12]. The approach divides the calculated proportions into two categories (knowledgeable and not knowledgeable) using the following rule: >50% = knowledgeable, and 0-49% = not knowledgeable. Two categories were also established for perception as follows: >50% = good perception and 0-49% = bad perception. Literature records that there are several NCD risk factors which can be classified as including lifestyle factors, behavioural factors, religious factors, economic factors, and demographic factors, amongst others. The focus of this study was on demographic risk factors. Therefore, the independent variables for the study were gender, age, and the history of NCDs in the participants' families.

### **1.8.3.6 Data Analysis**

Thematic analysis was used to analyse the open-ended questions, whilst quantitative results were presented in frequency tables. The analysis of quantitative data was done using Stata Version 13. The knowledge and perceptions of participants were assessed using different categorical questions. Binary logistic regression models were used to identify the demographic factors with significant effects on participants' knowledge and perceptions. To determine the significance of the relationship in the model, any calculated p-value < 0.05 was deemed as showing a significant relationship between the dependent and independent variables. The approach used in the thesis is outlined in the following section.

### **1.9 Approach to the thesis**

The study was conducted by collecting data from Chitungwiza Central Hospital as guided by the objectives presented above. Results of the study were presented as three manuscripts, which were published with three different journals. Results of the first two objectives were presented as a separate manuscript, which was published with PLoS ONE. The third objective was another manuscript published with the Globalization and Health Journal and the fourth objective was addressed through an article accepted for publication with the African Health Sciences Journal. Details of the manuscripts are presented hereunder:

1. Cheza A, Tlou B, & Zhou DT (2021) Incidence of non-communicable diseases (NCDs) in HIV patients on ART in a developing country: Case of Zimbabwe's Chitungwiza Central Hospital — A retrospective cohort study (2010–2019). PLoS ONE 16(5): e0252180. <https://doi.org/10.1371/journal.pone.0252180>
2. Cheza, A., & Tlou (2021), B. A qualitative exploratory study of selected physicians' perceptions of the management of non-communicable diseases at a referral hospital in Zimbabwe. Global Health 17, 82. <https://doi.org/10.1186/s12992-021-00730-3>
3. Cheza A, & Tlou B (2021) Knowledge and Perceptions about Non-Communicable Diseases by people living with HIV: A descriptive cross-sectional study from Chitungwiza Central Hospital Zimbabwe. Accepted for publication in the African Health Sciences journal.

Specific detailed methodologies applied in each of the published manuscripts are shown in the attached manuscripts.

## **CHAPTER TWO**

### **Incidence of non-communicable diseases (NCDs) in HIV patients on ART in a developing country: Case of Zimbabwe's Chitungwiza Central Hospital—A retrospective cohort study (2010–2019)**

The chapter is a research article published in the PLOS-ONE Journal; the article addresses the first two objectives of the study. The article highlighted the incidence of NCDs in HIV patients on ART at Chitungwiza Central Hospital (CCH) that was the first objective of the study. The article went on to evaluate the risk factors associated with NCD incidence at CCH, which is the second objective.

RESEARCH ARTICLE

# Incidence of non-communicable diseases (NCDs) in HIV patients on ART in a developing country: Case of Zimbabwe's Chitungwiza Central Hospital—A retrospective cohort study (2010–2019)

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**Citation:** Cheza A, Tiou B, Zhou DT (2021) Incidence of non-communicable diseases (NCDs) in HIV patients on ART in a developing country: Case of Zimbabwe's Chitungwiza Central Hospital—A retrospective cohort study (2010–2019). PLoS ONE 16(5): e0252180. <https://doi.org/10.1371/journal.pone.0252180>

**Editor:** Elizabeth S. Mayne, University of Witwatersrand/NHLS, SOUTH AFRICA

**Received:** April 26, 2020

**Accepted:** May 12, 2021

**Published:** May 27, 2021

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**Data Availability Statement:** All relevant data are within the manuscript and its [Supporting information files](#).

**Funding:** The authors received no specific funding for this work.

**Competing interests:** The authors have declared that no competing interests exist.

**Abbreviations:** AIDS, Acquired Immune Deficiency Syndrome; ART, Anti-Retro Viral Therapy; CCH,

## Abstract

### Introduction

The incidence of non-communicable diseases (NCDs) has been reported to be rising over the years leading up to 2010. In Zimbabwe, there are few studies done to examine the incidence of NCDs in people living with HIV (PLHIV) on anti-retroviral treatment (ART).

### Objective

To determine the incidence of NCDs in HIV patients on ART at the Chitungwiza Central Hospital over ten years and the associated risk factors.

### Methods

This was a retrospective cohort study using data from 203 patients enrolled on ART at the Chitungwiza Central Hospital between 2010 and 2019. All 500 records were considered and the selection was based on participants' consenting to the study and their strict adherence to ART without absconding. The incidence of NCDs was determined and generalized estimating equations (GEE) were used to estimate the association between NCDs and the selected risk factors.

### Findings

Data collected at the study's baseline (2010) showed that the most prevalent NCD was hypertension, found in (18/203) 8.9% of the study participants, followed by diabetes (6.9%), then followed by cardiovascular diseases (CVD) (3.9%), and the least common NCD was cancer (1.9%). Incidences of all of these NCDs showed an increasing trend as the time of follow-up progressed. The factors found to be significantly associated with the development of NCDs were gender ( $p = 0.002$ ) and follow-up time ( $p < 0.001$ ). Geographical location was

Chitungwiza Central Hospital; **CVD**, Cardiovascular Disease; **HIV**, Human Immunodeficiency Virus; **LMICs**, Low- to Medium- Income Countries; **NCDs**, Non-Communicable Diseases; **OI**, Opportunistic Infections; **PLHIV**, People Living with Human Immunodeficiency Virus.

a significant risk factor as urban patients were more likely to develop hypertension as compared to the peri-urban patients ( $p = 0.001$ ).

## Conclusions

NCDs and HIV comorbidity is common with women more likely than males to develop NCDs as they advance in age. There is need to devise targeted intervention approach to the respective NCDs and risk factors since they affect differently in relation to the demographic details of the participants.

## Recommendations

This paper recommends a multi-stakeholder approach to the management of NCDs, with researchers, clinicians and the government and its various arms taking a leading role.

## Introduction

Non-communicable diseases (NCDs) contribute an estimated 41 million deaths to the annual mortality rate globally and account for a total of 71% of the annual global deaths. Approximately 85% of these fatalities occur in low- and middle-income countries (LMICs) [1]. The NCDs with the leading case fatalities include cardiovascular diseases, which account for approximately 17.9 million deaths each year, followed by cancers with 9 million deaths. Respiratory diseases account for nearly 3.9 million deaths, and diabetes is responsible for 1.6 million deaths worldwide each year [1]. The persistent HIV burden predisposes HIV positive patients to NCDs due to persistent inflammation [2]. Moreover, behavioral risk factors such as tobacco smoking and alcohol use, and occupational hazards also increase the chances of PLHIV developing NCDs [3, 4].

Globally, more attention and resources have been dedicated towards dealing with HIV/AIDS, TB and malaria over the past few decades and there has been dramatic progress in patient outcomes, evidenced by improved health preparedness for these infectious diseases [5]. Despite this, in 2010 tuberculosis and malaria killed about two million people worldwide, whilst in the same year cancers killed four times as many people; about eight million [4]. This example presents the same picture across other NCDs such as heart disease, hypertension and diabetes [6]. The public health burden of NCDs in sub-Saharan Africa has been growing over the past two decades, resulting in premature deaths [7]. Sub-Saharan Africa is the region most affected by HIV/AIDS, accounting for close to 66% of the global population living with HIV/AIDS in 2017 [1, 8]. Challenges surrounding the reduction of HIV related deaths have been partly attributed to increases in NCDs. In 33 patient cohorts studied in sub-Saharan Africa, NCDs accounted for 56% of the morbidity and 40% of the mortality, and it has been shown that there is an increasing cumulative incidence of NCDs with each year of taking ART in sub-Saharan African cohorts [9]. These NCDs propel mortality in Southern Africa and all over the world. Studies in sub-Saharan Africa have shown that less than two-thirds of patients initiated on ART are on treatment two years after ART initiation [10]. A scoping review by Mudie et al. noted that NCDs are a major and growing problem in the sub-Saharan African region [11]. Many reviews have also shown that the 24-month ART retention rate is approximately 70% and the retention rate is 65% at 36 months [12].



The disease burden of NCDs in Africa has been on the rise and Zimbabwe has similarly been seeing a rise in mortality due to NCDs. Zimbabwe's population numbers about 14 million people and it is one of the countries in sub-Saharan Africa worst affected by the HIV and AIDS epidemic [11]. Of this population, UNAIDS estimated that as at the end of 2019, 12.7% of the people aged 15 years and above in the country were living with HIV/AIDS [13]. This prevalence rate of adult HIV has been on a declining trend since the turn of the millennium, down from 27.2% in 1998 to 13.7% in 2017 [14]. The emergence of ART, has thus lowered the devastating effects of the HIV/AIDS epidemic. In terms of the adult HIV prevalence in the country, the Zimbabwe Demographic and Health Survey showed a slightly higher HIV prevalence rate in urban areas than in rural areas, and ranged by province from 13% in Harare metropolitan province to 21% in Matabeleland South province [12].

People living with the human immunodeficiency virus (PLHIV) are susceptible to opportunistic diseases owing to their weakened immune systems caused by the HIV. This resulted in numerous deaths prior to the invention of ART. However, the subsequent discovery of highly active anti-retroviral therapy (HAART) in the late 1990s led to a significant improvement of the life expectancy of patients infected with HIV [15]. Nevertheless, it is estimated that at least 36 million people die globally each year from NCDs [7]. The most prevalent NCDs which account for at least 80% of the global deaths include diabetes, cancers, cardiovascular diseases, and chronic obstructive pulmonary disease [2]. These NCDs share four common risk factors, namely hereditary and environmental factors, aging and socio-economic status, and the effects can be severe for PLHIV. Another cohort study showed that antiretroviral therapy (ART) continues to dramatically reduce rates of mortality from HIV infection in high-income countries, such that non-AIDS-related deaths exceed AIDS deaths after approximately four years of taking ART [16].

Despite the devastating effects of NCDs on PLHIV, an integrated approach focusing on LMICs remains unexplored as much evidence of NCDs is still concentrated on the high income countries [11, 17]. An integrated approach enhances the synchronization of key actors and their actions to address health needs. It is thus imperative to examine the effect of the burden of NCDs on PLHIV in LMICs, focusing on NCDs such as diabetes mellitus, hypertension, cancers, and obesity. Kansiime et al. found a 20.7% chance of developing at least one NCD in PLHIV in Uganda, whilst the most prevalent NCD was found to be hypertension [18]. The high prevalence of NCD risk factors and unrecognized and untreated hypertension represent major problems [19]. There has, however, been evidence from other studies of no association between HIV viral load and NCDs comorbidity [20]. This is consistent with other studies in the same context in South Africa, but differs from findings obtained in high income countries.

The aim of the study was to determine the incidence and the associated risk factors of NCDs in HIV patients on ART at the Chitungwiza Central Hospital (CCH). The NCDs under consideration in the study were diabetes, cardiovascular diseases (CVD), hypertension and several cancers. Such a study was important for guiding policy formulation for national public health policies in Zimbabwe and other LMICs. The study also provided empirical evidence that informed the efforts of stakeholders in the health sectors on the public health challenges requiring integrated management approaches.

## Materials and methods

The study was a retrospective analysis of data from a longitudinal hospital-based cohort. The longitudinal study design enabled the collection of data from the medical records of the study subjects over a ten-year period. The study used data from patients enrolled for ART at the Chitungwiza Central Hospital's Opportunistic Infections Clinic (CCH OIC) in January 2010, who

had not absconded from ART or died by 2019. Records were examined at the initiation point of the study and then after five and ten years. The timeframe allowed the researcher to establish the relationship between ART and the incidence of NCDs in HIV infected persons enrolled on ART at the CCH OIC, among many other factors likely to increase the incidence of NCDs in the cohort. The incidence was measured after the first five years and the results noted, and the records were then re-examined after the subsequent five years. The purpose was to determine the incidence of the various NCDs and establish whether there was an association between the demographic variables and the development of NCDs in PLHIV who were undergoing ART. Application of the longitudinal study design entailed the extraction and analysis of data at different points from the records of the patients undergoing ART after every five years.

### Study setting

The study was conducted at the CCH, a 500 bedded hospital located about 30 kilometers to the south east of Zimbabwe's capital city, Harare. The CCH had been ISO certified since 2008. Chitungwiza had an estimated population of 1.5 million people, serving circa 400 000 patients annually. Due to high unemployment levels in Zimbabwe, many of the citizens within the catchment area of the CCH OIC were unemployed, and hence survived on informal self-help jobs such as vending for those in towns, and market gardening for the peri-urban and rural population. The catchment area of the CCH was made up of Chitungwiza town which formed the major urban area, spanning about 45 square kilometers, as well as peri-urban and rural areas covering an estimated 32 230 square kilometers. The peri-urban and rural areas served by the CCH included Beatrice, Mahusekwa, Marondera, Goromonzi, Murehwa and Nyadire [17].

### Study participants

The recruitment and selection of the participants in the study is outlined in the following section.

### Participants' recruitment strategy

All participants who were registered patients on ART at the CCH OIC were eligible for the study. Details of the participants' selection are shown in Fig 1.

The study considered the 500 records in the register in 2010. After applying the inclusion/exclusion criteria, 203 records were selected as shown in Fig 1. Access to records was done after gatekeepers' permission to access the patients' records was granted by the Ministry of Health and Child Care and the CCH Administration. Consent was also sought from the participants whose records had met the inclusion criteria shown below.

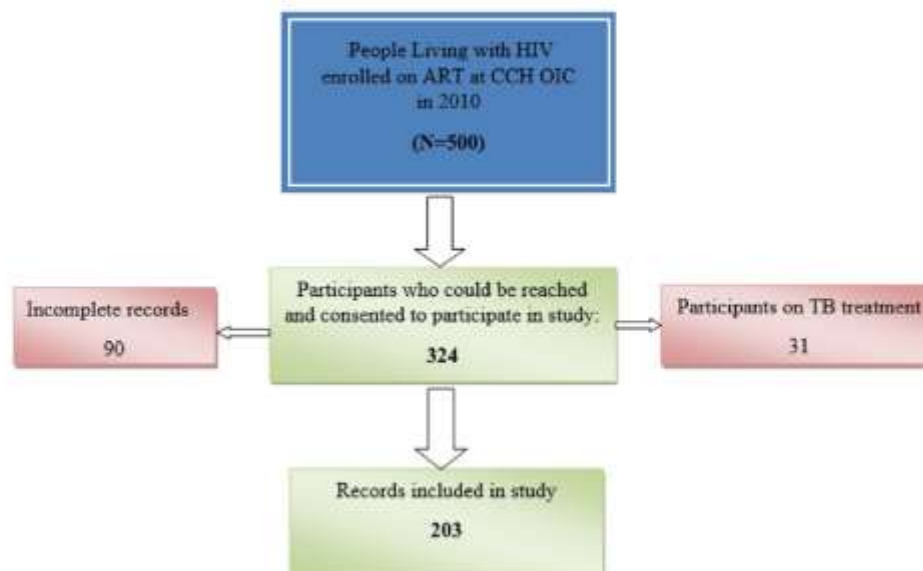
### Study data

The CCH OIC was a referral clinic for several primary clinics and the following locations within the CCH catchment area were used: Chitungwiza Central, Dema, Seke North, Seke South, St Marys and Zengeza. Data was collected from the clinic's records for the specific periods that the patients were attended to there. The following section of the paper presents the specifics of the data collected.

**Unit(s) of analysis.** The total population for the study was 500 patients who were seen at the CCH OIC in the year 2010 and who were enrolled for ART for the first time.

#### **Inclusion criteria.**

- Patients enrolled on ART and who were in the CCH OIC data records.



**Fig 1. Participants' records selection flow diagram.**

<https://doi.org/10.1371/journal.pone.0252180.g001>

- Only records for PLHIV who enrolled for ART during 2010 and continued without absconding until December 2019 were included.
- Only participants enrolled for the adult first line ART regimen at CCH OIC were included in the study.

#### Exclusion criteria.

- Participants who did not consent to participate in the study were excluded.
- Individuals on TB treatment, even if they presented with any malignancy regardless of their age, were excluded from the study.
- Individuals referred for ART from outside of Zimbabwe's primary health care system were also excluded.

#### Data collection procedures

A data collection sheet was used to gather the patients' data for analysis. The data sheet captured pertinent data from the patients' records at CCH OIC and all of the entries were allocated study identification numbers to ensure anonymity of the patients' records. Only patients on ART were considered. Age and gender were the demographic information captured. As the patients were assessed for the development of NCDs, geographical location and time of follow-up in the study were recorded. The NCD status of the patients was recorded at baseline and reviewed at subsequent five-year intervals to assess the progression and development of new cases.

The primary aim of the study was to determine the incidence of various NCDs in PLHIV who were on ART. The study also assessed the risk factors associated with NCDs in PLHIV, with a view to ascertain if there was any association between usage of ART and susceptibility



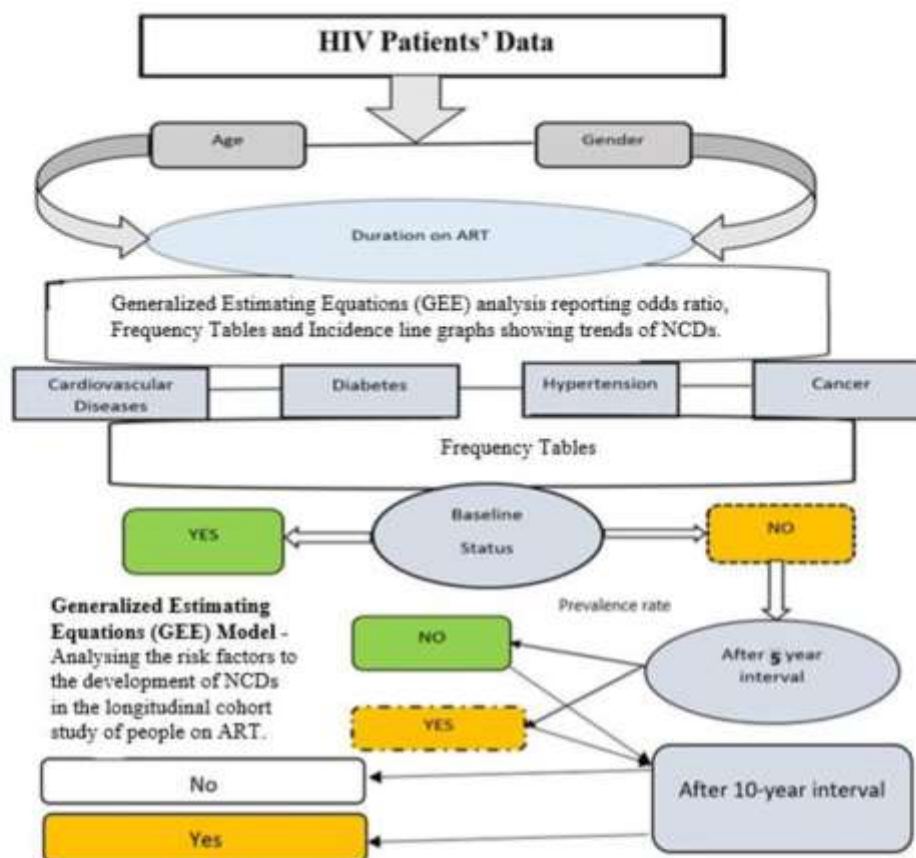


Fig 2. Methodology framework.

<https://doi.org/10.1371/journal.pone.0252180.g002>

to NCDs for the selected risk factors. The patients' records were extracted from the computerized health information department at the hospital. As shown in Fig 2, the data collected was analyzed in terms of gender, age, geographical location, and time of follow-up in the study. This analysis was guided by literature on the possibility of a causal relationship between gender, age, geographical location and time of follow-up in the study and NCDs development. The specific NCDs under consideration in this study were cardiovascular diseases, hypertension, cancer, and diabetes. All records for the 203 patients enrolled onto the study were re-examined at five-year intervals, as depicted in Fig 2 below.

**Outcome variable.** All of the response variables (cardiovascular diseases, diabetes, hypertension and cancers) were assigned binary numbers (0 = not diagnosed and 1 = diagnosed).

**Explanatory variable.** The independent variables that were assessed for their influence on NCDs were age, gender, geographical location and time of follow-up in the study.

**Ethical consideration.** Ethical approvals for the study were received from the Biomedical Research Ethics Committee of the University of KwaZulu-Natal (BE057/19) and the Medical Research Council of Zimbabwe (MRCZ/A/2441).

### Statistical analyses

Data was analyzed using Stata v13 software. Incidence rates were calculated as the new NCD diagnosed, divided by the population in each category. Frequency tables, bar graphs and pie-charts were used to summarize the demographic characteristics. The study used the Generalized Estimating Equations (GEE) approach to determine the risk factors associated with NCDs. The NCDs were also assessed for their influence on the development of other NCDs in participants already diagnosed with any NCD. All of the NCD response variables were assigned a binary number (0 = not diagnosed and 1 = diagnosed). A p-value  $\leq 0.05$  was deemed to be statistically significant. The methodology framework is summarized in Fig 2.

Fig 2 pictorially depicts the methodology adopted in the study, from initiation of the study up to the analysis of the results after the initial five-year interval and after the subsequent five-year period of the study.

### Results

The demographic features of the 203 participants were observed and of these 128 were females (63%), whilst 75 (37%) were males, as shown in Fig 3 below. In terms of the geographical spread of the study participants, the majority were from the urban and peri-urban areas (193 out of the 203), coming from areas such as Seke, Zengeza and St Marys, whilst only 10 came from the Dema rural area. Study participants were also spread across various age groups, which are presented later.

Of note is the fact that some participants were diagnosed with more than one NCD and the trend is presented in Fig 4.

Fig 4 summarizes the cumulative count of the patients who were diagnosed with one or more of the four NCDs during the study period. From the 203 participants at the commencement of the study, 4 (1.97%) were diagnosed with cancer, 8 (3.94%) had cardiovascular diseases, 14 (6.9%) were diabetic and 18 (8.87%) were hypertensive. All participants were followed-up after five years and after ten years to establish the incidence of NCDs. As shown in Fig 4, after the first five years hypertension was the most prevalent NCD in the 203 participants, with a prevalence rate of 35.96% (73 out of 203 participants), having increased from the baseline rate of 8.87%. The hypertension prevalence rate after the second follow-up did not

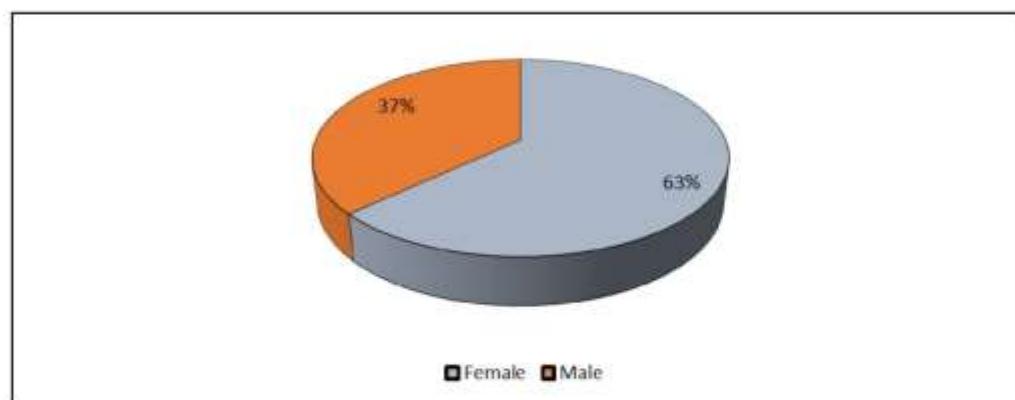


Fig 3. Participants' gender.

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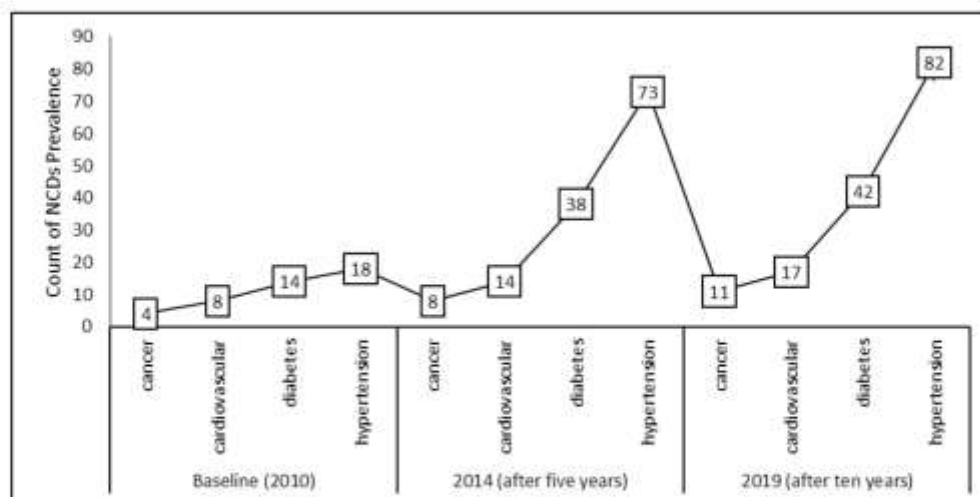


Fig 4. Prevalence of NCDs over time.

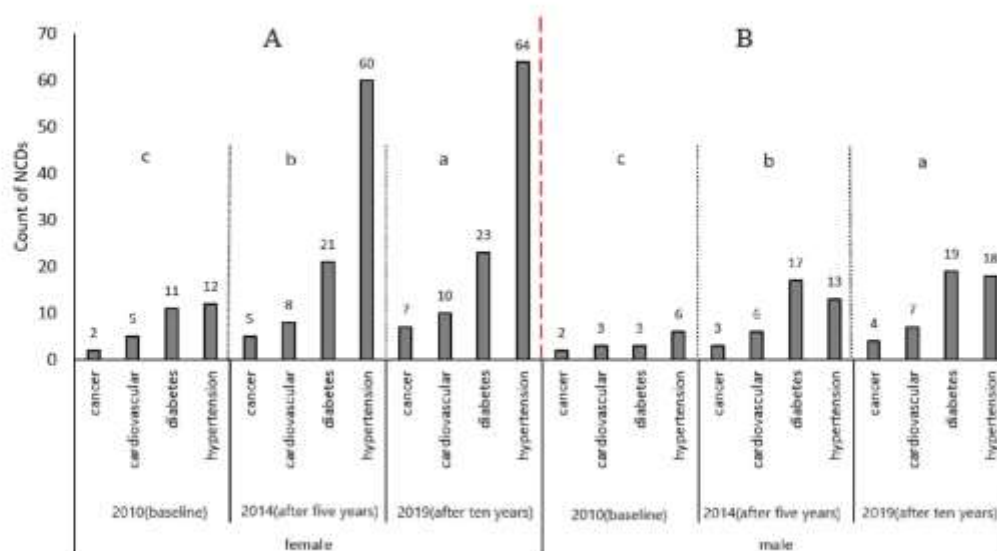
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increase as much as it did at the first follow-up, and the prevalence rate moderately increased to 40.39% (82 out of 203 participants). The next most prevalent NCD was diabetes, with a prevalence rate of 18.72% (38 out of 203 participants). This was a significant increase from the baseline observed prevalence of 6.9%. The cumulative prevalence of diabetes after the second follow-up also marginally increased to 20.69% (42 out of 203 participants). The next ranked prevalent NCD, as shown in Fig 4, was cardiovascular diseases with a 6.90% (14 out of 203) prevalence rate, which had nearly doubled from the baseline prevalence of 3.94%. Like the other NCDs, the prevalence slowed down in the second follow-up period. According to the data collected, the least prevalent NCD was cancer which had a baseline observation of 1.94% at commencement of the study and it doubled after five years to 3.94% prevalence. There was an almost constant increase in observed cancers during the last interval of the follow-up, with a cumulative prevalence of 5.42%.

The study also examined the development of NCDs by gender to establish if there was any association between NCDs' diagnosis and participants' gender. There were 128 (63%) female participants and 75 (37%) male participants in the study. Fig 5 summarizes the results of the analysis.

As shown in Fig 5, women were more likely ( $p < 0.001$ ) to develop hypertension and diabetes than men, as depicted by the towering bars in Fig 5. In terms of the NCDs, Fig 5 supports the view that hypertension was the most prevalent NCD, followed by diabetes in both men and women, as the bars representing hypertension were the tallest in both females and males. In addition to the analysis of the prevalence of NCDs based on gender, Table 1 presents the incidence rates of the NCDs based on gender and age groups.

Table 1 supports the views presented in Fig 5. The incidence of cancer in both males and females aged less than 40 years was small, although relatively higher in males (2/8). Similar trends in incidences of cancer were observed in both males and females in the other age groups. The incidence of cardiovascular diseases (CVDs) showed a general increase over time as the age of the participants also increased. The incidence of diabetes also increased as age increased in both males and females over the study period, with the highest incidences



**Fig 5. Analysis of NCD prevalence by gender, with 'mean NCDs count separation letter'. A-Female category; B-Male category; a-Time interval after ten years; b-Time interval after five years; c-Time at baseline of the study (2010).**

<https://doi.org/10.1371/journal.pone.0252180.g005>

recorded in participants aged above 55 years in both males and females. The incidence of hypertension also increased in both male and female participants as age increased. The highest incidence of hypertension was in participants older than 55 years for both male and female participants in all of the follow-ups. The incidences of the NCDs in both males and females presented in Table 1 are summarized and synthesized in Fig 6, which shows the general trend for all four NCDs under study over the study's timeframe.

As shown in Fig 6, the most common NCD was hypertension, which increased over time, followed by diabetes, CVDs and cancer in descending order.

**Table 1. Analysis of NCDs' incidence based on gender and age.**

Age group	NCDs	Follow up							
		Female				Male			
		Baseline	Five-year Interval	Ten-year Interval	Total	Baseline	Five-year Interval	Ten-year Interval	Total
<40 years	Cancer	0	2/45	2/45	4/45	0	2/8	2/8	4/8
	Cardiovascular	2/45	0	0	2/45	1/8	1/8	1/8	3/8
	Diabetes	1/45	5/45	5/45	11/45	0	0	0	0
	Hypertension	0	14/45	14/45	28/45	1/8	0	0	1/8
40–55 years	Cancer	0	3/98	4/98	7/98	1/40	0	1/40	2/40
	Cardiovascular	1/98	4/98	4/98	9/98	0	3/40	3/40	6/40
	Diabetes	4/98	8/98	8/98	20/98	2/40	9/40	9/40	20/40
	Hypertension	3/98	29/98	30/98	62/98	1/40	5/40	6/40	12/40
>55 years	Cancer	2/85	0	1/85	3/85	1/53	1/53	1/53	3/53
	Cardiovascular	2/85	4/85	6/85	12/85	2/53	2/53	3/53	7/53
	Diabetes	6/85	8/85	10/85	24/85	1/53	8/53	10/53	19/53
	Hypertension	9/85	17/85	20/85	46/85	4/53	8/53	12/53	24/53

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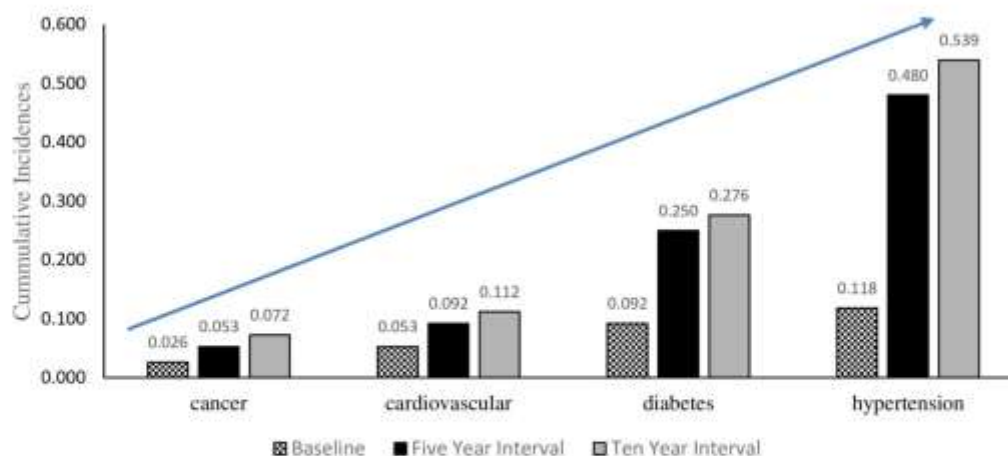


Fig 6. Incidence of NCDs over time.

<https://doi.org/10.1371/journal.pone.0252180.g006>

Table 2 shows that participants who resided in urban areas were 3.287 times more likely to develop hypertension when compared to those who resided in peri-urban locations ( $p$ -value = 0.001). However, participants from rural areas were about 30% less likely to develop hypertension as compared to peri-urban participants. Similar observations were obtained for

Table 2. Odds ratios for risk factors associated with NCDs using generalized estimating equations.

Explanatory variables	Categories of Explanatory Variables	Hypertension			CVD			Diabetes			NCDs		
		Odds Ratio	95% Confidence Interval	p-value	Odds Ratio	95% Confidence Interval	p-value	Odds Ratio	95% Confidence Interval	p-value	Odds Ratio	95% Confidence Interval	p-value
Geographic Location	Rural	0.701	0.109–4.530	0.709	4.401	0.755–25.655	0.099	0.776	0.098–6.136	0.810	1.474	0.420–5.175	0.545
	Urban	3.287	1.626–6.644	0.001	0.641	0.258–1.591	0.337	1.905	0.883–4.111	0.101	1.739	0.983–3.077	0.057
	Peri-urban	1.000			1.000			1.000			1.000		
Age	> = 45 years	2.496	0.219–28.442	0.461	0.584	0.069–4.923	0.621	1.318	0.112–15.539	0.826	1.387	0.273–7.060	0.693
	35–44	0.995	0.082–12.108	0.997	0.210	0.016–2.827	0.240	0.373	0.028–4.893	0.453	0.500	0.094–2.659	0.416
	25–34	1.856	0.183–18.814	0.601	0.486	0.090–2.625	0.402	0.448	0.102–1.963	0.287	1.051	0.253–4.370	0.945
	<25	1.000			1.000			1.000			1.000		
Gender	Female	3.623	2.076–6.324	<0.001	0.877	0.357–2.151	0.774	1.402	0.761–2.583	0.278	2.097	1.315–3.343	0.002
	Male	1.000			1.000			1.000			1.000		
Time Interval	Ten years	9.449	4.612–19.360	<0.001	2.873	1.069–7.726	0.036	6.335	3.098–12.953	<0.001	8.160	4.738–14.055	<0.001
	Five years	7.860	3.985–15.502	<0.001	2.107	0.796–5.579	0.133	5.382	2.733–10.598	<0.001	7.268	4.339–12.174	<0.001
	Baseline	1.000			1.000			1.000			1.000		
Diabetes	Yes	0.472	0.252–0.884	0.019	0.399	0.106–1.501	0.174						
	No	1.000			1.000								
CVDs	Yes	1.748	0.704–4.340	0.229				0.408	0.106–1.570	0.192			
	No	1.000						1.000					
Cancer	Yes	0.215	0.050–0.925	0.039	1.293	0.135–12.335	0.824	0.868	0.153–4.919	0.873			
	No	1.000			1.000			1.000					
Hypertension	Yes				1.876	0.793–4.438	0.152	0.441	0.228–0.853	0.015			
	No				1.000			1.000					

<https://doi.org/10.1371/journal.pone.0252180.t002>

diabetes. Across all of the NCDs, the urban participants were more likely to develop NCDs than the peri-urban participants. Results in Table 2 revealed that patients aged  $\geq 45$  years were 1.387 times more likely to develop various NCDs when compared to patients aged  $<25$  years. This trend was also shown in the odds of developing hypertension and diabetes, which were 2.496 and 1.318 times respectively more likely to develop in patients aged greater than or equal to 45 years in comparison to the patients less than 25 years of age.

Moreover, female patients showed a consistent trend across all of the NCDs to be about two times more likely to develop NCDs compared to male patients ( $p$ -value = 0.002). Female patients were 3.623 times more likely to develop hypertension as compared to male patients ( $p$ -value  $< 0.001$ ). Females were 1.402 times more likely to be diabetic when compared to male patients. However, CVDs did not follow the same pattern and females were about 10% less likely to develop the condition in comparison to the male participants.

Results revealed that as follow-up time increased, the odds of developing NCDs also increased. Patients were eight times more likely to be diagnosed with at least one NCD after ten years of follow-up when compared to their baseline results ( $p$ -value  $< 0.001$ ). At five-year intervals, the patients were seven times more likely to have developed an NCD as compared to their baseline results ( $p$ -value  $< 0.001$ ). This trend occurred across all of the individual NCDs, showing more likelihood of developing the conditions over time when comparing the incidence of these diseases in these same patients at baseline. The odds of becoming hypertensive increased to about 9 times more likely after 10 years ( $p$ -value  $< 0.001$ ), whilst participants were 2.873 times more likely to develop CVDs ( $p$ -value = 0.036) and about 6 times more likely to be diabetic after 10 years ( $p$ -value  $< 0.001$ ).

In addition, the results showed that patients who had already been diagnosed with diabetes had a lesser chance of developing hypertension ( $p$ -value = 0.019), and this was also true for the patients who were hypertensive at baseline as they were less likely to develop diabetes ( $p$ -value = 0.015). The CVD patients were seen to be 1.748 times more likely to be hypertensive as compared to the non-CVD patients. Cancer patients showed that they were 1.293 times more likely to develop CVD as compared to the patients without cancer. However, cancer patients were about 80% less likely to develop hypertension as compared to the non-cancer patients ( $p$ -value = 0.039). Nevertheless, we could not estimate the risk factors associated with cancer due to the low number of cancer cases recorded in the study.

## Discussion

We observed an increase in incidence across all four NCDs under study, with differing magnitudes for each condition. Participants were more susceptible to hypertension, followed by diabetes, and although the incidence was the lowest for cancer, there is a need to respond equally to this NCD due to the fatality associated with the condition. We concluded, based on the study's results that the likelihood of being diagnosed with hypertension increased as follow-up time increased, with the odds increasing from 7.860 to 9.449. This increase in incidence could not be explained merely by analyzing the calculated incidence rates shown in Fig 4, hence we analyzed the risk factors associated with the development of the various NCDs. We determined the odds of one developing an NCD against each risk factor and we concluded that participants who resided in urban areas were more likely to be diagnosed with NCDs in comparison to those in peri-urban locations.

Based on the GEE model, our results showed that PLHIV in rural areas were about 1.5 times more likely to develop at least one NCD when compared to those residing in peri-urban settings. These findings confirmed results obtained by Kavishe et al. [19], who studied and found the prevalence of hypertension to be higher in rural areas than in urban areas of

Tanzania and Uganda. There are several causes for such high incidences of NCDs in rural areas which may include but are not limited to lifestyle differences and economic capacity to seek medical assistance. Participants aged 45 years and above were more susceptible to developing NCDs when compared to participants aged below 25. As people got older they became more prone to different NCDs like hypertension and geriatric diabetes. This was consistent with several studies done in several LMICs where older participants in the cohorts were more likely to be diagnosed with NCDs [15–20].

Our findings revealed that the odds of being diagnosed with at least one NCD increased as the follow-up time interval increased. Since participants were enrolled onto ART at the start of the cohort study, the increase in follow-up time intervals was equivalent to the duration on ART. Therefore, participants were more likely to be diagnosed with NCDs as follow-up times increased, as a result of the increasing ages of the respective participants. The results were consistent with findings obtained in other longitudinal studies in other LMICs [4, 7, 17, 18]. However, our results showed that women were more likely to develop NCDs than men, and these results could not be confirmed from literature as other studies revealed that males were more likely to develop NCDs [18]. The discrepancy could be attributable to the difference in study settings and the gender composition of the studies' participants; in our study 63% were females. In addition, our findings revealed that diagnosis with hypertension increased the odds of developing CVDs, and participants with CVDs were also more likely to develop cancer and become hypertensive. These results showed a cross-morbidity between hypertension and CVDs.

Overall, the burden of NCDs was not only prevalent in Zimbabwe but was a common public health challenge in the sub-Saharan Africa region, as observed in a scoping review by Mudie et al. [11]. Our findings revealed that the most prevalent NCD was hypertension and that diabetes was the second most prevalent NCD; results which were confirmed by other studies from LMICs [18–20]. This was likely due to hypertension and diabetes being common comorbid NCDs, which implied that they were more likely to affect the same patients. One of the least prevalent NCDs was cancer in the scoping review by Mudie et al. [11], a result which was also confirmed by this study. Despite the cancer incidence and prevalence being reported as low in our study and in other studies, it must be given equally high priority in management because of the difficulty in managing the condition and the high fatality rates associated with cancer [2–5].

The strengths of this study included the elimination of data collection bias through the use of clinicians without vested interests in the study results besides academic knowledge generation. The data was also collected over a ten-year timeframe, implying that the time frame was long enough to allow for the development of NCDs up to levels when the conditions could be observable. Thus, the longitudinal nature of the data collected allowed the results to be detectable. Conversely, the major weaknesses of the study included the unavailability of HIV related data about the participants, such as CD4 cell counts and the exclusion of traditional risk factors for NCD development such as tobacco use and alcohol use, among others. The study also regarded the time of the participants' diagnosis as the time of developing the NCD condition. Despite the significant contribution of this study, our results cannot be generalized since we only conducted the study at one facility.

Chitungwiza has a high prevalence of hypertension and diabetes in PLHIV and therefore there is a need for a multiple stakeholder approach to managing these NCDs [3, 4, 6, 15]. Despite the relatively lower prevalence and incidence in cancer and cardiovascular diseases, there is a need for the Zimbabwean government to increase resources and efforts in managing cancer in the population living with HIV and AIDS [3, 4].



## Conclusions

All of the NCDs, namely hypertension, diabetes, cancer, and CVDs progressed constantly over time, as the prevalence rates after the first five years were almost like the prevalence rates after the subsequent five years. This increase in NCDs was supported by the results of the GEE. It was determined that more effort is needed for the management of the least prevalent NCDs (cancers and CVDs) due to their high mortality rates, as reported in literature, since cancer is now a leading killer globally.

## Declarations

**Consent for publication:** Written consent to participate in the study was sought from each participant and only records from individuals living at the time of this study were used. Participants consented to the study's findings being published without any jeopardy to their image.

## Supporting information

**S1 Dataset.**  
(XLS)

## Acknowledgments

We acknowledge the Zimbabwe's Ministry of Health and Child Care and the CCH Administration Staff for their approval and assistance during the data collection process. We wish to acknowledge the team of data collectors from CCH who worked tirelessly in a professional manner to meet the deadline during the data collection process.

## Author Contributions

**Conceptualization:** Alexander Cheza.

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**Investigation:** Alexander Cheza.

**Methodology:** Alexander Cheza, Boikhutso Tlou.

**Project administration:** Alexander Cheza, Boikhutso Tlou.

**Supervision:** Boikhutso Tlou, Danai Tavonga Zhou.

**Writing – original draft:** Alexander Cheza.

**Writing – review & editing:** Alexander Cheza, Boikhutso Tlou, Danai Tavonga Zhou.

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## **CHAPTER THREE**

### **A qualitative exploratory study of selected physicians' perceptions of the management of non-communicable diseases at a referral hospital in Zimbabwe**

This chapter is another research article published in the Globalization and Health Journal; the article addresses the third objective of the study, which was to explore physicians' perceptions on the care delivery systems in place for NCDs at Chitungwiza Central Hospital (CCH). Content of the published article are presented hereunder.

RESEARCH

Open Access

# A qualitative exploratory study of selected physicians' perceptions of the management of non-communicable diseases at a referral hospital in Zimbabwe



Alexander Cheza<sup>\*</sup> and Boikhutso Tlou

## Abstract

**Introduction:** Non-communicable diseases (NCDs) have recently become a global public health burden and a leading cause of premature death, mainly in low- and middle-income countries (LMICs). The aim of the study was to explore physicians' perceptions on the availability and quality of clinical care for the management of NCDs.

**Methods:** This was a qualitative exploratory study meant to obtain expert perceptions on clinical care delivery for NCDs in one Zimbabwean central hospital setting. Data was collected from participants who consented and was analyzed using Stata version 13. A four-point Likert scale was used to categorize different levels of perceived satisfaction.

**Findings:** Twenty-three doctors participated in the study: four female doctors and nineteen males. Nineteen of the doctors were general practitioners, whilst four were specialists. The findings indicated that both categories perceived some shortfalls in clinical care for NCDs. Moreover, the perceptions of general practitioners and specialists were not significantly different. Participants perceived cancer care to be lagging far behind the other three NCDs under study. Care of cardiovascular diseases (CVDs) and diabetes showed mixed perceptions amongst participants, with positive perceptions almost equaling negative perceptions. Furthermore, hypertension was perceived to be clinically cared for better than the other NCDs under consideration. Reasons for the gaps in NCD clinical care were attributed by 33% of the participants to financial challenges; a further 27% to patient behavioral challenges; and 21% to communication challenges.

**Conclusions:** The article concludes that care delivery for the selected NCDs under study at CCH need to be improved. Furthermore, it is crucial to diagnose NCDs before patients show clinical symptoms. This helps disease prognosis to yield better care results. The evaluation of doctors' perceptions indicates the need to improve NCD care at the institution in order to control NCD co-morbidities that may increase mortality.

**Keywords:** Non-communicable diseases (NCDs), Healthcare, Cancers, Diabetes, Cardiovascular disease (CVD), Hypertension

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## Introduction

Non-communicable diseases (NCDs) have recently become a global public health burden, contributing more than half of the global health loss [1]. NCDs account for between 60 and 70% of all deaths globally [1, 2]. NCDs are also a leading cause of premature death, 80% of which are in low- and middle-income countries (LMICs) [1]. The World Health Organization (WHO) also reported a 71% increase in morbidity and mortality related to NCDs, with more than 40.5 million deaths from the total 56.9 million global deaths recorded in 2016 being related to NCDs, three quarters of which were in LMICs [3, 4]. The NCD burden is exacerbated in LMICs due to co-morbidities with the HIV burden [5]. The WHO estimated that by 2020, NCDs were expected to result in approximately 80% of the worldwide disease burden, causing about seven in every ten deaths in LMICs [3, 6].

Apart from the high mortality and morbidity of NCDs, healthcare systems in most LMICs are generally ill-prepared, fragile, under-resourced and face infrastructural limitations in dealing with the epidemiological and economic costs associated with NCDs [6–8]. This is evident through disparities in health statuses and life-expectancies between high-income countries and LMICs, particularly in relation to NCDs, which is attributable to poor healthcare delivery and management systems in LMICs [9]. A healthcare delivery system is defined as a combination of organized people, organizations and resources for the purposes of delivering healthcare services to meet the health needs of a target population [10]. Healthcare services may be delivered by single-provider practices or a big healthcare ecosystem. Moreover, healthcare systems must provide quality healthcare services, whereby the World Health Organization defines “quality as the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge” [11]. Hence, the quality of healthcare services affects the level of satisfaction, which refers to the fulfilment of physicians’ expectations in the healthcare delivery system for NCD patients.

It is apparent that LMICs need to improve the performance of their healthcare systems with regard to NCDs. Global efforts for the prevention and control of NCDs have intensified after the endorsement of the Global Strategy for the Prevention and Control of Non-communicable Diseases [12]. However, the effective prevention, control and management of NCDs requires properly planned healthcare systems and response mechanisms [11]. These response mechanisms must incorporate a multiplicity of stakeholders/sectors, including those not directly involved in health [13].

Literature records that NCDs are a major public health burden in the Sub-Saharan Africa (SSA) region, with significant morbidity and mortality [14]. A few studies have been conducted in Zimbabwe to assess the disease burden of selected NCDs, but the authors did not find literature evaluating the management and control of NCDs. For instance, Smit et al. (2015) examined the burden of NCDs in people living with HIV (PLHIV) in Zimbabwe [15]. The results showed that PLHIV had a 19.6% chance of being diagnosed with at least one NCD and a 4.6% likelihood of being diagnosed with more than one NCD [11]. Other studies focused on the prevalence of hypertension. Chimberengwa and Naidoo (2019) examined the knowledge, attitudes and practices related to hypertension in a rural setting in Zimbabwe [16]. Additionally, Chireshe and Naidoo (2019) studied hypertension amongst patients treated at Parirenyatwa Hospital, Zimbabwe’s biggest referral hospital, and found an incidence of hypertension of 29.9% [17]. In a meta-analysis, Mutowo et al. (2015) found a hypertension prevalence of 30%, with a higher burden in urban areas than in rural areas [18]. Overall, the WHO in Zimbabwe estimates that NCDs accounted for about 33% of the mortalities recorded in 2016 [19].

The management of NCDs in LMICs faces a myriad challenges such as poor laboratory facilities; frequent medicine stock-outs; a limited and poorly distributed health workforce and pharmaceuticals; and poor access to financial resources for caregivers and clients, amongst many other challenges [20, 21]. The challenges highlighted above also affect the management and control of NCDs in Zimbabwe.

The improvement of the management and control of NCDs by the Ministry of Health and Child Care (MoHCC) in Zimbabwe, in cooperation with the WHO, has been a strategic priority since 2016 [22]. The management of NCDs in Zimbabwe includes several personnel who are either directly or indirectly involved in the daily management of different NCDs. These personnel include physicians, laboratory scientists, nurses, pharmacists, administrators and community health workers, amongst others. Physicians are amongst the primary direct caregivers with the responsibility for screening, diagnosis, ordering further examinations, reviewing and treatment of NCD patients. The authors elected to evaluate physicians’ perceptions in order to gather expert opinions in light of the fact that physicians play a key role in healthcare, since the ultimate responsibility for patients’ care rests on them. This study can be a foundation for expanding the scope of research to evaluate perceptions by other NCD-care personnel.

The aim was to conduct an exploratory study to evaluate the availability and quality of NCDs clinical care based on the perceptions of physicians who attend to

NCD patients at Chitungwiza Central Hospital (CCH), a referral hospital located in the Harare metropolitan province of Zimbabwe. The study was also motivated by the existence of scant literature on evaluations of care delivery systems for the management and control of NCDs by caregivers such as physicians in developing countries, including Zimbabwe.

## Materials and methods

### Study design

This was a qualitative exploratory study meant to obtain expert perceptions of care delivery for NCDs in one Zimbabwean referral hospital setting. Data was collected from participants who consented and was analyzed using Stata version 13.

### Study setting

The study was conducted at CCH, which is a referral hospital with a catchment area including urban, peri-urban and rural locations. There are about 15 hospitals in Mashonaland East Province surrounding CCH. In addition, CCH serves an estimated population of 1.5 million people, spread over an estimated 32,230 km<sup>2</sup> area. CCH attends to an average of 80 NCD patients in the outpatients' department and 20 in the inpatients' department daily. The economic status of the population within the catchment area of the CCH is generally poor, with the majority living below the national poverty line, averaging US\$220 monthly for a family of five [23], a common feature for most settings in Zimbabwe due to high unemployment levels. The population is therefore mostly unemployed or self-employed, embarking on livelihood sustenance projects such as market gardening, vending and other informal economic activities.

### Recruitment of participants

From a total population of 43 medical doctors engaged by CCH on a part-time or full-time basis, 26 doctors, including specialists, were recruited to participate in the study based on the inclusion/exclusion criteria provided below. Only doctors who consented to the study were included in the study, while doctors who do not provide clinical care for NCD-related conditions were excluded from participating in the study. For example dental surgeons.

#### i) Inclusion Criteria

- Medical doctors employed by the CCH, both on a full-time or part-time basis, who provide clinical care to patients with NCD-related conditions.

- Only doctors who consented to participate in the study were included.

#### ii) Exclusion Criteria

- Other hospital staff who are not medical doctors.

### Data collection procedures

Data was collected from both sessional and resident doctors at CCH through a self-administered questionnaire. To ensure that there was minimum bias regarding the respondents' perceptions, the anonymity of the participants was assured in both data collection and analysis. The questionnaires were distributed electronically through the Survey Monkey platform. The participants included general practitioners and specialists providing clinical care for NCD-related conditions.

The selection of study participants was based on their knowledge and experience in the management of NCDs. Therefore, doctors who do not provide clinical care for NCDs or any related conditions were excluded from the study. All the participants who met the inclusion criteria were communicated with in order to obtain their consent and thereafter, a link to the online questionnaire was distributed via email to the 26 participants who consented.

In order to assess the quality of clinical care, the World Health Organization's definition of quality was used as the basis for assessing quality, that is, "the extent to which the healthcare services provided to individuals and patient populations improve desired health outcomes. To achieve this, healthcare must be safe, effective, timely, efficient, equitable and patient-centered" [10]. The quality of healthcare is a collaborative effort involving the patient, physician, patient's family and the community. Therefore, it can be assessed from the perspectives of any of these. Accordingly, physicians' perceptions of quality were assessed based on the features highlighted in the above definition, measured using a four-point Likert scale with the following options:

Not satisfactory	Somewhat satisfactory	Satisfactory	Very satisfactory
1	2	3	4

The Likert scale was used to quantify the qualitative evaluations of physicians' perceptions of clinical care with the following meanings: *Not satisfactory* means that physicians perceived the clinical care to be unable to meet the healthcare service expectations; *Somewhat satisfactory* means that physicians were indifferent about the NCD clinical care, that is, it was meeting doctors' expectations to a lesser extent; *Satisfactory* means that the physicians perceived the clinical care to be just



meeting basic healthcare needs; and *Very satisfactory* means that the physicians perceived the clinical care to be world-class and going beyond expectations.

#### Data analysis procedures

Data was analysed using Thematic Analysis [24]. Since some of the questions were open-ended, open coding was done, capturing the frequency of the major themes which are presented in tables and bar graphs. Stata version 13 was used for the statistical analysis of data and to plot bar graphs. Qualitative data was open coded first and subsequently axial coded before presentation and analysis [22]. The analysis of data was guided by themes that emerged from the data and related responses were analyzed together [22].

#### Ethical consideration

Ethical approvals for the study were received from the Biomedical Research Ethics Committee of the University of KwaZulu-Natal (BE057/19) and the Medical Research Council of Zimbabwe (MRCZ/A/2441). Participants provided informed consent prior to data collection.

#### Results

Twenty-six participants consented to the study, 23 of which completed and uploaded their responses. These are valid for the study, giving a response rate of 88.5%. Their demographic characteristics are presented in Table 1 below.

As shown in Tables 1, 17.4% of the valid responses were from female doctors, whilst 82.6% were from male doctors. Although most of the participants were general practitioners (82.6%), the doctors were well experienced in providing clinical care for NCDs, as shown in Fig. 1.

As shown in Fig. 1, all specialists had been offering clinical care to NCD patients for more than 5 years, whilst 71% of general practitioners had more than 5 years of clinical care experience for NCD patients. The doctors gave their perceptions of the quality of clinical care services rendered to NCD patients. These responses are presented hereunder, starting with Fig. 2 depicting the physicians' perceptions of diabetes care at CCH.

Figure 2 represents doctors' perceptions of the quality of clinical care services for diabetes. The quality of clinical care services for diabetic patients at CCH was perceived by 44% of general practitioner doctors as

being satisfactory, whilst a further 44% of the general practitioners viewed the quality as somewhat satisfactory. The remaining 12% regarded diabetes clinical care to be unsatisfactory. In addition, 50% of the specialists regarded clinical care to be satisfactory and 25% regarded diabetes clinical care to be somewhat satisfactory. However, 25% of the specialists perceived the clinical care services for diabetic patients as not satisfactory.

Figure 3 below presents a summary of the physicians' perceptions of clinical care for cardiovascular diseases (CVD).

The quality of clinical care services rendered to CVD patients was perceived by 50% of specialists and 50% of general practitioners as being somewhat satisfactory. A further 12% of general practitioners and 25% of specialists regarded the quality of clinical care to be satisfactory, whilst 38% of general practitioners and 25% of specialists viewed the quality of CVD clinical care as not satisfactory.

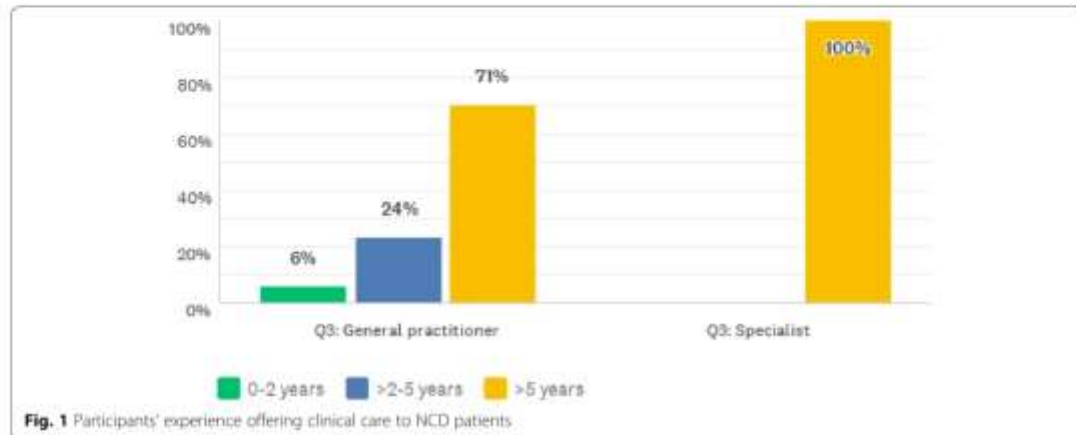
The physicians' perceptions of the quality of clinical care for the management of hypertension showed that 25% of general practitioners regarded the quality of clinical care services as very satisfactory. In addition, 50% of specialists and 44% of general practitioners perceived the quality of clinical care for hypertension to be satisfactory. Furthermore, 25% of both specialists and general practitioners regarded the quality of clinical care to be somewhat satisfactory; whilst 25% of specialists and 6% of general practitioners regarded the quality of clinical care to be not satisfactory. These results are shown in Fig. 4.

Lastly, in relation to the management of cancers, the doctors evaluated the quality of clinical care and the results of their perceptions are presented in Fig. 5. A majority of both general practitioners (69%) and specialists (50%) indicated that the quality of clinical care was not satisfactory. In addition, 25% of specialists and 19% of general practitioners perceived the quality of care as somewhat satisfactory, whilst a further 25% of specialists and 13% of general practitioners regarded the quality of cancer clinical care as satisfactory.

Given the perceptions of both general practitioners and specialist doctors of the quality of clinical care, it was important to ascertain the circumstances under which these physicians would request further tests and

**Table 1** Demographic Characteristics of Respondents ( $n = 23$ )

Features	Description	Frequency	Percentage (%)
Gender	Male	19	82.6
	Female	4	17.4
Doctors' specialization	Specialist	4	17.4
	General practitioner	19	82.6



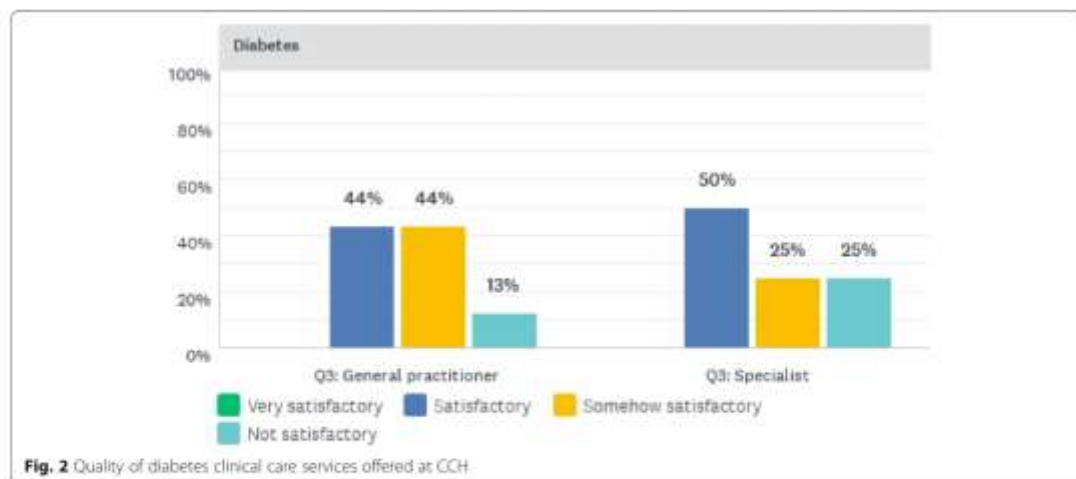
diagnosis. Screening and testing are critical for the effective management of NCDs since early detection makes most NCDs manageable and less fatal. The results are presented separately for the four NCDs under study. Figure 6 presents the reasons for both specialist and general practitioner doctors requesting testing for diabetic patients. It is observed that it is common practice for general practitioners (82%) and specialists (75%) to request further diabetes tests for patients presenting clinical symptoms. The rest of the reasons are shown in Fig. 6.

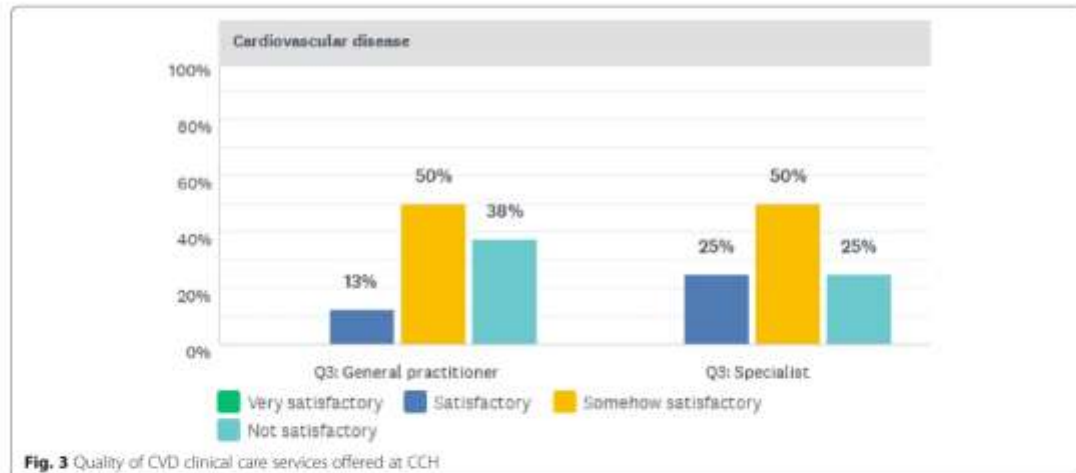
As presented in Fig. 7, it was also common practice to request screening tests for CVD patients presenting clinical signs and symptoms, as shown by 75% of specialists and 65% of general practitioners.

The predominant reasons for screening and testing for cancers, as shown in Fig. 8, are similar to CVDs and diabetes, as both specialists (100%) and general practitioners (71%) mainly requested screening for patients presenting with clinical signs and symptoms.

Of the four NCDs under study, hypertension presented a dissimilar predominant reason for screening and testing whereby almost all patients had their blood pressure checked when being attended to as part of the admission procedure. The reasons for testing for hypertension are shown in Fig. 9.

After establishing the conditions under which doctors requested further screening tests for effective management, the challenges that doctors faced when providing clinical care to NCD patients were enquired





from the doctors in order to establish their perspectives. The responses obtained in relation to these challenges are grouped by themes into related challenges and are summarized in Table 2 below.

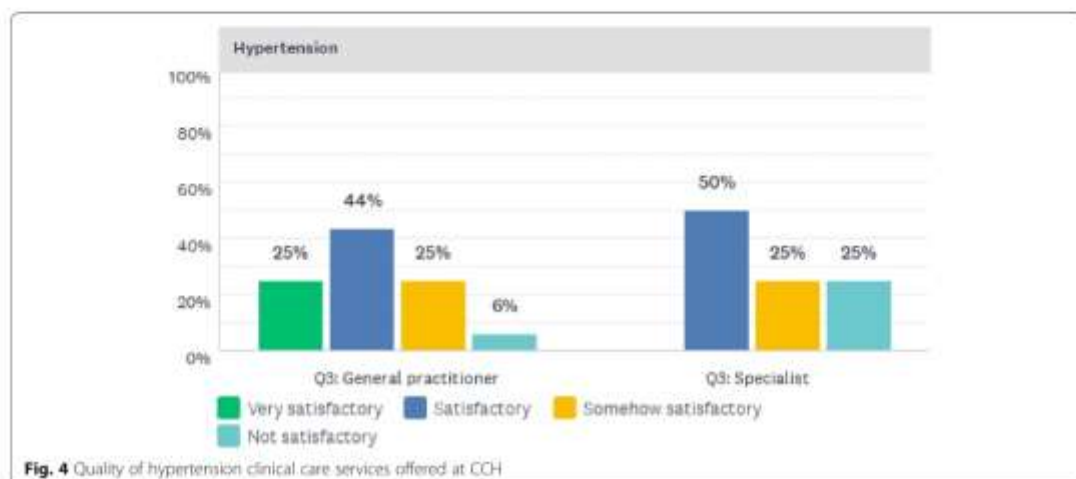
Table 2 shows the five categories of challenges identified by the study, namely financial challenges, patient behavior challenges, supply chain challenges, communication challenges, as well as care provider challenges. The statistics regarding the highlighted challenges are provided in Fig. 10.

The most cited challenges were financial challenges, as perceived by 33% of the doctors. This was followed by patient behavioral challenges, which was cited by 27% of the doctors at CCH. Another 21% of the doctors viewed communication as a challenge in the provision of care for NCD patients,

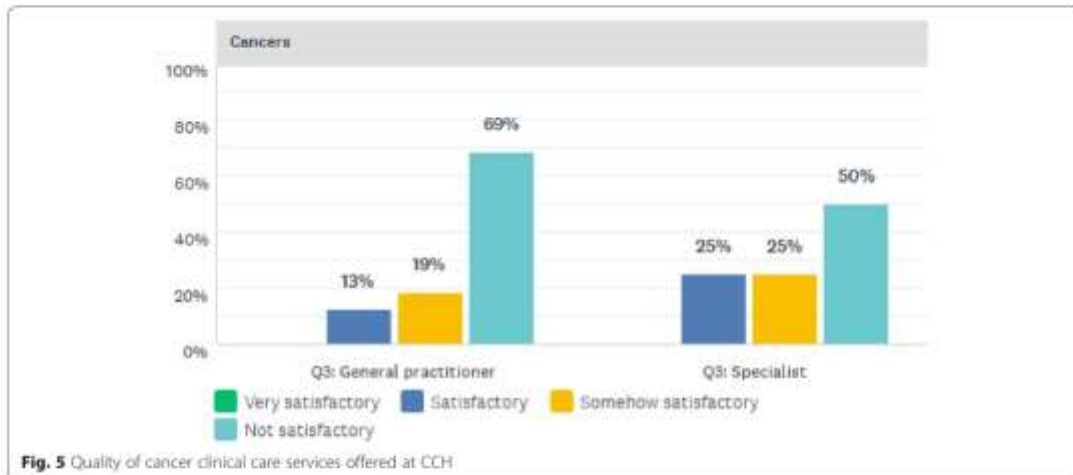
whilst a further 10% cited challenges in the medical supply chain and 9% cited challenges with care providers for NCD care.

Given the challenges presented in Table 2 and summarized in Fig. 10, the study enquired about the gaps that the doctors considered to be stumbling blocks in the provision of care for NCD patients. The gaps established are summarized in Fig. 11 below.

The gap cited by the highest number of respondents was poverty and economic instability, as 20% of the doctors identified this factor as affecting the delivery of care to patients. The least identified gap was the varied methods used by doctors to manage different NCD patients, as cited by only 2% of the doctors. This shows a need for a standard framework for the screening and management of NCDs. Possible mitigatory measures







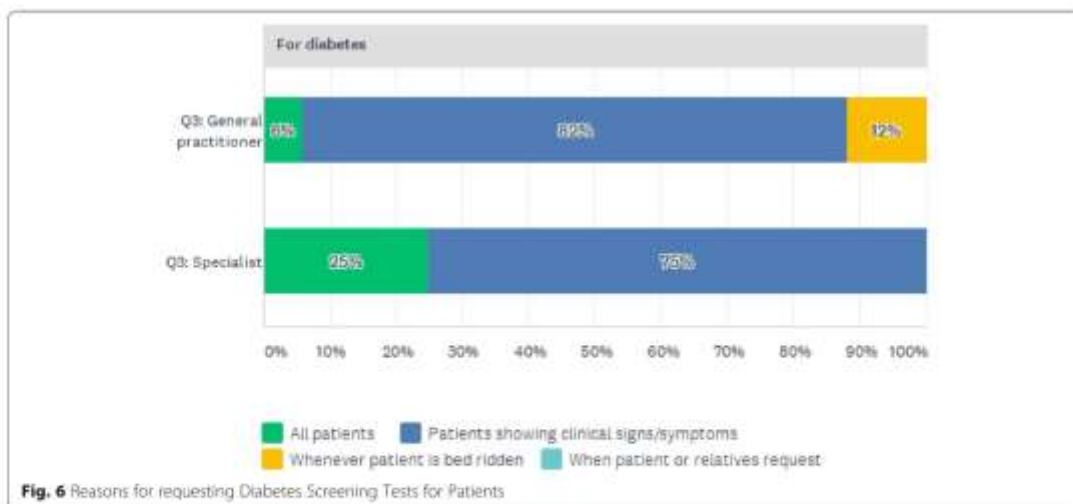
which could be implemented to improve the situation are summarized in Table 3 below.

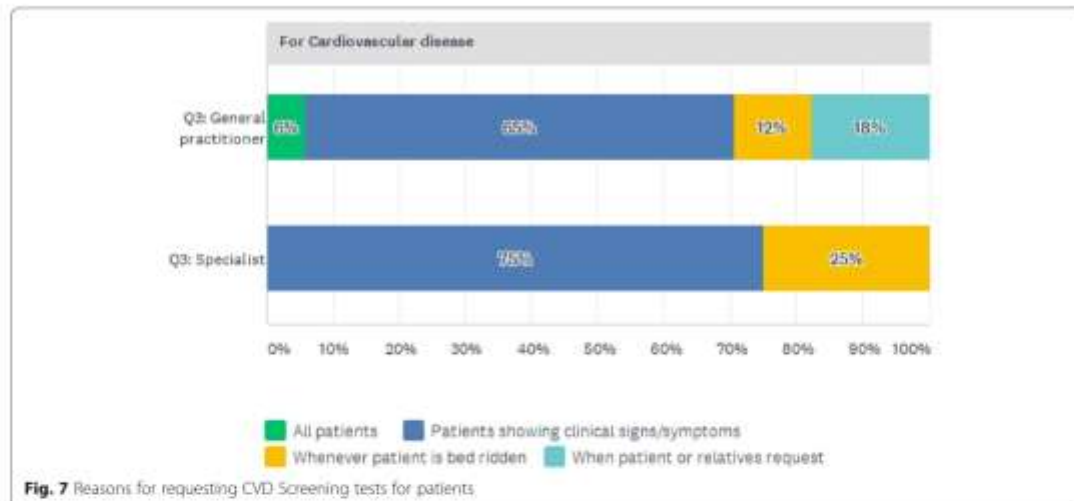
As shown in Table 3, several possible measures are highlighted which could be implemented at CCH in order to mitigate the extent of NCDs and improve care delivery for NCD patients. According to 14% of the doctors, educational campaigns could help in mitigating the exposure of patients to various NCDs. A further 12% viewed the provision of funding from central government and development agencies as an effective strategy to mitigate the challenges faced in providing effective care to NCD patients. The strategies presented in Table 3 would be helpful in dealing with NCDs at public health institutions in Zimbabwe. The effectiveness of these strategies was

not covered by this study and may require further enquiry.

### Discussion

The aim of the study was to evaluate the availability and quality of NCDs clinical care based on the perceptions of physicians who attend to NCD patients at Chitungwiza Central Hospital (CCH), a referral hospital located in the Harare metropolitan province of Zimbabwe. The findings indicated perceived gaps in care delivery for NCD patients attended to at CCH. The authors found that a significant number of the doctors thus viewed the quality of the care services offered to NCD patients to be unsatisfactory overall. This was



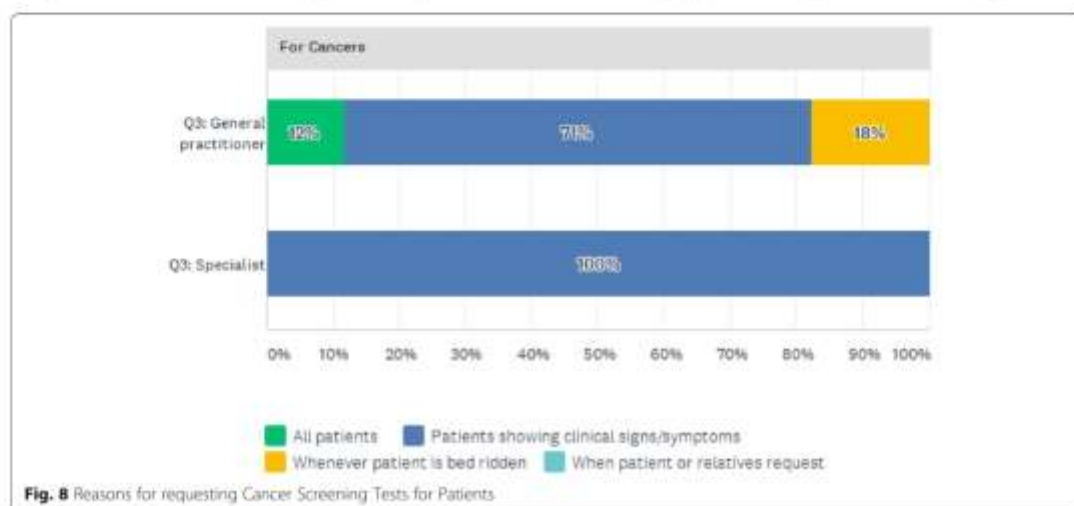


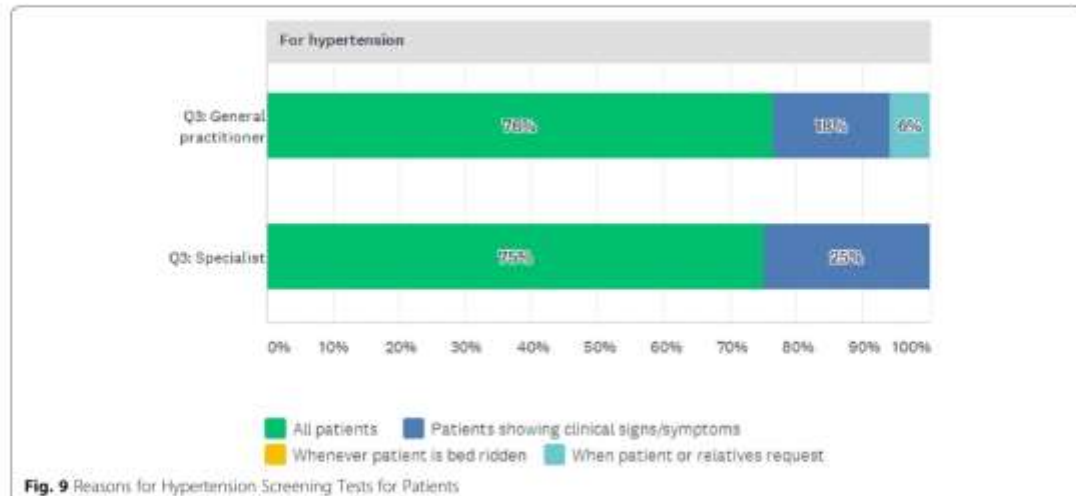
attributable to various challenges impeding the smooth flow of care delivery for the selected NCDs.

The study also assessed the screening procedures for diabetes, hypertension, CVD and cancers. The authors observed that except for hypertension, which was screened for the majority of patients, the doctors first checked clinical signs and symptoms in order to request further tests. This is a matter of concern since NCDs may take time to be evident clinically, and in most cases will show signs at advanced stages, leading to poor prognosis of the condition. Devi, et al. elaborate further on the necessity of including screening and diagnosis of NCDs in the models for NCD management [8]. The study also identified the challenges faced by doctors in

the management of NCDs. The most prevalent challenges were financial where the patients could not afford some of the procedures and services ordered by the physicians to manage the condition for better prognosis. The least challenging obstacle related to service provider challenges, since the study setting was in an urban location which is not badly affected by human resources challenges, which are common impediments in rural areas [25]. However, the researchers could not rule out possible bias since the participants were caregivers.

Doctors who participated in the study identified several gaps in clinical care delivery for NCD patients at CCH and proposed strategies that could be pursued in





order to improve the quality of clinical care. Some of the proposed strategies include pursuing hospital-based tutoring to educate the community on the risk factors, disease burden and mortality associated with NCDs. CCH management and the responsible ministry should consider providing mandatory and free testing for NCDs for all patients in order to ensure early detection. This enhances the quality and effectiveness of the care and management of NCDs. Medical institutions such as CCH can improve clinical care quality through availing resources, medication and equipment for NCD screening and management at primary healthcare institutions.

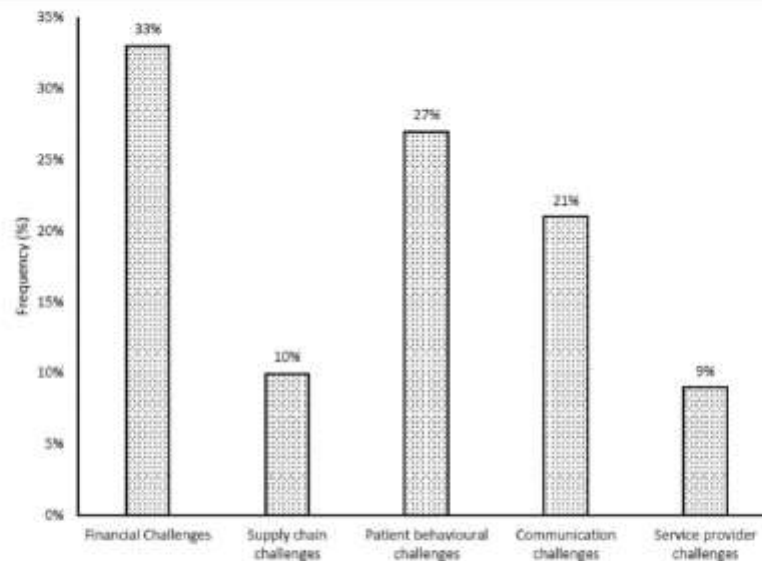
The doctors' perceived unsatisfactory quality of clinical care delivery for NCD patients was consistent with findings obtained from other studies in almost similar settings, especially those in the SSA region [2, 6,

7]. Poverty has been cited as a common cause for high NCD prevalence and the unsatisfactory care of NCD patients, as well as for the high mortality rates for various NCDs in the SSA region and LMICs [3, 5, 8]. This is attributable to various reasons, which include incapacitation to meet hospital bills for general medical check-ups, which are key to the early diagnosis of NCDs [5, 8]. Moreover, poverty compromises educational achievements, which impedes the knowledge base on prevention and the lifestyle changes necessary to minimize exposure to NCDs [3, 25]. The chronic nature of NCDs makes most of the populations from LMICs unable to afford the lifelong treatment required because of poverty [2].

Challenges faced in the care delivery for NCD patients were not unique to doctors at CCH. Due to economic

**Table 2** Challenges faced by Doctors providing quality NCD clinical care at CCH

Financial Challenges	Patient Behavioral Challenges
No money for laboratory tests.	Non-compliance with lifestyle changes and denial.
Unavailability of affordable screening services.	Non-compliance with treatment.
Drugs are unaffordable.	Religious and Traditional beliefs which cause bad health-seeking behavior.
Lack of funding from government.	Lack of co-operation from patients.
Supply Chain Challenges	Communication Challenges
Shortages of screening tools and equipment for tests.	No clear guidelines for NCD patients.
Unavailability of drugs.	Poor information dissemination.
Shortages of advanced equipment.	A lack of basic knowledge about risk factors by the populace.
Care provider challenges	
No special testing laboratories.	
Shortages of specialists.	
Lack of expertise to support the patients.	

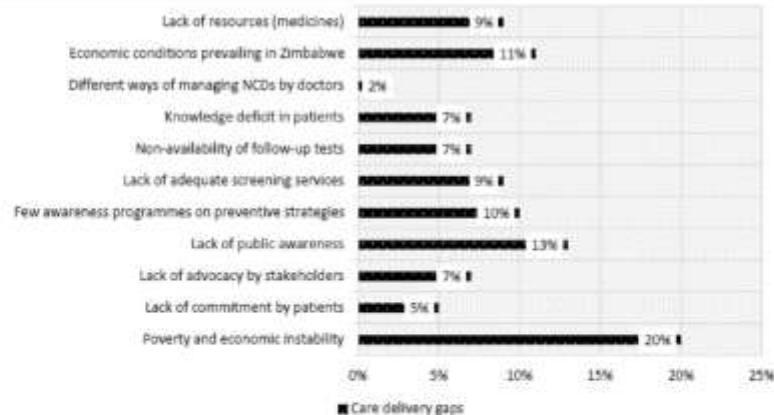


**Fig. 10** Categorized Challenges Faced by Doctors Caring for NCDs at CCH

challenges in developing countries, financial challenges are common for NCD care providers in developing countries and the SSA region [2, 7, 8]. Doctors also highlighted perceived challenges related to patients' behavior, which exposes them to higher NCD risks [4]. Behaviors identified in literature include absconding from treatment due to stigma or the inability to afford medication, as well as religious practices such as faith-healing beliefs resulting in medication abscondment [4, 5, 8]. The study also revealed doctors' perceptions of the

existence of behaviors by patients, which compromise care delivery for NCDs [6, 10]. Patient behaviors and attitudes are common challenges in medicine whereby adherence to prescriptions is neglected and patients are sometimes unwilling to change behaviors such as smoking and alcohol abuse, despite the resultant exposure to undesirable effects such as NCD development [4, 5].

The strength of this exploratory study was primarily its contribution to an initial evaluation of NCD patients' care delivery from a referral hospital in a developing



**Fig. 11** Care Delivery Gaps

**Table 3** Mitigatory Measures to Close the Care Delivery Gaps for NCDs Patients

Possible mitigatory measures that could be implemented	Percentage (%)
Mandatory hospital-based tutoring for the public	7
Educational awareness campaigns	14
Better information dissemination through the media	7
A policy that speaks to NCDs	7
Free treatment at designated hospitals	10
Integration of health provision	6
Decentralization of NCD clinics to district hospitals	4
Screening tests at each clinic visit	5
Availing of funding from central government and development partners	12
Set up specific NCD clinics and help support them by providing adequate stocks of medication and laboratory equipment support	3
Affordable health insurance schemes	10
Give flexible timetables for patients' visits	7
Procure medicines on time	7

country setting. The study population comprised medical doctors who are experts with varied experience in the management of NCDs. The study thus contributed towards the body of knowledge on the management of NCDs from an expert viewpoint. This research presents a baseline study that can guide further studies on evaluating NCD care delivery using either an expanded population from CCH or incorporating other care-givers in order to ascertain gaps and strategies for enhancing care delivery.

However, the main limitation of the study was the limited geographical coverage and the small sample used, which meant that the findings obtained in the study were not generalizable to be representative of the entire country and its health professionals. Moreover, there is a possibility of bias by respondents since the study was a self-evaluation. Therefore, doctors were unlikely to highlight their own weaknesses in NCD clinical care provision. The exclusion of patient observations was another limitation of the study. However, these limitations cannot invalidate the findings, since the study was exploratory in nature and hence there is need for conducting a study with a bigger population and sample.

The authors recommend that the management at CCH consider a deliberate policy for enhancing the quality of clinical care provided to NCD patients through the development and implementation of a service level agreement. Since CCH is a provincial hospital, the proposed policy can be disseminated to district clinics and hospitals. It is also recommended that all medical staff such as nurses be capacitated to offer acceptable quality NCD care to patients. Moreover, clinical processes must be re-engineered to ensure that NCD care is an integral part of patient care procedures at the institution. These recommendations are envisaged

as having the ability to improve the quality of NCD clinical care at CCH.

### Conclusions

The study's findings showed that the clinical care offered for most NCDs at CCH is not of the quality and standard expected by the physicians to reduce morbidity and mortality. The quality of clinical care is compromised by challenges affecting healthcare institutions such as CCH. There is an unavailability of sufficient equipment and/or affordable services for NCD care. Medical supplies are also limited in terms of availability and affordability. In addition, physicians at CCH perceived the existence of informational and knowledge gaps in the care and management of NCDs by patients. Doctors also observed that NCD patients fail to adhere to treatment protocols due to religious and traditional beliefs.

Based on the findings obtained in the study, the following conclusions were drawn regarding doctors' perceptions of care delivery for NCD patients at CCH:

- Care delivery for NCD patients is perceived by some doctors as being unsatisfactory in meeting the requirements of the patients since there were challenges impeding their delivery of clinical care to NCD patients.
- There are no clear guidelines and policies for healthcare practitioners on clinical care delivery for NCD patients. As a result, doctors do not have benchmarks for care delivery, as was evidenced by the varied responses from the doctors regarding the care of patients.



- c) There are no standard protocols for screening and managing NCDs, which encourages the early diagnosis of NCDs. This is likely to improve the quality of care, resulting in care which is safe, effective, timely, efficient, equitable and patient-centered.

The study is important in giving direction to both doctors and other stakeholders at CCH and in Zimbabwe on areas of possible improvement in NCD care delivery. The evaluation of doctors' perceptions of NCD clinical care delivery at CCH enlightens hospital management and policy-makers on the need to improve NCD care at the institution in order to control NCD co-morbidities that may increase mortality. Findings from the study can also inform other low-income countries facing an escalation of NCDs burden and need to improve their clinical care delivery for persons diagnosed with NCDs. The study showed a need to improve timely NCD diagnosis, and the earlier commencement of care will ultimately give better results for the patient management. Policy makers, hospital management, and clinical caregivers in comparable settings can draw valuable lessons on ways to improve NCDs management and customize the findings to their unique clinical care settings.

#### Abbreviations

AIDS: Acquired Immune Deficiency Syndrome; CCH: Chitungwiza Central Hospital; CVD: Cardiovascular disease; HIV: Human Immunodeficiency Virus; LMICs: Low to Medium Income Countries; NCDs: Non-Communicable Diseases; OI: Opportunistic Infections; PLHW: People Living with Human Immunodeficiency Virus; SSA: Sub-Saharan Africa

#### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12992-021-00730-3>.

**Additional file 1.** Questionnaire

**Additional file 2.** Anonymized Study Dataset.

#### Acknowledgements

We acknowledge the Ministry of Health and Child Care (Zimbabwe) and the CCH Administration Staff for the approval and assistance during the data collection. In addition, special gratitude goes to the University of Kwa-Zulu Natal's College of Health Sciences for all the support throughout the process.

#### Authors' contributions

AC, the Principal Investigator responsible for providing overall direction and oversight of the study at all stages fully engaged from the project design, protocol development and obtaining of ethical approvals to the study conduct, data analyses and dissemination of the study outcome. TB, Supervisor and Co-Investigator, responsible for technical direction, supervised and provided advice for all steps from the project design, protocol development and obtaining of ethical approvals to the study conduct, data analyses and dissemination of the study outcome. Reviewed the final article. The authors read and approved the final manuscript.

#### Funding

The study has not received external funding.

#### Availability of data and materials

The data that support the findings of this study are available and an anonymized dataset is included as an additional supporting file.

#### Declarations

##### Ethics approval and consent to participate

The Biomedical Research Ethics Committee of the University of Kwa-Zulu Natal (BE057/19) and the Medical Research Council of Zimbabwe (MRCZ/A/2441) granted ethical approvals. Participants provided informed consent prior to data collection.

##### Consent for publication

Written consent to participate in the study was a pre-requisite from each participant. Participants consented to the publication of the study findings without any jeopardy to their image.

##### Competing interests

The authors declare that they have no competing interests.

Received: 6 January 2021 Accepted: 7 July 2021

Published online: 19 July 2021

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## CHAPTER FOUR

### **Knowledge and Perceptions about Non-Communicable Diseases by people living with HIV: A descriptive cross-sectional study from Chitungwiza Central Hospital Zimbabwe.**

This chapter is a research article accepted for publication by the African Health Science Journal which addresses the fourth objective of the study that was to determine knowledge and perceptions of non-communicable diseases by people living with HIV (PLHIV). The details of the article are presented hereunder.







**Knowledge and Perceptions about Non-Communicable Diseases by people living with HIV: A descriptive cross-sectional study from Chitungwiza Central Hospital Zimbabwe.**

Journal:	<i>African Health Sciences</i>
Manuscript ID	WKRO-2021-02-0333.R3
Manuscript Type:	Original Article
Date Submitted by the Author:	25-Feb-2022
Complete List of Authors:	Cheza, Alexander; University of KwaZulu-Natal College of Health Sciences, School of Nursing and Public Health Tlou, Boikhutso ; University of KwaZulu-Natal School of Nursing and Public Health, Public Health Medicine
Keywords:	Perception, Knowledge, Non-Communicable Diseases

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**Knowledge and Perceptions about Non-Communicable Diseases by people living with HIV:  
A descriptive cross-sectional study from Chitungwiza Central Hospital Zimbabwe.**

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## 30 Abstract

31 **Background:** Sub-Saharan Africa has shown a rise in morbidity and mortality due to NCDs.  
32 PLHIV have shown to be more exposed to NCDs and identifying the knowledge gaps might help  
33 the management of NCDs in PLHIV.

34 **Objective:** The study was conducted in order to determine knowledge and perceptions regarding  
35 NCDs in PLHIV from Chitungwiza Hospital.

36 **Methods:** This was a cross-sectional survey on 324 participants from Chitungwiza Hospital. Data  
37 collection was through a designed questionnaire. Knowledge and perceptions were evaluated, and  
38 the associated risk factors were identified using the Logistic Regression Model.

39 **Results:** Results showed a 65% level of knowledge and 80% positive perceptions on NCDs.  
40 Participants <40 years of age were more knowledgeable ( $p=0.003$ ) and history of NCD in the  
41 family influenced positively on knowledge ( $p=0.001$ ). Females showed a more positive perception  
42 ( $p=0.043$ ), both increasing age and low education negatively impacted the perceptions ( $p<0.001$ )  
43 as well as the knowledge ( $p=0.020$ ).

44 **Conclusion:** Knowledge and perception were moderately high, but reduced with decreasing levels  
45 of education and increasing age. The study recommends educational campaigns to disseminate  
46 information about NCDs in PLHIV, targeting the least educated population groups and those older  
47 than 40 years of age.

48  
49 **Keywords:** Non-Communicable Diseases (NCDs), HIV, Knowledge, Perceptions

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## 56 Introduction

57 The Human Immunodeficiency Virus (HIV) is known for weakening the immune system, thus  
58 resulting in a higher exposure of patients to opportunistic infections, which led to a high mortality  
59 before the development of anti-retroviral therapy (ART); which significantly increased survival  
60 rates for people living with HIV (PLHIV)<sup>1</sup>. Non-communicable diseases (NCDs) have had a very  
61 high comorbidity in PLHIV thereby threatening to reverse the gains realised from ART<sup>1,2</sup>. The  
62 sub-Saharan African (SSA) region has been noted to be worst affected by HIV/AIDS, being home  
63 to almost two-thirds of the global PLHIV in 2017<sup>3,4</sup>. There has also been a notable increase in  
64 morbidity and mortality associated with NCDs globally, with LMICs equally affected. NCDs'  
65 mortality rate is more than 70% of the total deaths worldwide and more than two-thirds of these  
66 deaths occur in LMICs<sup>5</sup>.

67  
68 The World Health Organisation highlighted in 2016 that about 33% of all deaths in Zimbabwe  
69 were attributable to NCDs<sup>6</sup>. Thus, Zimbabwe is facing an increased risk of the comorbidity of  
70 NCDs and HIV disease burden<sup>7</sup>. The comorbidity rate is likely to be increased by an expanded  
71 lifespan after the introduction of ART, as well as the high urbanisation rate together with the  
72 associated risks involving lifestyle changes.

73  
74 A literature scan reveals a dearth in studies focusing on knowledge, attitudes and perceptions on  
75 NCDs in LMICs and the SSA region. Most of the studies focusing on the knowledge, attitudes,  
76 and practices on NCDs were conducted in India<sup>8,9</sup> and Pakistan<sup>10</sup>. To our knowledge studies  
77 conducted in the SSA region do not assess patients' knowledge and perceptions regarding the  
78 comorbidity of HIV and NCDs. For instance; a study in Uganda assessed the knowledge and  
79 attitudes of village health teams on NCDs,<sup>11</sup> whilst a study in Cameroon focused on the knowledge,  
80 attitudes, and behaviour of the residents towards diabetes<sup>12</sup>. In Zimbabwe, a study by  
81 Chimberengwa and Naidoo focused on knowledge among rural residents and found a low level of  
82 knowledge about hypertension<sup>13</sup>. Therefore, knowledge about NCDs is not readily available to the  
83 public and hence affects their health seeking behaviour.

84  
85 Despite the availability of global information about the growing burden of NCDs, strategies to  
86 address the escalation of NCDs in PLHIV remain evasive, especially in low-resourced countries<sup>14</sup>.  
87 An integrated approach which entails the involvement of all stakeholders, such as healthcare



88 providers, the community, healthcare funders and the patients, amongst many others is necessary.  
89 PLHIV need knowledge to enable them to manage their exposure to NCDs by practising healthy  
90 lifestyles, as well as avoiding any risk factors which expose them to NCDs burden<sup>15</sup>. It is therefore  
91 apparent that there is limited evidence about how patients' knowledge and perceptions of HIV and  
92 NCDs may be incorporated into managing the mortality associated with the comorbidity or multi-  
93 morbidity of HIV and NCDs. The aim of the study is to assess the levels of knowledge and  
94 perceptions of PLHIV at Chitungwiza Central Hospital's (CCH) opportunistic infection clinic  
95 (OIC) regarding the comorbidity of HIV and NCDs to enhance management thereof. The study  
96 also takes a view of perceived challenges faced by patients in line with NCDs care. Thus, the study  
97 assesses the level of knowledge and perceptions with a view to inform strategies to be adopted to  
98 ensure PLHIV diagnosed with NCDs receive requisite care, management and/or treatment.  
99

## 100 **Methodology**

### 101 **Study Design**

102 This is a cross-sectional explanatory study using a mixed methods approach to describe-the  
103 participants' responses. The study explores and descriptively documents the perceptions and  
104 knowledge of PLHIV on their exposure to the NCDs burden.

### 105 **Study Setting**

106 The study was conducted at CCH (OIC), located in the town of Chitungwiza, which is in  
107 Zimbabwe's capital city metropolitan province of Harare, with an estimated population of about  
108 1.5 million, serving circa 400 000 patients annually in both its in-patient and out-patient divisions.  
109 The CCH's catchment area spans 45 square kilometres in urban and peri-urban areas, and about  
110 30 000 square kilometres in rural areas. The main sources of income for the patients served at CCH  
111 include self-help jobs, such as street vending for those in towns and market gardening for the peri-  
112 urban and rural populations. The CCH has been certified by the International Standards  
113 Organisation (ISO) since 2008.  
114

### 115 **Study Population**

116 The study population was made up of PLHIV receiving care from the CCH OIC. Therefore, the  
117 total number of such persons was 2500 people who received ART and other related care during  
118 the six-month data collection period. For participants' selection, the inclusion/exclusion criteria  
119 used.

## **Sampling and Recruitment of Participants**

Simple random sampling was used to select the patients who were receiving ART at the CCH OIC. Using the sample calculation tables by Krejcie and Morgan<sup>16</sup>, a sample of 333 was determined from the population of 2500 patients seen by the CCH OIC during the six-month period of data collection. A significance level of 5% was used. The inclusion and exclusion criteria for the recruitment of the participants for the study are outlined below.

### **i) Inclusion Criteria**

- Patients who consented to the study;
- Patients aged 18 years or above as they were able to give their consent; and
- Only PLHIV who were on the CCH OIC register.

### **ii) Exclusion Criteria**

- All patients who were too sick and not able to communicate.

## **Data Collection Procedures**

Data was collected by trained resident nurses at the CCH OIC during the six-month period between August 2019 and January 2020. Consent was obtained from the respondents before their participation in the study. A questionnaire designed and distributed using the KoBo Toolbox was used for data collection. The questionnaire comprised of closed and open-ended questions. Participants provided their knowledge and perceptions regarding their conditions, as well as how they perceived the nature of the NCDs affecting them through the questionnaire. In a situation where direct and specific responses were required, closed-ended questions were used; in order to allow an infinite array of responses, open-ended questions were also used.

## **Study Variables**

**Outcome variables:** Knowledge and Perception – the study sought to ascertain knowledge and perceptions in PLHIV about their added exposure to NCDs and how NCDs affect them.

**Explanatory variables:** Demographic risk factors which according to literature include lifestyle factors, behavioural factors, religious factors, economic factors, and demographic factors, amongst many others<sup>10,11,12,15</sup>. The focus of this study was on demographic risk factors. Therefore, the explanatory variables for the study are gender, age and history of NCDs in the participants' families.

## Data Analysis

Data was analysed using a mixed methods approach. Stata Version 13 was used for data analysis and a p-value  $\leq 0.05$  was deemed statistically significant to the relationship between the dependent and independent variables. Descriptive quantitative results were presented using frequency distribution tables and bar graphs. Knowledge and perceptions of participants were assessed using different binary categorical questions. Frequency of responses for each question was used to compute the respective proportions. To determine the extent of how knowledgeable the participants were about NCDs, the authors adopted a subjective approach, as suggested by Ojo, Hawley and Desai<sup>11</sup>. The approach divides the calculated proportions into two categories (knowledgeable and not knowledgeable) using the following rule:  $\geq 50\%$  = knowledgeable and 0-49% = not knowledgeable. Two categories were also established for perception as follows:  $\geq 50\%$  = good perception and 0-49% = bad perception. Multiple logistic regression was used to determine the factors associated with participants' knowledge and perceptions.

Whilst for qualitative data, the study employed a six-step thematic analysis framework to analyse open-ended questions, which involved process of familiarising with the responses, generating themes, reviewing themes, defining themes, and writing up<sup>17</sup>. Major themes in terms of the challenges that impede the smooth care delivery for NCD conditions were identified under treatment adherence, financial and status of the home-based care. The focus of the open-ended questions was to establish the challenges faced by the participants in the care of HIV and NCDs and prompt further research into that. The results from the study are presented in the following section of this paper.

## Results

Data cleaning was performed prior to analysis and 9 incomplete questionnaires from respondents were removed from the 333 received, hence the responses analysed was from 324 participants. 60% of participants were female, whilst 40% were male. The highest represented participants were those older than 50 years (44%), whilst those aged between 18 and 25 years (4%) were the least represented. Emerging themes from the thematic analysis showed that under the theme 'treatment adherence' the participants had poor dose timetable adherence behaviours, another challenge was



the lack of funds for medical care under the theme 'financial' and the third theme 'status of home-based care' showed that participants had unsupportive environments at home creating stigma.

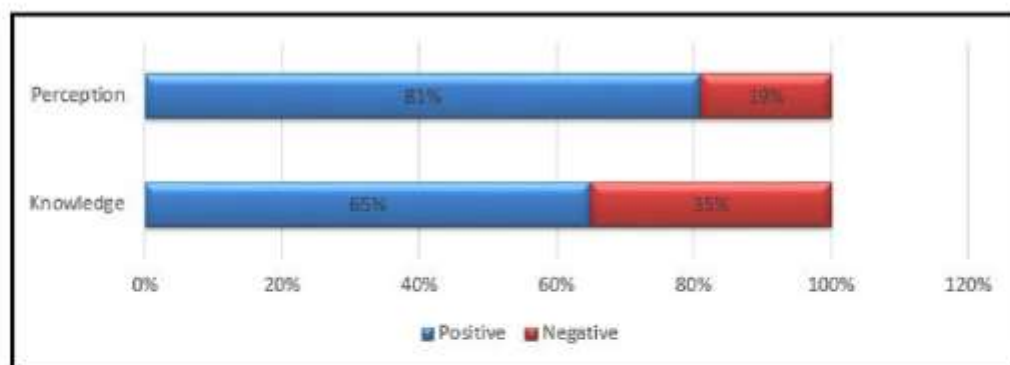
**Table 1: Respondents' demographic and clinical characteristics**

Features	Description	Frequency (Percentage)
Age Group(years)	18 – <25	13(4)
	25 - <40	87(27)
	40 – <50	81(25)
	≥ 50	143(44)
	<b>Total</b>	<b>324(100)</b>
NCD Diagnosed	Hypertension	168(52)
	Diabetes	133(41)
	Cardiovascular Diseases (CVDs)	78(24)
	Cancers	13(4)
	<b>Total</b>	<b>392(121)</b>
Gender	Male	129(40)
	Female	195(60)
	<b>Total</b>	<b>324(100)</b>
Highest Education	≤ Primary	61(19)
	Secondary	174(54)
	Tertiary	89(27)
	<b>Total</b>	<b>324(100)</b>
History of NCDs in the Family	Yes	134(41)
	No	190(59)
	<b>Total</b>	<b>324(100)</b>

Table 1 shows the NCDs that the participants were diagnosed with, either before or after commencement of ART. The results indicate that most of the 324 participants (52%) were diagnosed with hypertension, whilst 41% were diabetic. The least common NCD in participants was cancer diagnosed in 4% of participants. Results showed comorbidity of NCDs in 21% of PLHIV. However, the results did not specify the number of participants diagnosed with specific NCDs. Given the fact that some NCDs have genetics as a risk factor, the study also asked the question about the family history of the NCDs that they were diagnosed with. The results showed that 58.6% of participants had no other family member diagnosed with NCDs, whilst 41.4% had a history of similar NCDs in their families.

Summary of the measurement of knowledge and perceptions are presented in Figure 1.





**Figure 1: Overall Participants' Level of Knowledge and Perceptions on NCDs**

As shown in Figure 1, 35% of participants in the study were not knowledgeable about NCDs, whilst 65% were knowledgeable. Overall, the participants' perception of the comorbidity of NCDs in PLHIV is good (81% positive), with only 19% having negative perceptions about NCDs. The details of participants' perceptions are presented in Table 2 below.

**Table 2: Participants' Perceptions and Knowledge on NCDs (n = 324)**

Perceptions	Response	Frequency	Proportion	Rating
Can a non-communicable disease be spread in the community?	No	258/324	79.63	Good
	Yes	66/324	20.37	Bad
Can high blood pressure be silently fatal? Does it need to be checked regularly?	Yes	308/324	95.06	Good
	No	16/324	4.94	Bad
You must regularly go for medical examinations to screen for non-communicable diseases.	Yes	277/324	85.49	Good
	No	47/324	14.51	Bad
Heart disease is more common in active individuals than the elderly.	False	226/324	69.75	Good
	True	98/324	30.25	Bad
If NCDs are managed well, people can live normally and significantly improve their life expectancy.	True	300/324	92.59	Good
	False	24/324	7.41	Bad
In general, do you think NCDs are becoming common in Zimbabwe?	More Common	276/324	85.19	Good
	Less Common	48/324	14.81	Bad
<b>Knowledge</b>				
A stroke involves the cut of blood supply to the brain.	True	283/324	87.35	Good
	False	41/324	12.65	Bad
Diabetes mellitus can be inherited from parents.	True	288/324	88.89	Good
	False	36/324	11.11	Bad
Cancers affect only HIV-positive people.	False	251/324	77.47	Good
	True	73/324	22.53	Bad
Non-communicable disease cannot be managed.	False	213/324	65.74	Good
	True	111/324	34.26	Bad

You only suffer from one NCD at a time.	False	199/324	61.42	Good
	True	125/324	38.58	Bad

206

207 As shown in Table 2, the participants generally had good perceptions about NCDs. For instance,  
 208 when asked if high blood pressure can be silently fatal and whether it needs to be checked  
 209 regularly, more than 95% perceived that hypertension can be a silent killer and should therefore  
 210 be tested regularly.

211

212 The study focused on assessing how knowledge and perceptions about NCDs are affected by  
 213 demographic risk factors, using a binary logistic regression model. The independent variables (risk  
 214 factors) under consideration in the study were gender, age, education, and history of NCDs in  
 215 participants' families. The results of the model are given in Table 3.

216

217 **Table 3: Demographic factors associated with knowledge and perceptions on NCDs**

Variable	Categories	Knowledge				Perception			
		Odds Ratio	95% CI		P-value	Odds Ratio	95% CI		P-value
Gender	Female	1.662	0.116	3.220	0.079	1.833	1.006	2.659	0.043
	Male	1.000				1.000			
Age	≥40	0.606	0.273	0.934	0.003	0.108	0.047	0.158	<0.001
	<40	1.000				1.000			
Highest Education	≤ Primary	0.544	0.120	0.968	0.020	0.229	0.015	0.442	<0.001
	Secondary	0.963	0.434	1.492	0.059	0.991	0.402	1.580	0.066
	Tertiary	1.000				1.000			
NCD Condition	Yes	1.887	0.778	2.995	0.001	1.132	0.861	1.402	0.086
History in Family	No	1.000				1.000			

218

219 Table 3 summarises the demographic characteristics associated with the knowledge and  
 220 perceptions of PLHIV receiving ART at the CCH OIC who participated in the study. The study  
 221 findings showed that age, education and history of NCD condition in the family were significantly  
 222 associated with knowledge of NCDs, whilst age, gender and education were significantly  
 223 associated with perceptions about NCDs.

224

225 The odds of participants older than 40 years of age were 0.6 times less likely to be knowledgeable,  
226 as compared to those under 40 years ( $p\text{-value} = 0.003$ ). Furthermore, the participants who attained  
227 a primary education level or less were 0.55 times less likely to be knowledgeable about NCDs  
228 when compared to those with a tertiary education ( $p\text{-value} = 0.020$ ). Participants whose family  
229 members had a history of NCD conditions were 1.9 times more likely to be knowledgeable when  
230 compared to those with no history of NCDs in their families ( $p\text{-value} = 0.001$ ).

231

232 On the other hand, female participants were 1.8 times more likely to have a good perception of the  
233 management of NCDs compared to male participants ( $p\text{-value} = 0.043$ ). Furthermore, the odds of  
234 participants older than 40 years of age were approximately 0.1 times likely to have a good  
235 perception towards NCDs compared to those younger than 40 years ( $p < 0.001$ ). Participants who  
236 achieved a primary education level or less were about 0.2 times likely to have a good perception  
237 towards NCDs than those with a tertiary education ( $p < 0.001$ ). Gender and history of NCD  
238 conditions in the family were not significantly associated with the knowledge and perceptions  
239 thereof, respectively.

240

## 241 Discussion

242 Data was collected from participants whose age range was wide although with the majority (44%)  
243 aged above 50 and most of the participants had a secondary level of education. The results showed  
244 that 65% of the participants were knowledgeable about NCDs and how they develop whilst 81%  
245 showed good perceptions about NCDs and their development. Findings showed that participants'  
246 moderately high knowledge was significantly influenced by age, education, and a history of NCDs  
247 in participants' families. On the other hand, perceptions were found to be significantly influenced  
248 by gender, education, and the age of participants. Results also showed a 21% comorbidity of NCDs  
249 in PLHIV.

250

251 The moderately high knowledge levels of PLHIV exhibited in the study are not consistent with  
252 other prior studies that have shown a significantly poor knowledge of NCDs<sup>4,6,10</sup>. The moderately  
253 high knowledge level exhibited by the participants is likely to have been a result of the  
254 demographics of the population served by the OIC, which is situated in a peri-urban setting. The  
255 level of knowledge shown by the participants was higher than other studies conducted in rural  
256 areas in Zimbabwe, such as research by Chimberengwa and Naidoo<sup>15</sup> who conducted a study in a



257 rural setting and found poor knowledge of hypertension, results that are inconsistent with this study  
258 findings. The level of knowledge was expected to be higher because of the peri-urban setting where  
259 the literacy level is higher. This was confirmed by the results, which showed that the level of  
260 knowledge is significantly influenced by age and education.

261

262 The moderately high knowledge levels about NCDs exhibited by the participants was however  
263 less than the level of good perception (81%). Findings revealed that the participants' perception  
264 about NCDs comorbidity are significantly influenced by age, gender, and education. Literature  
265 showed that most studies focused on knowledge, attitudes, and practices<sup>11-15</sup>. A few studies  
266 focusing on perceptions were conducted in developing countries<sup>6, 19</sup>, which made it difficult for  
267 the researchers to compare this study's findings with other studies conducted in developing  
268 countries. However, these results were different from the results in studies conducted in developed  
269 countries such as Japan, where a study that focused on migrant workers' perceptions about NCDs  
270 found poor knowledge and perceptions due to language barriers<sup>18</sup>. This study's results were also  
271 different from the results obtained in a South African study, where the perception about NCDs  
272 and/or chronic diseases was found to be negative, both in urban and rural areas<sup>15, 17</sup>. This study's  
273 results confirmed earlier findings that perception affects knowledge, but not all good perceptions  
274 translate into good knowledge<sup>15, 18</sup>.

275

276 NCDs are preventable, especially through positive and health-conscious lifestyles. Therefore,  
277 given the relatively moderate knowledge gap of 35%, it is important to educate PLHIV and the  
278 general populace of Zimbabwe on the benefits of healthy lifestyles, especially in relation to  
279 NCDs<sup>19</sup>. This is important for closing the knowledge gap. PLHIV usually attend counselling  
280 sessions and support group meetings, which must be used to narrow the knowledge gap. The  
281 narrowing of the knowledge gap is expected to further narrow the perceptions gap regarding  
282 NCDs.

283

284 The participants highlighted challenges as applicable to their care in terms of HIV and NCDs; one  
285 issue pointed out was the adherence to medication timetables as the time slot for taking medication  
286 may arrive when participant is away from their medication or simply forgetting due to busy  
287 schedules. Literature shows a variance between people drawn from LMICs and high income  
288 countries (HICs), with people from LMICs having poor medical adherence behaviour whilst those  
289 from HICs have higher adherence rates<sup>4, 9, 11</sup>. Several respondents pointed out that they are self-

employed, and their normal day is usually never planned hence this may lead to challenges in remembering the times for medication. The other issue pointed out was not unique, financial crisis was also categorised as one of the thematic areas of concern. In as much some of these medications are dispensed free of charge at Government facilities there is still transport cost to get to those facilities as well as other indirect costs and all these expenses are amid the country's poor economic status which makes it costly to the patients. Furthermore, the participants pointed out stigma from relatives and community at large as another major challenge mainly due to limited knowledge of the conditions in the society. This shows need for community education on NCDs for the families and the public as highlighted in the key literature reviewed<sup>6, 8, 9, 14</sup>,

The strength of the study is that it focused on PLHIV, therefore critical in enhancing care delivery systems focused on minimising the mortality of NCDs in this specific cohort of PLHIV, who are at an increased risk to NCDs. One of the weaknesses is that the study is cross-sectional, and the results present a snapshot and do not show a long-term trend. In addition, the study was conducted at one hospital only, making the generalisation of findings difficult. The informative outcome of the study can benefit from making the study longitudinal, thereby assessing the long-term effects of knowledge and perceptions on NCDs as well as mitigating situational bias. Moreover, the study will benefit from expanding on the explanatory factors affecting the level of knowledge and perceptions on NCDs.

## **Conclusion and recommendation**

The study concludes that there is a moderately high knowledge (65 percent) about NCDs in the catchment area of the CCH OIC. However, the knowledge level exhibited was lower than perceptions of the participants about the NCDs in PLHIV, where the participants' perceptions were 81 percent. It is therefore imperative to further narrow the knowledge gap identified.

Given the findings obtained and the factors that significantly influence knowledge and perceptions, the authors recommend more education of PLHIV regarding NCDs. Enhancement of knowledge will help improve the lifestyles of PLHIV and help in reducing the mortality of NCDs in PLHIV. Training should embrace PLHIV with lower educational achievements as well as the elderly since these were found to negatively influence knowledge levels as compared to those with higher educational levels and the young generation respectively. Furthermore, healthy lifestyles are

expected to minimise PLHIV's exposure to NCDs. Lessons on NCD risk factors should be incorporated into HIV counselling and support group sessions to enhance the knowledge levels of study participants.

## Abbreviations

<b>ART:</b>	Anti-retroviral therapy
<b>CCH:</b>	Chitungwiza Central Hospital
<b>CVD:</b>	Cardiovascular disease
<b>HIV:</b>	Human Immunodeficiency Virus
<b>NCDs:</b>	Non-Communicable Diseases
<b>OI:</b>	Opportunistic Infections
<b>PLHIV:</b>	People Living With Human Immunodeficiency Virus
<b>SSA:</b>	Sub-Saharan Africa

## End Materials

### Acknowledgements

We acknowledge the Chitungwiza Central Hospital Administration Staff for the approval and assistance during the data collection.

### Authors' contributions

**AC**, the Principal Investigator responsible for providing the overall direction and oversight of the study at all stages was fully engaged from project design to protocol development and obtaining ethical approvals, study conduct, data analyses and the dissemination of the study outcome.

**TB**, Supervisor and Co-Investigator, was responsible for technical direction, supervised and provided advice for all steps from project design to protocol development, and obtaining ethical approvals, study conduct, data analyses and the dissemination of the study outcome. Reviewed the final article.

### Competing interest statement

The authors declare that they have no competing interests.

### Ethics and consent

351 The Biomedical Research Ethics Committee of the University of Kwa-Zulu Natal (BE057/19) and  
352 the Medical Research Council of Zimbabwe (MRCZ/A/2441) granted ethical approvals.  
353 Participants provided informed consent prior to data collection and publication of the study  
354 findings, without any jeopardy to their image.

355

356 **Funding**

357 No external funding was received.

358 **Data availability**

359 Data is available from the power-BI repository and can be accessed through the Principal  
360 Investigator.

361 **Disclaimer**

362 The views and opinions expressed in this article are those of the authors and do not necessarily  
363 reflect the official policy or position of any affiliated agency of the authors.

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## CHAPTER FIVE

### SYNTHESIS/DISCUSSION

This chapter of the thesis discusses the findings obtained and presented in the three manuscripts, thus causing the preceding chapters to highlight the contribution of the thesis and implications of this work in a cohesive manner. The chapter also provide some recommendations and highlights future related research questions that still need to be addressed in research towards developing countries overcoming the public health burden caused by non-communicable diseases (NCDs) in PLHIV.

#### 5.1. Discussion

This section focuses on reviewing findings from the study relative to the literature as well as the existing body of knowledge about NCDs, especially in people living with HIV (PLHIV). NCDs have been escalating as a public health challenge for developing countries, which are handicapped in terms of resources, such as public health infrastructure, human resources, and financial resources, to respond to the challenge appropriately. Furthermore, the researcher reviews and compare findings in his study with other scholars and showcases the contribution of the current study to the discourse on NCDs in PLHIV. Lastly, in this chapter, demonstrations of the limitations of the study and its implications in the formulation of public health policy and practice are exhibited.

##### 5.1.1. Incidence of NCDs in PLHIV on ART

Hereunder are the key findings on the incidence of NCDs in PLHIV from a retrospective cohort study conducted at Chitungwiza Central Hospital:

- The most prevalent NCD was hypertension (8.9%), followed by diabetes (6.9%), cardiovascular diseases (3.9%) and lastly, cancer (1.9%).
- The incidence of NCDs showed an increasing trend as the time of follow-up progressed.
- Factors found to be significantly associated with the development of NCDs are gender, follow-up time and geographical location, with urban patients more likely to develop hypertension as compared to the peri-urban patients.

In the study, the researcher observed an increase in the incidence of all four NCDs studied, with differing magnitudes. Participants were more susceptible to hypertension, followed by diabetes, and the incidence was lowest for cancer. There is a need to respond equally to all NCDs due to their associated fatality rates, despite moderate or low incidences. For example, cancer is a leading cause of death globally. The researcher concluded that, based on the study's results, the likelihood of being diagnosed with hypertension increased as follow-up time increased, with the odds increasing from 7.860 to 9.449.

The burden of NCDs is not only prevalent in Zimbabwe but is a common public health challenge in the sub-Saharan Africa region, as observed in a scoping review by Mudie et al. [65]. This study's findings revealed that the most prevalent NCD was hypertension and diabetes was the second most prevalent NCD, results which were also confirmed by other studies from LMICs [60, 63]. This was likely due to hypertension and diabetes being common comorbid NCDs, which implied that they were more likely to affect the same patients. The least prevalent NCD was cancer in the scoping review by Mudie et al. [64], a result which was also confirmed by this study's findings. Despite the cancer incidence and prevalence being reported as low in this study and in other studies, it must be given equally high priority in its management because of the difficulty in its management and the high fatality rates associated with cancer [2, 28, 61].

### **5.1.2. NCD risk factors at Chitungwiza Central Hospital**

Increases in incidence cannot be explained merely by analysing the calculated incidence rates. Hence the researcher also analysed the risk factors associated with the development of various NCDs. Key findings include the following:

- The risk of developing and being diagnosed with NCDs increases with age.
- PLHIV living in urban areas are more susceptible to developing and being diagnosed with NCDs, whilst those living in rural areas were more prone to NCDs than those living in peri-urban areas, especially hypertension.
- Women are more likely to be diagnosed with NCDs than men.

The researcher calculated the odds of one developing an NCD against each risk factor and concluded that participants residing in urban areas were more likely to be diagnosed with NCDs when compared to those

in peri-urban locations. Based on the GEE model, the results showed that PLHIV in rural areas were about 1.5 times more likely to develop at least one NCD when compared to those residing in peri-urban areas. The findings confirmed results obtained by Kavishe et al. [66], who studied and found the prevalence of hypertension to be higher in the rural areas than in urban areas of Tanzania and Uganda. Several factors are associated with such a high incidence of NCDs in rural areas, which include but are not limited to lifestyle differences and the economic capacity to seek medical assistance. Participants aged 45 years and above were found to be more susceptible to the development and diagnosis of NCDs when compared to participants aged below 25 years. As people got older, they became more prone to different NCDs like hypertension and geriatric diabetes. This was consistent with several studies done in a number of LMICs where older participants in the cohorts were found to be more likely to be diagnosed with NCDs [4, 26, 60].

This study's findings revealed that the odds of being diagnosed with at least one NCD increased as follow-up time intervals increased. Since participants were enrolled onto ART at the start of the cohort study, the increase in follow-up time intervals was equivalent to the duration on ART. Therefore, participants were more likely to be diagnosed with NCDs as follow-up times increased because of the ageing of participants. These results were consistent with findings obtained in other longitudinal studies in other LMICs [26, 67, 68, 69]. However, the results showed that women were more likely to develop NCDs than men, but these results were not confirmed from literature as other studies revealed that males were more likely to develop NCDs [63]. The discrepancy could be attributable to the difference in study settings and the gender composition of the studies' participants, as in the current study 63% were females. In addition, the findings revealed that diagnosis with hypertension increased the odds of developing CVDs, and participants with CVDs were also more likely to develop cancer and become hypertensive. These results showed a cross-morbidity between hypertension and CVDs.

### **5.1.3. Physicians' perceptions of care delivery systems in place for NCDs**

The study sought to assess the availability and quality of NCDs clinical care based on the perceptions of physicians who attend to NCD patients at Chitungwiza Central Hospital (CCH). Key findings from the study were that:

- There are perceived notable NCD care delivery gaps of various levels for the four NCDs under consideration in the study.
- Physicians perceive cancer care and CVD care to be poorest at the CCH, whilst care for hypertension and diabetes are better off.
- A significant number of doctors who participated in the study perceived the quality-of-care services offered to NCD patients to be unsatisfactory overall.
- The authors observed that except for hypertension, which was screened for in most patients, physicians first checked clinical signs and symptoms in order to request further tests. This is a matter of concern since NCDs may take time to be evident clinically, and in most cases will show signs at advanced stages, leading to poor prognosis of the condition.

Twenty-three doctors participated in the study: four females and nineteen males. Nineteen of the doctors were general practitioners, whilst four were specialists. Findings showed that both categories of physicians perceived shortfalls in the clinical care for NCDs. Moreover, the perceptions of general practitioners and specialists were not significantly different. Participants perceived cancer care to be lagging far behind the other three NCDs under study. Care for cardiovascular diseases (CVDs) and diabetes showed mixed perceptions amongst participants, with positive perceptions almost equalling negative perceptions. Furthermore, hypertension was perceived to be clinically cared for better than the other NCDs under consideration. Reasons for the gaps in NCD clinical care were attributed by 33% of the participants to financial challenges; whilst a further 27% was attributed to patient behavioural challenges and 21% to communication challenges. The findings were, however, not comparable to other studies done elsewhere, the only convergence was that care for NCD patients was poor. A study in Malawi found that only 5 out of 32 structural criteria were met at all 5 clinics and 9 out of 29 process criteria were never performed at any clinic in the study [70]. The only process criteria performed at all five clinics was measurement of blood pressure [70]. Findings in the current study also agrees with Wood et al., (2015) in relation to some of the challenges faced in NCDs care, that is, staff's knowledge on NCDs was basic and the main barriers to providing quality care were lack of medication and essential equipment, inadequate knowledge and guidelines, fee-for-service at two clinics, geographic inaccessibility, and lack of confidence in the primary health care system by patients [70]. The findings were also to some extent similar to results shown in a systematic review of studies on NCDs care in South Asia in which from the 829 identified studies, 13 were included in the review for in-depth analysis. Most



of the studies focused on cancer followed by diabetes and cardiovascular disease. NCDs care can be improved through establishment of community and clinic-based screening, NCD care education, NCD specialized corner or hospital, and a follow-up system ensure patient satisfaction, accessibility, early detection, timely referral, and help to reduce disease severity, mortality rate, and incidence of the new disease [71]. There is therefore need and scope for improving NCDs care in resource limited setting such as Zimbabwe where this study was conducted as shown by literature for studies done in Malawi which is a country within the Southern African region and the South Asian system review results.

#### **5.1.4. Knowledge and Perceptions of non-communicable diseases by PLHIV**

The study also evaluated the knowledge levels and perceptions of PLHIV about NCDs and the extent to which they were exposed. This was motivated by the extension of lifespans for PLHIV as a result of the introduction of ART, which has significantly reduced mortality for PLHIV. Key findings from the study are:

- 65% of participants were knowledgeable about NCDs and their nexus with HIV.
- 81% of study participants indicated positive perceptions about NCDs and their effects on PLHIV given their extended longevity due to their uptake of ART.
- Study findings showed that 21% of the participants were living with HIV and affected by more than one NCD.
- Factors affecting participants' knowledge about NCDs, and the possibility of comorbidity or multi-morbidity were found to be significantly influenced by age, <40 years ( $p < 0.005$ ), and history of NCD in the family ( $p < 0.005$ ).
- Perceptions were found to be significantly influenced by gender, female ( $p < 0.005$ ) and knowledge ( $p < 0.005$ ); whilst increasing age ( $p < 0.005$ ) and low education negatively impacted the perceptions ( $p < 0.001$ ).

The odds of participants older than 40 years of age were 40% less likely to be knowledgeable, as compared to those under 40 years ( $p\text{-value} = 0.003$ ). Furthermore, the participants who attained a primary education level or less were 0.55 times less likely to be knowledgeable about NCDs when compared to those with a tertiary education ( $p\text{-value} = 0.020$ ). Participants whose family members had a history of

NCD conditions were 1.9 times more likely to be knowledgeable when compared to those with no history of NCDs in their families ( $p\text{-value} = 0.001$ ).

On the other hand, female participants were 1.8 times more likely to have a good perception of the management of NCDs compared to male participants ( $p\text{-value} = 0.043$ ). Furthermore, the odds of participants older than 40 years of age were approximately 0.1 times likely to have a good perception of NCDs compared to those younger than 40 years ( $p < 0.001$ ). Participants who achieved a primary education level or less were about 0.2 times more likely to have a good perception of NCDs than those with a tertiary education ( $p < 0.001$ ). However, gender and history of NCD conditions in the family were not significantly associated with the knowledge and perceptions thereof, respectively.

The moderately high knowledge levels of PLHIV exhibited in the study are not consistent with other prior studies that have shown a significantly poor knowledge of NCDs [7,15,72]. The moderately high knowledge level exhibited by the participants is likely to have been a result of the demographics of the population served by the OIC, which is situated in a peri-urban setting. Moreover, the level of knowledge shown by the participants was higher than other studies conducted in rural areas in Zimbabwe, such as research by Chimberengwa and Naidoo [73], who conducted a study in a rural setting and found poor knowledge of hypertension, results that are inconsistent with this study's findings. The level of knowledge was expected to be higher because of the peri-urban setting where the literacy level is higher. This was confirmed by the results, which showed that the level of knowledge is significantly influenced by age and education.

The moderately high knowledge levels on NCDs exhibited by the participants were however less than the level of good perception (81%). Findings revealed that the participants' perceptions of NCDs comorbidity are significantly influenced by age, gender and education. Literature showed that most studies focused on knowledge, attitudes and practices [64,74]. Only a few studies focusing on perceptions were conducted in developing countries [15,75], which made it difficult for the researchers to compare this study's findings with other studies conducted in developing countries. However, these results were different from the results in studies conducted in developed countries such as Japan, where a study that focused on migrant workers' perceptions about NCDs found poor knowledge and perceptions due to language barriers [76]. This study's results were also different from the results obtained in a South African study, where the perception of NCDs and/or chronic diseases was found to be negative, both in

urban and rural areas [64,77]. This study's results confirmed earlier findings that perception affects knowledge, but not all positive perceptions translate into good knowledge [64, 67].

## **5.2.Conclusions**

This study's findings revealed that the most prevalent NCD was hypertension and diabetes was the second most prevalent NCD, which was likely due to hypertension and diabetes being common comorbid NCDs, implying that they were more likely to affect the same patients. All NCDs under study; that is hypertension, diabetes, cancer and CVDs were found to progress constantly over time, as the incidence rates after the first five years had increased by the same magnitude as the incidence rates recorded after the subsequent five years. The increase in NCDs incidence was supported by results of the GEE model. Thus, Chitungwiza and the CCH OIC catchment area has a high prevalence of hypertension and diabetes in PLHIV. Therefore, there is a need for a multiple stakeholder approach to managing NCDs, especially in PLHIV, given the fact that more effort is needed for the management of the least prevalent NCDs (cancers and CVDs) due to their high mortality rates, as reported in literature, since cancer is now a leading killer globally.

The study findings also showed that the clinical care offered for most NCDs at CCH is not of the quality and standard expected by the physicians to reduce the morbidity and mortality for the NCDs under consideration in the study. The quality of clinical care is also compromised by challenges affecting healthcare institutions in Zimbabwe, where there is an unavailability of sufficient equipment and/or affordable services for NCD care. Medical supplies are also limited in terms of availability and affordability. In addition, physicians at CCH perceived the existence of informational and knowledge gaps in the care and management of NCDs by patients. Doctors also observed that NCD patients fail to adhere to treatment protocols due to religious and traditional beliefs. Based on the findings obtained in the study, the following conclusions were drawn regarding doctors' perceptions of care delivery for NCD patients at CCH:

- a) Care delivery for NCD patients is perceived by some doctors as being unsatisfactory in meeting the requirements of the patients since there were challenges impeding their delivery of clinical care to NCD patients.

- b) There are no clear guidelines and policies for healthcare practitioners on clinical care delivery for NCD patients. As a result, doctors do not have benchmarks for care delivery, as was evidenced by the varied responses from the doctors regarding the care of patients.
- c) There are no standard protocols for screening and managing NCDs. Standard protocols encourage the early diagnosis of NCDs and are likely to improve the quality of care, resulting in healthcare that is safe, effective, timely, efficient, equitable and patient-centred.

Although the results of the study presented a snapshot of the status of PLHIV's knowledge and perceptions about their exposure to NCDs, the study also concluded that there is a moderately high knowledge (65 percent) about NCDs in the catchment area of the CCH OIC. However, the knowledge level exhibited was lower than the levels of positive perceptions of the participants about NCDs in PLHIV, where the participants with positive perceptions were 81 percent of the participants in the study. It is therefore imperative to further narrow the knowledge gap identified and further enhance the perceptions of PLHIV regarding their exposure to NCDs.

### **5.3.Recommendations**

The mortality of PLHIV was significantly reduced by the introduction of ART. There has also been a global promotion of people knowing their HIV status, as well as the need to ensure that those who are HIV-positive commence ART through the 95-95-95 treatment targets meant to end the HIV pandemic by 2030. Significant progress was realised towards the set targets, which significantly reduced the mortality rates and threats caused by HIV. However, the public health benefits realised in ending the HIV and AIDS pandemic are under threat due to the higher incidence and prevalence of NCDs in PLHIV. Based on the conclusions presented in the preceding section, the study recommends the following:

- a) More effort is needed for management of the least prevalent NCDs (cancers and CVDs) due to their high mortality rates, as reported in literature, since cancer is a leading killer globally. Therefore, the author recommends the need for enhanced efforts towards the management of cancers and CVDs to minimise the incidence rates of these two NCDs due to their high mortality rates especially shown by statistics of cancer related deaths globally.
- b) The management at CCH have to consider deliberate policies for enhancing the quality of clinical care provided to NCD patients through the development and implementation of a service level agreement. Since CCH is a provincial hospital, the proposed policy can be disseminated to district

clinics and hospitals. It is also recommended that all medical staff such as nurses be capacitated to offer acceptable quality NCD care to patients. Moreover, clinical processes must be re-engineered to ensure that NCD care is an integral part of patient care procedures at the institution including integration of HIV and NCD care for PLHIV. These recommendations are envisaged as having the ability to improve the quality of NCD clinical care at CCH and other institutions may do the same and modify according to their institutional uniqueness and preferences.

- c) Given the findings obtained and the factors found to significantly influence knowledge and perceptions, the study recommends more tailor-made education of PLHIV regarding NCDs as well as carers / family members to increase support for NCD/HIV sufferers. This enhancement of knowledge will help improve the lifestyles of PLHIV and help in reducing the mortality of NCDs in PLHIV. Training should also accommodate PLHIV with lower educational achievements as well as the elderly, since these were found to negatively influence knowledge levels as compared to those with higher educational levels and the young generation respectively. Furthermore, healthy lifestyles are expected to minimise PLHIV's exposure to NCDs. Lessons on NCD risk factors should be incorporated into HIV counselling and support group sessions to enhance the knowledge levels of study participants.

#### **5.4.Scope for future research**

The public health challenges caused by NCDs globally are huge as NCDs are the leading cause of death and the trajectory is expected to continue. The NCD public challenges are even worse in low-income countries where public health institutions are under-resourced and ill-equipped to deal with communicable diseases which have ceased to be public health challenges. The study focused on the public health challenges caused by NCDs in PLHIV, which represents a smaller population as only 37.7 million people were living with HIV in 2020. The study therefore recommends the expansion of the scope of the current study to incorporate other at-risk population groups besides PLHIV in order to ensure that the public health challenges caused by NCDs, and the related mortalities are minimised. This is important to ensure that countries such as Zimbabwe develop interventions that cover the most affected population groups and achieve the greatest impact for reducing the mortality of NCDs. Moreover, there is need to consider larger study beyond CCH with a scope for expanding the reach of the current study by focusing on areas most affected with the HIV pandemic in Zimbabwe, focusing on PLHIV residing in farming communities who have limited access to healthcare facilities due to accessibility challenges. Future

studies should also consider exploring multiple morbidity of NCDs – and implication for NCD treatment in addition to HIV care.

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## APPENDICES

### Study Ethical Clearance (BREC Approval)



Amended letter

05 July 2019

Mr A Cheza  
School of Nursing and Public Health  
College of Health Sciences  
[Alexandercheza@gmail.com](mailto:Alexandercheza@gmail.com)

Dear Mr Cheza

Protocol: Non-Communicable Diseases (NCDs) Among Patients on ART in a Developing Country:  
Case of Chitungwiza Central Hospital. Degree: PhD BREC Ref No: BE057/19

#### EXPEDITED APPLICATION: APPROVAL LETTER

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 31 January 2019.

The study was provisionally approved pending appropriate responses to queries raised. Your response received on 20 June 2019 to BREC letter dated 12 June 2019 has been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have been met and the study is given full ethics approval and may begin as from 05 July 2019. Please ensure that site permissions are obtained and forwarded to BREC for approval before commencing research at a site.

This approval is valid for one year from 05 July 2019. To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at <http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx>.

BREC is registered with the South African National Health Research Ethics Council (REC-290405-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 67B).

The sub-committee's decision will be noted by a full Committee at its next meeting taking place on 13 August 2019.

Yours sincerely

A handwritten signature in black ink, appearing to read 'D Wassenaar', is written over a horizontal line.

Prof D Wassenaar  
Acting Chair: Biomedical Research Ethics Committee

cc: Postgrad administrator: [grm@ukzn.ac.za](mailto:grm@ukzn.ac.za) Supervision: [hou@ukzn.ac.za](mailto:hou@ukzn.ac.za) [ds@ukzn.ac.za](mailto:ds@ukzn.ac.za)

Biomedical Research Ethics Committee

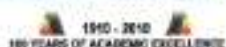
Professor V Rambirich (Chair)

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Website: <http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx>



Founding Campuses: Eldersburg Howard College Medical School Pietermaritzburg Westville

## Study Ethical Clearance (MRCZ Approval)

Telephone: 791792/791193  
Telefax: (203) -4- 790733  
E-mail: [secret@mrcz.org.zw](mailto:secret@mrcz.org.zw)  
Website: <http://www.mrcz.org.zw>



Medical Research Council of Zimbabwe  
Joshua Tsenganga / Mazoe Street  
P. O. Box CY 572  
Causeway  
Harare

### APPROVAL LETTER

MRCZ/A/2441

29 April, 2019

Mr. Alexander Cheza  
14295 Zengeza 3 Extension  
Chitungwiza  
Harare

**RE: Non-Communicable Diseases (NCDs) Among Patients on ART in a Developing Country: Case of Chitungwiza Central Hospital**

Thank you for the application for review of Research Activity that you submitted to the Medical Research Council of Zimbabwe (MRCZ). Please be advised that the Medical Research Council of Zimbabwe has reviewed and approved your application to conduct the above titled study.

This approval is based on the review and approval of the following documents that were submitted to MRCZ for review:-

1. Study Protocol
2. Informed Consent Forms (English and Shona)
3. Data Collection Tools

• **APPROVAL NUMBER** : MRCZ/A/2441

This number should be used on all correspondence, consent forms and documents as appropriate.

• **TYPE OF MEETING** : Full Board

• **MEETING DATE** : 28 February 2019

• **APPROVAL DATE** : 25 April 2019

• **EXPIRATION DATE** : 24 April 2020

After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the MRCZ Offices should be submitted three months before the expiration date for continuing review.

• **SERIOUS ADVERSE EVENT REPORTING:** All serious problems having to do with subject safety must be reported to the Institutional Ethical Review Committee (IERC) as well as the MRCZ within 3 working days using standard forms obtainable from the MRCZ Offices or website.

• **MODIFICATIONS:** Prior MRCZ and IERC approval using standard forms obtainable from the MRCZ Offices is required before implementing any changes in the Protocol (including changes in the consent documents).

• **TERMINATION OF STUDY:** On termination of a study, a report has to be submitted to the MRCZ using standard forms obtainable from the MRCZ Offices or website.

• **QUESTIONS:** Please contact the MRCZ on Telephone No. (04) 791792, 791193 or by e-mail on [secret@mrcz.org.zw](mailto:secret@mrcz.org.zw)

#### Other

- Please be reminded to send in copies of your research results for our records as well as for Health Research Database
- You're also encouraged to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study.
- In addition to this approval, all clinical trials involving drugs, devices and biologics (including other studies focusing on registered drugs) require approval of Medicines Control Authority of Zimbabwe (MCAZ) before commencement

Yours faithfully,

MRCZ SECRETARIAT  
FOR CHAIRPERSON  
MEDICAL RESEARCH COUNCIL OF ZIMBABWE

PROMOTING THE ETHICAL CONDUCT OF HEALTH RESEARCH

MEDICAL RESEARCH COUNCIL OF ZIMBABWE

2019-04-25

APPROVED

<http://www.mrcz.org.zw>

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Language Editing Letter

696 Clare Road

Clare Estate

Durban

4091

27 August 2022

To: Whom it may concern

Editing of PhD: ALEXANDER CHEZA

NON- COMMUNICABLE DISEASES AMONG PEOPLE LIVING WITH HIV AT CHITUNGWIZA  
CENTRAL HOSPITAL IN ZIMBABWE

This letter serves as confirmation that the aforementioned thesis has been language edited.

Any queries may be directed to the author of this letter.

Regards



MP MATHEWS

Lecturer and Language Editor

Mercimathews4@gmail.com

083 676 4778