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Hypertension in South Africa between 2008 and 2017: An analysis of National Income Dynamics Study Data by

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Submitted

in partial fulfilment of the academic

requirements for the degree of Master

in Population Studies

in the School of Built Environment and Development Studies,

University of KwaZulu-Natal

Howard College Campus

Durban

November 2020

Declaration

I, Simangele Azande Shezi, declare that:

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2. This dissertation has not been submitted for any other degree or examination at any other university.

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Abstract

The world is faced with unprecedented increases in non-communicable and lifestyle-related diseases. This growth is of grave concern as these diseases have become the leading cause of global mortality. Hypertension is one of the leading lifestyle-related diseases. In South Africa, the increase in the prevalence of hypertension seeks to threaten a healthcare sector that is already inundated with a high burden of HIV/AIDS, tuberculosis as well other infectious and non-communicable diseases. Against this backdrop, this study aimed to determine the burden of hypertension between 2008 and 2017 in South Africa as well as the demographic and socioeconomic profiles of those that are at risk in order to contribute to the growing but limited existing body of literature that examines this. It is a quantitative study which analysed secondary data from the National Income Dynamics Surveys' Waves 1 and 5 using multivariate logistic regression to determine the relationship between independent demographic and socioeconomic variables and hypertension. The sample size from this data is over 28 255 individuals and 7305 households. The study also employed the Social Determinants of Health (SDOH) as the underlying theoretical framework to guide the study.

Key findings indicate that overall, there is a significant association between high blood pressure and demographic and socioeconomic factors amongst South African adults. High blood pressure was highest amongst females than males and those aged 65+. The data analysis also revealed that high blood pressure was impacted by marital status, wealth quintile, educational attainment and employment status. Interestingly, contradictory to the literature reviewed, the study found that White South Africans were most at risk instead of Africans. Whilst the literature highlighted the importance of behavioural changes to combat hypertension, it equally emphasized the need to look at health factors beyond biological and genetic factors. The study recommends that future policies and intervention strategies recognize that improving the socioeconomic status and decreasing demographic inequality is imperative in any attempts aimed at decreasing negative health outcomes. Underestimating the influence these factors have, will lead to futile combat efforts as the prevalence of hypertension and other diseases grow rapidly.

Keywords: hypertension, demographic determinants, socioeconomic determinants, lifestyle-related diseases, non-communicable, South Africa

Acknowledgements

“To accomplish great things, we must dream as well as act.” ― Anatole France

I am overwhelmed with joy at the thought of how far I have come. Throughout the journey of acquiring this degree, I have learned a great deal which I am eternally grateful for. I did not achieve this for or by myself, and I would like to express my sincerest gratitude to all those that contributed.

I would like to first and foremost give praise to God Almighty. He has made all things work together for my good as He promised.

I would like to extend my sincerest gratitude to my supervisor, Dr Kerry Vermaak. Your patience, humility and encouragement made this journey less traumatising. I am grateful for all that you have done for me.

To my family, especially my two moms- Mrs Nonsikelelo Shezi and Miss Kholiwe Madlala, thank you for your spiritual, mental, and financial support. This Masters would not have been possible without you, and therefore I dedicate it to you. I would also like to thank my sister Nonduduzo Shezi as well as my nieces and nephews for their unwavering support and cheering me on during my down moments. I love you all.

To my best friends and sisters- Amanda Gumede and Philile Gumede, I am short of words to express my gratitude for your support. Thank you for reminding me of my capabilities when I had lost hope. You are both my strength, and I love you both so much.

Finally, to my close friends Qiniso Khumalo, Zuziwe Ndlela, Simtholile Mavundla, and all those I have not mentioned, I truly appreciate you and this win is for all of us.

Acronyms

CI	Confidence Interval
CSDH	Commission on Social Determinants of Health
CSMs	Continuing Sample Members
GDP	Gross Domestic Product
HSSREC	Human and Social Sciences Research Ethics Committee
ILO	International Labour Organization
NDP	National Development Plan
NHI	National Health Insurance
NIDS	National Income Dynamics Survey
PSUs	Primary Sample Members
SALDRU	Southern Africa Labour and Development Research Unit
SDGs	Sustainable Development Goals
SDOH	Social Determinants of Health
Stats SA	Statistics South Africa
UCT	University of Cape Town
UNICEF	United Nationals International Children's Emergency Fund
WHO	World Health Organization

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The prevalence of non-communicable and lifestyle-related diseases as the leading cause of mortality is an issue of serious global concern (Spires 2016). Approximately 17 million deaths per annum are attributable to cardiovascular diseases alone (Rahman *et al.* 2019), with hypertension being one of the leading and most important modifiable factors of cardiovascularrelated morbidity and mortality (Nkondjock & Bizome 2010; Pilakkadavath & Shaffi 2016). Globally, Africa has the highest rate of hypertension amongst adults (Berry *et al.* 2017). The increase in non-communicable diseases arises amidst various political, social, economic, and health-related challenges already faced by the continent (Chiedozie 2016).

In South Africa, the growth in the prevalence of hypertension is particularly unsettling as the healthcare sector is already faced with a high burden of HIV/AIDS, Tuberculosis as well as a myriad of other infectious and non-communicable diseases (Brennan *et al. 2018*). Additionally, there are various challenges when it comes to identifying and managing hypertension in South Africa. The profiling of those at risk of hypertension is, therefore, imperative in order to devise suitable combat strategies (Berry *et al.* 2017).

Lifestyle diseases are diseases that are associated with the lifestyle choices that individuals make daily and are thus considered preventable through lifestyle modification (Gopal & Raj 2017 ; Gupta *et al.* 2017) Lifestyle diseases are often associated with behavioural risk factors such as alcohol abuse, unhealthy diet, smoking, and physical inactivity (Barnes 2013; Berry *et al.* 2017; Tabish 2017). In the South African context, the historical background which led to the marginalization of various groups often impedes access to healthcare for those who are unequally affected by diseases and exposure to risk (Benatar 2013; Burger & Christian 2018). While various lifestyle diseases are affecting South Africa, hypertension is one of the most dominant (Govuzela *et al.* 2018; Mangena *et al*. 2016).

Dubbed “the silent killer”, hypertension has proven to be a severe public health issue (Arima *et al.* 2011; Nuraini 2015). In low- and middle-income countries, hypertension remains harder to detect, treat, and prevent (Mills *et al.* 2014; Tibazarwa *et al.* 2014). According to Ndinda *et al.* 2018, by the year 2030, non-communicable diseases will affect an estimated 52 million of the

global population, of which approximately 80% is predicated would be in low- and middleincome countries.

Additionally, in South Africa, non-communicable diseases have and continue to become a significant part of the country's health profile diseases, which in turn puts tremendous strain on healthcare services (Puoane *et al.* 2017). The former national health director-general Precious Matsoso argued that non-communicable diseases such as hypertension would become a problem for the proposed National Health Insurance system which seeks to equalize access to healthcare, by putting a strain on resources for chronic care (Skosana 2013).

Considering South Africa's attempts to provide better health care for all its citizens, it is essential to have profiles of dominant diseases, especially those that have increased drastically over the years and that poses a severe threat to the health sector. This study, therefore, purposes to provide a demographic and socioeconomic profile of the prevalence and risk of high blood pressure amongst South African adults over ten years spanning from 2008-2017.

1.2 Background of the Study

The poor quality of early life in the first densely human settlements habitats provided a conducive environment for the breeding and spread of communicable diseases, leading to high mortality attributable to infectious diseases (Ortiz-Ospina & Roser 2016). However, following the industrialization and modernization of the world, which saw improvements in the environment, food, and medication, life expectancy has greatly increased in comparison to earlier centuries (Finch 2010). This shift has resulted in a decrease in the number of deaths caused by communicable diseases and a significant increase in the prevalence of noncommunicable or degenerative diseases (Kahn *et al.* 2010).

While the international healthcare community has made tremendous progress in its fight against infectious diseases by virtue of technological advancements, the tide has turned as noncommunicable diseases sweep over the world (Hunter & Reddy 2013). The World Health Organization (WHO) estimates that non-communicable diseases are responsible for approximately 41% of the deaths across the globe, of which approximately 32 million of those deaths occur in low income and middle-income countries (WHO 2018). The high death rates in these countries indicate that it is the poorest countries that are most affected by noncommunicable diseases combined with the high prevalence of infectious diseases, economic and political instability as well as other social mishaps which compromises their ability to effectively deal with unrelenting health issues (Kankeu *et al.* 2013).

South Africa being a developing country, shrouded by the consequences of historical inequities previously entrenched in the apartheid era laws, the burden of providing healthcare services for the majority of the population falls mostly on the state (Rayner 2010). In their March 2018 statistical released report titled, '*Mortality and causes of death in South Africa, 2016: Findings from death notification'*, Stats SA (2018) reported that although Tuberculosis and HIV/AIDS remain the leading causes of mortality in South Africa, non-communicable diseases in the periods between 2011-2016 gained momentum.

South Africa's health profile is comprised of a quadruple burden of disease due to the HIV/AIDS epidemic, communicable diseases, interpersonal violence, and injuries, as well as non-communicable diseases (Pillay-van Wyk *et al*. 2016). Thus, for health policies to effectively deal with the accelerating levels of hypertension, there is a need for an understanding of the conditions that enable it to flourish (Jardim *et al.* 2017). South Africa's society is plagued with various demographic and socioeconomic factors that lie outside of the healthcare system, which greatly contributes to its disease burden (Maphumulo & Bhengu 2019). It is, therefore, against this backdrop that this research launches itself.

1.3 The rationale of the Study

As aforementioned, the prevalence of hypertension in adults, especially in developing countries, has taken a turn for the worst with estimates suggesting that over a third of African adults are hypertensive (Tibazarwa *et al.* 2014). In South Africa, access to primary health care services and the distribution of health resources is unequal amongst population groups, gender, socioeconomic groups, and geographical location as well as across other social, economic, and demographic boundaries (Maphumulo & Bhengu 2019; Stats SA 2019). An analysis of data from the *South African National Health and Nutrition Examination Survey of 2011-2012* found that the prevalence rate of hypertension for adults aged 15 years and older was 35.1 % (Berry *et al.* 2017). This increase in the prevalence of chronic lifestyle diseases is of grave, serious public health concern and requires adequate understanding in order for it be dealt with accordingly (Jardim *et al.* 2017).

Hypertension affects South Africans of all demographic groups (Sliwa *et al.* 2014). However, due to the country's historical background, different demographic and socioeconomic groups are disproportionately affected (Ataguba *et al.* 2011). Although there is an increase in the number of studies that focuses on chronic lifestyle disease, context-specific research is rather

minimal (Khalil *et al.* 2015). Context-specific research is vital for policy-making decisions with the aim of developing effective interventions (Tomoaia-Cotisel *et al.* 2013).

1.4 Aims and Objectives

This study aims to determine the burden of hypertension between 2008 and 2017 in South Africa as well as the demographic and socioeconomic profiles of those that are at risk. The specific objectives are as follows:

1. To determine the prevalence of hypertension in 2008 and 2017 among adults in South Africa.
2. To determine whether there is a significant association between demographic factors and hypertension in 2008 and 2017
3. To determine whether there is a significant association between socioeconomic factors and hypertension in 2008 and 2017

The study aims to answer the following questions:

- How has the burden of hypertension changed in South Africa between 2008 and 2017?
- Is there a significant association between demographic factors and hypertension in 2008 and 2017?
- Is there an association between socioeconomic factors and hypertension in 2008 and 2017?

1.5 Data

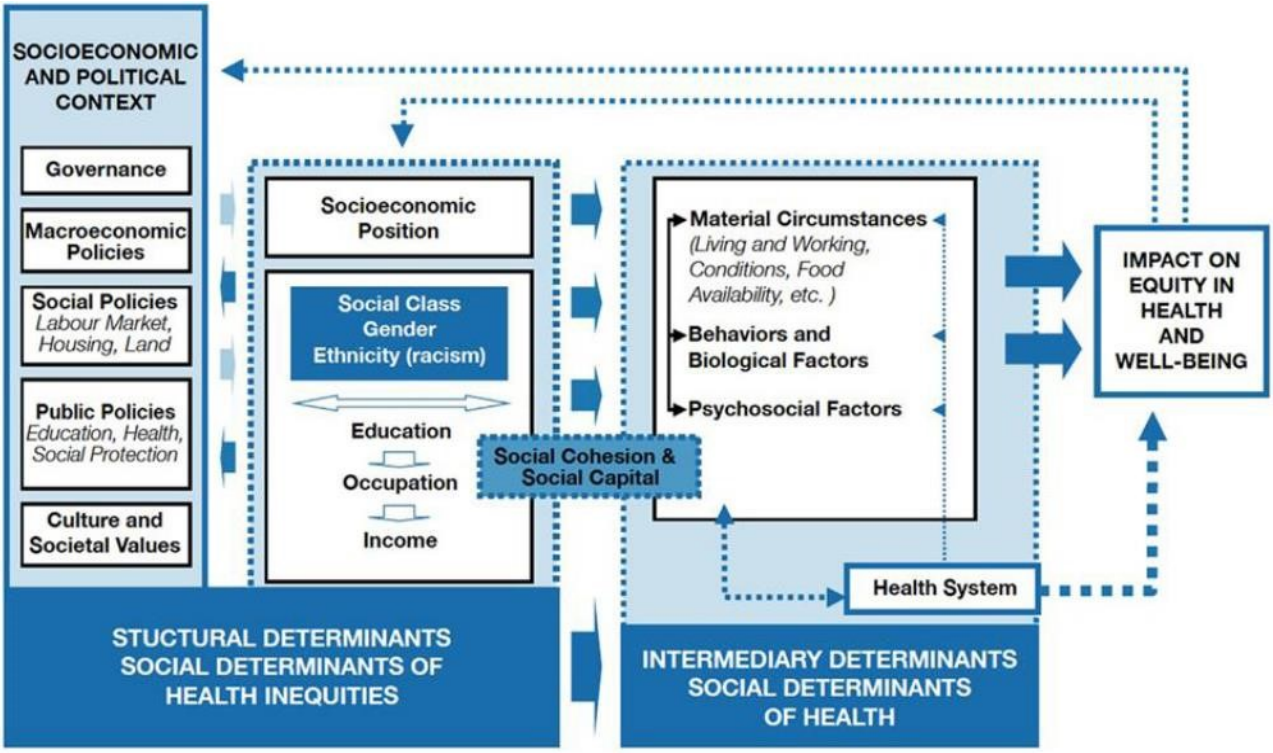
This research analyses secondary data obtained from the National Income Dynamics Study (NIDS) Waves one and five. Wave one was the first study undertaken in 2008, and Wave five was released on the 13th of August 2018. The primary investigator for this research is the Southern Africa Labour and Development Research Unit (SALDRU), which is affiliated to the University of Cape Town (UCT) with aid from the Department of Planning, Monitoring, and Evaluation. The study was conducted in all nine South African provinces with households and individuals being the units of analysis excluding those in nursing homes, hostels, hospitals, military barracks as well as student hostels. It is a longitudinal study that covers aspects including but not limited to health, education, race, employment, mortality, the standard of living and agriculture amongst children and adults. The sample size from this data is over 28

255 individuals and 7305 households, which is generalizable to the entire population as it possesses characteristics of the population represented (Leibbrandt *et al.* 2009).

1.6 Theoretical Framework

The study's underlying framework is the Social Determinants of Health (SDOH) compiled by the WHO's Commission on Social Determinants of Health (CSDH). According to Magnan (2017), health outcomes are influenced by conditions that exist outside the clinical walls. The CSDH therefore illustrates how determinants such as employment status, educational attainment, occupation, place of residence, marital status and more play a role in the exposure to risk and the overall health of populations (Solar & Irwin 2010).

Figure 1.1: A summary of the CSDH framework



Source: Solar & Irwin (2010)

The CSDH adopts a human rights-based approach to reducing health inequity based on the advancement of existing related theories (Solar & Irwin 2010). Health inequities, as opposed to health inequalities, are intentional and avoidable as they are produced socially and perpetuated through systematic and unfair distribution across the population (Malqvist *et al.* 2012). Hence health inequities are referred to as avoidable inequalities (Solar & Irwin 2010). The CSDH groups health determinants into three broad categories, namely the socioeconomic

and political context, the social determinants and socioeconomic position and the intermediary determinants of health (Solar & Irwin 2010).

The SDOH framework emphasizes social position as a critical feature of health determinants (Malqvist *et al.* 2012). The framework is placed within a socioeconomic and political context that includes the government and its' macroeconomic policies, social policies that include policies related to the labour market, housing and land, public policies such as those related to education, health and social protection and lastly cultural and societal values (Solar & Irwin 2010). The interaction between the socioeconomic position and the political context results in the social position of the individual. The individuals' social position then determines social class, educational attainment, occupation, and level of income. The CSDH also recognizes gender, race or ethnicity as being influential in determining the social position of individuals (Solar & Irwin 2010). Together the socioeconomic and political context and socioeconomic position make up the structural determinants which then operate through intermediary determinants to produce and configure health inequities (Solar & Irwin 2010)

Income levels have the power to influence material circumstances, which directly influences health outcomes (Solar & Irwin 2010). Societies with high-income inequality observe poorer health in comparison to their less unequal societies (Pickett & Wilkinson 2015). Those that earn higher in society have better social and health outcomes (Rowlingson 2011). Although income on its' own does not influence health outcomes, it does, however award individuals the power to modify their material circumstances so that it promotes good health (Solar & Irwin 2010). Compared to all the other socioeconomic indicators, income is the one indicator that can change the most and in a short space of time (Solar & Irwin 2010). Therefore, using income as a direct measure of health is problematic as it is not a simple variable, but rather it is made up of multiple components such as dividends, maintenance, wage earnings, pensions, and more (Solar & Irwin 2010). In order to avoid the challenges that come with using income as an indicator, this study will instead adopt wealth quintile rather than income.

One of the most useful predictors of health outcomes is education (Solar & Irwin 2010). Education increases the prospects of better living standards in the future as it opens doors for better economic opportunities (Akande 2016). Education allows individuals to carve their own socioeconomic status as one's initial status is inherited from their parents (Solar & Irwin 2010). Access to early good quality education is not only essential to set one up for access to resources that could enhance their health in their adulthood, but it is also crucial for how receptive one is

to health knowledge and education (Solar & Irwin 2010). Therefore, not being able to access education from a young age can lead to adverse health outcomes by carving a path of social and economic inequalities (Solar & Irwin 2010).

Occupation is a strong determinant of social standing (Solar & Irwin 2010). However, as a socioeconomic status indicator in health research, it is often not as clearly understood due to its ambiguity in what it represents which is both health-enhancing resources and healthdamaging hazards (Fujishiro *et al.* 2010). Health is unevenly distributed by occupation as each occupation indicates potentially hazardous gases that one is or might be exposed to (Ravesteijn *et al.* 2013). It also indicates the type of psychological and physical stress that one may endure due to work related demands, which can severely influence health outcomes (Marabotti *et al.* 2017). One's occupation is often related to their level of income, intellectual capabilities, and overall social standing (Solar & Irwin 2010). Income level because of its' relation to ones' occupation, is found to be a useful predictor of health outcomes as it also determines the type of resources one will have access to therefore directly influencing their health (White *et al.* 2015). The use of occupation as an indicator has its limits as it excludes crucial groups of people (Solar & Irwin 2010). Amongst the excluded groups are those that have retired, those that are not currently employed, students, those with informal and illegal jobs, therefore making it unreliable as the only source of information (Solar & Irwin 2010). It is for this reason that this study will make use of employment status rather than occupation to understand its impact on the risk of hypertension.

Gender is an important part of health-related health inequities (Men *et al.* 2011). The socially designated roles of men and women are significant sources of gender-based discrimination (Solar & Irwin 2010). The ideas surrounding masculinity that promote irresponsible behaviours amongst boys, such as alcoholism and irresponsible sexual practices, have dire health implications (Fleming *et al.* 2016; Hunt & Antin 2019). Women, however, are the most affected by gender divisions as being a woman inevitably means that they have limited access to power and resources, which translates to unequal access to health facilities and health knowledge (Solar & Irwin 2010). In many societies, women are victims of female genital mutilation and domestic violence (Williams-Breault 2018). Women are also disproportionately affected by health despite their longer life expectancy compared to their male counterparts due to unequal income and opportunities which further perpetuates the dominance and dependency of women on men (Malmusi *et al*. 2014). Therefore, significant levels of negative health outcomes are likely to be avoided by fighting gender divisions (Solar & Irwin 2010).

The CSDH added race and ethnicity to the framework as a problem to health outcomes (Solar & Irwin 2010). Racial and ethnic categorization often leads to the unfair discrimination of perceived inferior and minority groups based on cultural and skin colour distinctions (Williams *et al.* 2016). Racial and ethnic discrimination lead to the denial of resources and opportunities based on these grounds, which affects the discriminated groups' social standing and life trajectory (Stanley *et al.* 2019).

Intermediary determinants include material circumstances, behaviours, and biological factors, as well as psychosocial factors (Solar & Irwin 2010). Material circumstances include things such as living and working conditions, availability, and the ability to purchase healthy food, which is influenced mainly by a person's social class and income (Solar & Irwin 2010). Psychosocial circumstances refer to the stressful living conditions and relationships that one may find themselves in, various psychosocial stressors, and whether or not they have social support (Solar & Irwin 2010). A causal relationship exists between structural determinants of health inequities and intermediary determinants of health whereby structural determinants indirectly affect health inequities by directly influencing intermediary determinants (Solar & Irwin 2010). Thus, unfairly affecting populations or an individual. Marginalized groups record worse health status and outcomes in comparison to privileged groups (Solar & Irwin 2010).

Although the framework takes a human rights-based approach to reduce health inequities, the implementation is criticized for lacking this approach. (Kumanan *et al.* 2010). Former United Nations Special Rapporteur for the Right to Health, Professor Paul Hunt argued that while the commission recognizes the link that exists between the social determinants and human rights, the human rights aspects remains underdeveloped and silent (Kumanan *et al.* 2010). While recognizing this limitation is necessary, this study aims to compare demographic and socioeconomic profiles of those with hypertension, and therefore the limitation has minimal or no effect on it.

This framework serves as an essential guide for this study due to its focus on the various contributing factors to overall health outcomes. This study aims to understand whether there is an association between various demographic and socioeconomic factors and the prevalence and risk of hypertension amongst South African adults.

1.7 Structure of the dissertation

The study consists of five chapters. The first chapter is comprised of the background and rationale of the study, the aims and objectives, the type of data used, ethical considerations, limitations, as well as the underlying theoretical framework. Chapter two reviews the literature available related to the topic. The research methodology, including the variables and data analysis, is presented in chapter three. The fourth chapter contains the results obtained from the statistical analysis conducted in the study. Finally, the fifth chapter discusses the findings as well as reports on recommendations and concluding remarks.

1.8 Summary

This chapter gave an outline of the introduction, background of the study and rationale. It also included the aims, objectives, and research questions as well as the data used in the analysis. The chapter also detailed the guiding theoretical framework that was chosen. The chapter further outlined the structure of the dissertation which includes the various chapters and what they will entail.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

Health is an important part of overall human development (STATS SA 2016). Over the past few decades, the global burden of disease has and continues to rapidly change (Habib & Saha 2010). Following the modernization of the world, there has been a global epidemiological shift from the domination of infectious diseases to the domination of degenerative and lifestyle diseases (Murray & Lopez 2013). Whilst well-developed countries are mostly dominated by the latter, poorer countries are faced with a double burden of disease or like South Africa, a quadruple burden of disease (Bradshaw *et al.* 2011). There are however vast differences in the way the burden affects various groups within the population (Maphumulo & Bhengu 2018). Inequalities in mortality and morbidity burdens exist not only as a result of differential access to health services but first as a result of increased exposure to risk factors. (Kruize *et al.* 2014). Health-related inequality is linked to demographic and socioeconomic status-related inequalities (Ataguba *et al.* 2011).

According to the WHO (2013b), non-communicable diseases such as hypertension are the leading cause of global mortality, accounting for 60% of overall deaths. It is only recently that non-communicable diseases have been included in the global development agenda as they were excluded from the Millennium Development Goals (Collins *et al.* 2019). The United Nations 2030 Sustainable Development Agenda seeks to reduce non-communicable premature mortality by one third by the year 2030. Whilst countries work towards attaining these goals, the African continent lags far behind as it faces unprecedented population growth, a multiplicity of health challenges and a healthcare system that is in disarray (Chiedozie 2016). The growth is attributed to the epidemiological transition which has led to high levels of urbanization and rapid lifestyle changes (Iwelunmor *et al.* 2015).

This study looks at the prevalence of hypertension between 2008 and 2017 as well as the demographic and socioeconomic profiles of adult South Africans at risk in order to determine if there is a significant association. The following chapter is an extensive review of existing literature on the prevalence of hypertension amongst adults as well as the demographic and socioeconomic determinants that contribute to the risk. The demographic determinants include gender, age, marital, status, geographic location and population group. The socioeconomic determinants include educational attainment, employment status and wealth quintile.

2.2 Lifestyle diseases

The modernization of the world has greatly simplified life for humankind (Sharma & Majumdar 2009). One major benefit has been the technological advancements which have transformed the healthcare sector from introducing new drugs to new medical devices (Thimbleby 2013). However, the fast economic growth and rapid industrialization have also led to an increase in urbanization as more and more people move to cities in pursuit of better economic and social conditions (Yarahmadi *et al.* 2013). Consequently, there have been major dietary shifts due to hectic work and social schedules resulting in minimal time to prepare home-cooked meals regularly (Khanna *et al.* 2012.). Moreover, the unprecedented world population growth over the years has also led to an increased demand for the mass production of food which has subsequently led to the use of genetic modification in order to meet it (WHO 2016).

Time-consuming jobs have resulted in physically inactive and stressful lives (Khanna *et al.* 2012). Stressful working and living conditions also contribute to the adoption of the use of alcohol, tobacco and other drugs as a means of stress relief and as part of recreational activities (Azagba & Sharaf 2011). According to (Owen 2010), people are increasingly spending vast amounts of time in environments that minimize not only physical activity but also require prolonged hours of being sedentary whether at work, home, or public spaces. It is through all these various ways that the modernized world has made people live daily and that fuels much of the growing burden of what is referred to as lifestyle-related diseases (Khanna *et al.* 2012).

Lifestyle diseases simply refer to diseases that have much to do with the way people live (Tabish 2017). Lifestyle diseases are characterized by diseases that are primarily based on one's daily habits or lifestyle behaviours (Al-Maskari 2010). These include among others, diseases such as obesity, type 2 diabetes, metabolic diseases, joint and skeletal problems, cardiovascular diseases and the focus of this study, hypertension (Farhud 2015; Petrie *et al.* 2018.). Khanna *et al.* (2012) argue that lifestyle diseases are as a result of the complex relationship between social, economic and cultural changes that are unavoidable in the era of urbanization and globalization. According to Vallgarda (2011), the concept of lifestyle diseases is a narrow approach to diseases that fall within this category as it implies that their prevention depends solely on people changing their behaviour. This is because all diseases whether lifestyle-related or infectious, have multiple causes and therefore choosing to understand them from the perspective of a single cause limits the prevention strategies to just one cause and, in this case, behaviour (Vallgarda 2011).

2.3 Hypertension

Hypertension is a chronic lifestyle related non-communicable disease (Seedat & Rayner 2011; Abdulsalam *et al.* 2014). Hypertension, otherwise, commonly referred to as high blood pressure or elevated blood pressure, has severe health implications for those that are affected if it is not managed properly (American Heart Association 2017; WHO 2019a). High blood pressure rarely presents itself in isolation as two out of three hypertensive patients have comorbidity (Kennard & O'Shaughnessy 2016; Ventura & Lavie 2016). According to WHO (2019b), hypertension increases the risk of developing brain, kidney, heart as well as other diseases. Additionally, hypertension is the leading cause of strokes and cardiovascular-related mortality despite it being the most modifiable risk factor for these diseases (Awoke *et al.* 2012). Moreover, hypertension is often further complicated by poor detection, management and awareness especially in low and middle-income countries (Chijioke *et al.* 2016; Jongen *et al*. 2019). In most instances, people with hypertension are often unaware that they are hypertensive until it is too late, hence the nickname 'silent killer' (Ibekwe 2015).

Hypertension, based on the etiology, is divided into two categories namely primary and secondary hypertension (Sawicka *et al* .2011). Essential or primary hypertension affects approximately 90-95% of hypertensive adults and as a result it is considered a disease of adulthood (Gupta-Malhotra *et al.* 2015). This first category refers to hypertension whereby the causes are unknown of which genetics, environmental factors and overall lifestyle choices play significant roles (Iqbal & Jamal 2019). The second category which is known as secondary hypertension or direct cause refers to hypertension with underlying causes such as chronic diseases or the use of certain medications and pregnancy and affects about 5-10% of hypertensive patients (Sawicka *et al.* 2011).

Blood pressure measurements are broken into systolic and diastolic values (American Health Association 2017). These represent the maximum and minimum pressure in the arteries and are the active and resting heart rates respectively (Sawicka *et al.* 2011). In other words, systolic values represent the peak pressure in the arteries when the heart contracts, while diastolic values measure the minimum pressure or the resting rate between beats (The Heart and Stroke Foundation South Africa 2017). As depicted in Table 2.1, normal blood pressure is that which is measured to be below 120/80 mm Hg, where 120 mm Hg represents the systolic value and 80 mmHg is the diastolic value (American Health Association 2017). Hypertension is defined by readings of 140/90 mm Hg (Monakali *et al*. 2018). Anything between 120/80 mmHg and

139/89 mm Hg is referred to as prehypertension and although it is not considered a medical condition, it increases the risk of developing hypertension (Singh *et al.* 2017). Malignant hypertension or hypertensive emergencies refer to elevated blood pressure readings of 180/120 mm Hg. Blood pressure measurements of several readings are required before a diagnosis is made (Schwartz & McManus 2015).

Table 2.1: A depiction of an explanation of the systolic and diastolic blood pressure measurements in mmHg

	Systolic (mmHg)	Diastolic (mmHg)
Normal blood pressure	Less than 120	Less than 80
Elevated	Between 120 and 129	Less than 80
Stage 1 hypertension	Between 130 and 139	Between 80 and 89
Stage 2 hypertension	At least 140	At least 90
Hypertensive crisis	Over 180	Over 120

Source: American Heart Association (2017)

2.4 The causes of hypertension

Hypertension is a serious health concern due to its association with comorbidities (Wang *et al.* 2017). Its occurrence is attributed to the lifestyle and behavioural choices that people make daily (Sharma & Majumdar 2009). This refers to behaviours classified as modifiable risk factors such as smoking, alcohol abuse, physical inactivity, being obese or overweight, having unhealthy eating habits, being stressed and insufficient vitamin intake (WHO 2019b). Salt intake is also one of the most significant contributors as it dramatically increases the chances of hypertension and its reduction can lead to approximately 2.5 million deaths being avoided (WHO 2016). It is also caused by factors such as ageing, chronic diseases and genetics which are known as non-modifiable risk factors (WHO 2019b).

According to Basu *et al.* (2011) approximately a fifth of the global population smokes or uses tobacco products. In this regard, the use of tobacco is responsible for the death of six million people yearly with a majority of these being premature deaths (WHO 2015). Approximately

2.8 million premature deaths globally are attributed to alcohol consumption yearly (Ritchie & Roser 2019). The greatest impact of alcohol is observed in Africa which reportedly has the heaviest disease burden and injury related to alcohol despite Europe having the highest consumption levels (WHO 2019a).

Global obesity is now a pandemic and varies dependent on gender and country amongst other factors (Kanter & Caballero 2012; Van Gaal & Maggioni 2014). Kleinert & Horton (2019) argue that not much progress has been made towards dealing with obesity except acknowledging that it is a global problem and outlining recommendations. Future projections estimate that by 2030 approximately 2.16 billion and 1.12 billion adults globally will be overweight and obese respectively (Popkin *et al.* 2012). A recent study reported that approximately 1.4 billion adults worldwide are physically inactive, which means that they do not reach the recommended minimum weekly physical activity of 150 minutes (Guthold *et al.* 2018). The study reported that wealthier countries had become increasingly inactive as an estimated 40% and 36% of the adult population in the United States and the United Kingdom respectively were found to be physically inactive (Guthold *et al.* 2018). This is important as physical inactivity is a significant risk factor in the development of hypertension (Diaz & Shimbo 2013).

Hypertension is preventable through the reduction of salt intake (an averaged dosage of 5mg daily is recommended), avoiding or minimizing the use of tobacco and alcohol, leading a physically active lifestyle and adopting a healthy lifestyle with adequate fruits and vegetables (WHO 2016). It can also be managed through frequent check-ups, effectively managing mental stress, managing other diseases as well as with treatment (Rashid *et al.* 2011).

2.5 Burden of hypertension

Hypertension is estimated to be affecting over one billion people across the globe (Van Der Spuy *et al*. 2018). In their report titled *Global status report on non-communicable diseases 2010: Description of the global burden of NCDs, their risk factors and determinants,* WHO (2019a) reported that the number of people with hypertension grew immensely from 600 million in the year 1980 to 1 billion in the year 2008. In 2000 already, it was estimated that 26.4% of the world's adult population was hypertensive (Midha *et al*. 2012). In the year 2010 hypertension became the leading risk factor for morbidity and premature death (Bromfield & Muntner 2013). According to Singh, Shankar & Singh (2017), an estimated 7.5 million of the global deaths are attributable to raised blood pressure annually. Moreover, 1 in 5 deaths

globally is a result of hypertension (Zack *et al.* 2019). Future projections estimate that by the year 2025, 1.56 billion of the adult population will be hypertensive (Midha *et al*. 2012). Additionally, it is expected to increase by 29% by the year 2026 where almost 1 billion of the world's population will be older (Kotchen 2011). Similarly, Bromfield & Muntner (2013) maintain that the burden of hypertension can only increase with economic development and the ageing population globally.

Historically, hypertension has been considered an affliction affecting developed countries (Bromfield & Muntner 2013). However, it has become more prevalent in low- and middleincome countries as well (Salem & Kinsara 2017). It is estimated that approximately 75% of the world's hypertensive patients are found in low income and middle-income countries (Mills *et al*. 2016). According to Zack et al. (2019), 1 in 11 hypertension related deaths are found in middle-income countries. Furthermore, cardiovascular diseases and related diseases are the leading causes of mortality in low and middle-income countries as they account for almost half of the deaths in these countries (Otgontuya *et al.* 2013). Additionally, over 50% of these deaths are found amongst those aged below 60 years of age in low and middle- income countries whereas only 20% of those in that age range are found in high-income countries (Otgontuya *et al.* 2013). It is also worth noting that Africa is the most affected continent (Adeloye *et al.* 2015). Salem & Kinsara (2017) emphasize that approximately 45% of adults over the age of 25 years, are hypertensive in Africa. Abdulsalam *et al*. (2014) attribute the increase and the changing pattern of the health and burden of disease in developing countries to the epidemiological and demographic transitions.

As stated previously, non-communicable diseases were formerly understood to be diseases associated with wealthy countries (Bromfield & Muntner 2013). However, they are now major contributors to the mortality and morbidity rate in middle income and low-income countries (Mbouemboue & Ngoufack 2019; Salem *et al.* 2018). Dorrington *et al.* (2014), argue that premature deaths related to non-communicable diseases, of which hypertension is a major contributor, has fast become a significant indicator to monitor in light of improving the quality and access to health through the implementation of the National Health Insurance in South Africa. The rapid growth of non-communicable diseases is said to lead to these diseases topping the list of leading causes of death in all countries by the year 2020 surpassing infectious diseases, puerperal, prenatal and food diseases (Kankeu *et al.* 2013). Currently, the African continent has the highest rate of hypertension with an overall average of 46% (WHO 2019a).

The World Heart Foundation (2018) maintains that out of the 17 million annual deaths associated with cardiovascular diseases, 55% of them are a result of hypertension-related complications. Additionally, out of a total of an approximate population of 650 million people in Sub-Saharan Africa, an estimated 10 to 20 million is suspected to be hypertensive (Guwatudde *et al.* 2015). In South Africa, the country's history has shaped the overall health outcomes (Coovadia *et al*. 2009).) The majority of the country's population is poor and black and the most affected by the country's quadruple burden of disease (Coovadia *et al.* 2009)

The Heart and Stroke Foundation South Africa (2017) maintains that only 2 out of 10 South Africans over the age of 55 do not have high blood pressure. Additionally, the increase observed over the last decade is breeding ground for an increase in strokes and heart attacks (Bradshaw *et al*. 2011). Furthermore, South Africa has the highest prevalence of hypertension in Southern Africa as well as the lowest levels of control despite the availability of treatment (Gómez-Olivé *et al*. 2017). According to the 2016 Mortality and causes of death report, hypertensive related illnesses ranked 6th in South Africa (STATS SA 2018). The high prevalence is attributable to the unhealthy life led by most South Africans which includes the high daily intake of salt of about 6mg- 11mg and highly processed foods (Wentzel-Viljoen *et al.* 2013). It is also linked to obesity, physical inactivity, use of tobacco, alcohol intake amongst other factors (Shisana *et al.* 2015).

2.6 Demographic profile of hypertension

There is an unequal distribution of the risk of hypertension amongst groups whether demographic, social or economic which is important to understand as hypertension continues to become a public health concern (Khajedaluee *et al.* 2016). Health inequalities according to Solar & Irwin (2010) are attributed to the unequal distribution of power and resources amongst all groups in society. Understanding the extent, therefore, to which these negatively impact health outcomes is vital for effective health strategies that focus on individuals as well as entire populations.

2.6.1 Population Group

Race is understood to be a product of social construction of perceived differences between groups of people that have been assumed to go beyond superficial differences in physical appearance such as skin and eye colour (Clair & Denis 2015). It is, however, more than physical appearance and refers to groups of people that share a common history, ancestry, genes,

geography and more (Nyborg 2019). Racial categorization and sometimes ethnic categorizations are problematic in that they group people into majority and minority groups which leads to racism, racial discrimination and racial inequality (Clair & Denis 2015). Racially discriminated groups are at a higher risk of illness and bear a disproportionate burden of mortality and morbidity (Gee & Ford 2011).

According to Hozawa & Ueshima (2009), epidemiological studies have found and reported evidence that hypertension varies between racial and ethnic groups in the United States, as the prevalence of hypertension is higher among African Americans than any other population group (Kershaw *et al*. 2009). Additionally, Lackland (2014) found that there were similar levels in awareness and treatment across racial groups in the US, however, there are noticeable racial differences in the control of hypertension. Balfour *et al.* (2015) additionally maintain that approximately 78 million adults in the United States aged 20 years and older are hypertensive. Furthermore, a study that made use of the National Interview Health Survey data to examine disparities in hypertension amongst racial and ethnic groups found that non-Hispanic blacks are disproportionately affected by hypertension which is attributed to differences in income, insurance status, as well as various socioeconomic, demographic and prognostic factors (Holmes 2012). Additionally, South Asians are between 1.5 to 2 times more likely to experience strokes than Europeans (Eastwood 2015).

Sliwa *et al.* (2014) demonstrate that black Africans are not only more prone to hypertension than other race groups, but hypertension is often found to be more severe amongst this group According to a study that analyzed the South African General Household Survey conducted amongst 59 227 adults aged 18 years and older in 2010, the highest hypertension prevalence rates were found amongst Coloured and black African women whereas the lowest were amongst the black African men and Indian/ Asian men (Hasumi & Jacobsen 2012).

Race has been documented as a major source of racial and ethnic disparities in health access (Chen 2016). Racial discrimination limits access to resources, opportunities, education and healthcare information and services (Richardson & Norris 2010). Moreover, this discrimination also results in residential segregation, safe social and environmental spaces amongst other factors purely based on race whilst providing maximum access to others thus resulting in unequal living standards and behavioural differences (Richardson & Norris 2010).

In South Africa, the healthcare system during the apartheid regime was a divide along racial lines which saw some groups and particularly the black majority being under-resourced,

underdeveloped and underfunded (Omotoso & Koch 2018). Well into democracy, the legacy of apartheid still lingers as an estimated 60% of the health care expenditure is largely accessed by the 14% minority with access to private health insurance (Mooney & McIntyre 2008). This is because of the huge health status and health provision disparities that were inherited by the first democratically elected government (Lalloo *et al.* 2004).

Racially related health outcomes have less to do directly with skin colour but rather more to do with the opportunities and access to resources one has as a result of the colour of their skin which is what leads to racial inequalities (Clair & Denis 2015). The apartheid-era excluded black people legally, socially, politically and economically (Mooney & McIntyre 2008). This is one of the reasons why better healthcare services are not enough to improve the health of the population as there is a myriad of underlying issues that impact overall health outcomes (Mooney & McIntyre 2008). Today South Africa is regarded as being one of the most unequal societies in the world due to the legacy of the apartheid regime. According to Stats SA (2017), of the 30.4 million people that were living in poverty in 2015, the majority were black, uneducated and young.

2.6.2 Gender

Health indicators display differences between men and women as gender determines not only disparities in opportunities but also risks (Matud 2017). It is important first to clarify the difference between gender and sex as they are often used inconsistently and interchangeably in health research (Short *et al*. 2013). Sex refers to one's biological makeup which is then used to characterize them into either male or female, whereas gender is a social construct that varies from society to society (Peters & Norton 2018). Rolleri (2013) further argues that even the terms male and female are not interchangeable with man and woman respectively as male and female are derived from physical characteristics that are defined by biological features whereas man and woman have broader meanings characterized by cultural and societal ideals of masculinity and femininity amongst other factors. The term gender distinguishes socially constructed expectations, behaviours and attitude from sex which is determined by biological traits (Rolleri 2013).

Gender and health equality and equity have become a significant part of the move towards 'health for all' (Kuhlmann & Annandale 2015). The inclusion of gender in health research is important as the biological composition alone is not enough in understanding the inequality in health outcomes and behaviour that exists between men and women (Philips 2011). Various

social classifications such as race, class, age, disability or ability and education, influence one's health experience to either benefit or marginalize them (Morgan *et al.* 2018). Therefore, understanding not only sex but gender differences are significant for health research in order to develop more strategic and effective interventions that are unbiased (Theobald *et al*. 2017). Additionally, Greaves (2012), argues that the improvement of health relies on the recognition that both biological and social aspects impact growth, development, risk and exposure to illness as well as recovery.

Women are amongst the socially disadvantaged groups including in health research (Peters & Norton 2018). Women have for much of history been expected to fulfil domestic and caretaker duties at home and they have often been employed in people and service-oriented services as the more competitive ones were reserved for men (Hentschel *et al.* 2019). These expectations have limited women in various ways and have had dire consequences on the gender differences in illness and health thus cannot be left out in attempts to address the existing inequalities in order to fight hypertension (Hosseinpoor 2012) effectively. Peters & Norton (2018) argue that the assumption that health research findings on diseases that affect both sexes but studied only or mostly men can be applied to women is what led to the failure of gender and sex-specific determinants of health.

Commendable efforts have been made by the health care community in understanding sex and gender differences in relation to cardiovascular diseases especially for women (Mosca *et al.* 2011). In general, men have a higher rate of hypertension than women up until women reach menopause (Ramirez & Sullivan 2018). According to Reckelhoff (2018), hypertension mainly affects men below the age of 50 years of age however after the age of 50, age-specific hypertension rates are much higher for women as a result of menopause. According to WHO (2019b), hypertensive patients are comprised of 1 in 4 men and 1 in 5 women. Reckelhoff (2018), in contrast, argues that the prevalence of hypertension is higher amongst men whilst awareness is higher amongst women. However, regardless of sex or gender, the prevalence of hypertension is likely to be higher amongst the elderly (Choi *et al.* 2017; Pimenta 2012).

The causes of hypertension tend to differ for men and women (Ghosh *et al.* 2016; Ramirez & Sullivan 2018). For men, the most common causes are smoking, alcohol abuse and stress whereas the most common causes for women are menopause, obesity as well as the use of contraceptive pills (Ghosh *et al.* 2016). This is not to say that hypertension in men cannot be caused by obesity or alcohol abuse in women. Differences are also linked to pressures related

to cultural and societal ideas of masculinity and femininity that often lead to adolescent boys and men engaging in irresponsible behaviours such as alcohol abuse and promotes voluptuous women as being more attractive (Edström 2015; Rohleder 2012). Additionally, Everett & Zajacova (2015) add that gender differences related to hypertension are not just limited to biological and behavioural factors, however, they are also significantly affected by gender differences in the use and access to health care services.

A cross-sectional study carried out amongst a population of 2 974 people living in Mashhad, Iran, found the prevalence of smoking and drug abuse to be approximately 14.9% and 3.8% for men and women respectively and that 51% of women led a physically inactive life (Khajedaluee 2016). Guthold, Stevens, Riley and Bull (2018), similarly to WHO (2019b), maintain that there are gender differences in physical activity as 1 in 3 women and 1 in 4 men are not physically active enough to remain healthy. Moreover, a study conducted amongst 27 887 Korean adults found that the prevalence of hypertension was 34.6% amongst men compared to 30.8% amongst women, however higher levels were observed after the age of 60 years amongst women (Choi *et al.* 2017). Furthermore, Bradshaw *et al.* (2011) argue that more than 70% of South African women over the age of 35 years are either overweight or obese and the past decade has recorded an increase of over 45% of women being overweight or obese, which are key risk factors for hypertension.

2.6.3 Age

Hypertension has often been associated with old age (Buford 2016; Lloyd-Sherlock *et al.* 2014), to the extent that it is often viewed as being an inevitable part of aging (Gurven *et al*. 2012). However, hypertension has increasingly become common amongst younger people especially in the sub-Saharan region (Van Der Spuy *et al*. 2018). In this regard Ejike *et al.* (2018) argue that the patterns of hypertension must be monitored in childhood and adolescent stages of life as if it is left unchecked, it becomes problematic in older ages. Moreover, approximately between 74% and 87% of hypertension in children is undiagnosed (Ewald *et al.* 2017). The strongest risk factor for developing hypertension in adulthood in children is obesity (Bhimma *et al.* 2018). According to their recent State of the World's Children report, UNICEF (2019) found that between the period of 2000-2006 the proportion of overweight children between the ages of 5-19 years old, went from 1 in 10 to 1 in 5 children. This increases the risk of cardiovascular diseases, hypertension and type two diabetes in later stages of life (UNICEF

2019). Ewald *et al.* (2017) further add that the risk of undiagnosed and untreated obesity and hypertension is higher for adolescents from disadvantaged backgrounds.

Whilst hypertension does not only affect the elderly, but age is also an important risk factor (Emeriau & Kalula 2013). The bulk of hypertension related morbidity and mortality is accounted for by the elderly population (Buford 2016). Furthermore, the increase in life expectancy and consequently of the elderly population, will add to the future burden of hypertension (Buford 2016; Kotchen 2011). In South Africa, a study conducted in the Limpopo province comprising of 1 407 participants found that hypertension did increase with age (Ntuli *et al.* 2015). A similar study amongst 203 nurses from 41 health care institutions in the Eastern Cape found that age played a significant role in the prevalence of hypertension (Monakali *et al.* 2018). The high prevalence of hypertension amongst older ages is said to be significantly due to the changes in arterial and arteriolar stiffness that occurs with age (Singh *et al.* 2017).

2.6.4 Marital Status

A correlation has been established between hypertension and marital status (Ramezankhani *et al.* 2019). Marital status and related changes play a role in not only the health but the mortality of individuals (Robards *et al.* 2012). Specifically, marital status and changes that occur such as divorce, separation and losing a spouse are associated with negative health outcomes (Manfredini *et al*. 2017). In this regard marriage is considered to provide a certain degree of protection against illness due to the support system that is provided by the union (Robards *et al*. 2012).

A study conducted by Hosseinpoor *et al.* (2012) that analysed self-reported data on 10 3154 men and 125 728 women from 57 countries in the World Health Survey 2002–2004 found that those that were divorced, widowed or separated reported poorer health in comparison to those that were never married. Similarly, a study that aimed to assess the prevalence and risk factors of hypertension amongst those 15 years and older in Limpopo, found that hypertension was lowest amongst those that were single and higher for those that were married (Ntuli *et al*. 2015). Furthermore, a study conducted in the United States that sought to examine the relationship between cardiovascular-related health outcomes and marital status, found that a complex relationship exists, and that it varies by gender (Schwandt *et al.* 2010).

A review of literature conducted by Manfredini *et al.* (2017) that seek to find evidence on the association between marital status and cardiovascular-related disease outcomes and their risk

factors found that those that were married had better health outcomes and lower cardiovascular risk factors as well as an overall better health status than those that were single, especially single men who reportedly had the poorest health outcomes. Likewise, a study conducted amongst 2271 Polish men aged between 25 and 60 years of age concluded that the prevalence of hypertension was on average higher amongst never-married men than it was for married men even when demographic, socioeconomic and lifestyle-related factors were controlled (Lipowicz & Lopuszanska 2005). Additionally, a study amongst 763 adults between the ages of 25 and 74 years of age found that married persons were less likely to have high blood pressure, however there were gender differences as married women were less likely than married men to have high blood pressure (Abu-Saad *et al.* 2014). In contrast, a communitybased cross-sectional study conducted in the Ngaoundere community of Cameroon amongst 948 participants, found that married and widowed persons were more likely to be hypertensive compared to their single counterparts (Mbouemboue & Ngoufack 2019).

2.6.5 Geographic Location

There are significant differences in rural and urban health which research has largely attributed to the physical environment, the social environment as well as access to healthcare services and resources (Spasojevic *et al.* 2015). Studying these differences is important for relevant health-related combat strategies.

Genetic and environmental conditions play a significant role in influencing health outcomes (Duranton *et al*. 2018). The prevalence and risk factors vary from country to country and even within countries variations are evident between urban and rural areas (Singh *et al.* 2017). According to (Duranton *et al*. 2018), variations in blood pressure can be attributed to climatic and seasonal differences. Higher blood pressure has even been associated with increasing distance from the equator (Cabrera *et al.* 2016; Liu *et al.* 2014). However, whilst understanding and acknowledging the role of nature as an important as a determinant of health outcomes, it should not be exaggerated (Marmot 1984).

Variations in hypertension differ from one geographic location to another (Kershaw *et al.* 2010). As previously discussed, rapid industrialization has led to rapid urbanization thus resulting in an increase in hypertension due to the lifestyle changes that occur during this shift (Awoke 2012). It is estimated that more than half of the world's total population lives in cities (UNICEF 2019). A multinational cross-sectional study amongst 142 042 participants in 17 countries between the ages of 35-70 years, found that awareness, treatment and control of

hypertension were higher in urban rather than rural communities (Chow *et al.* 2013). Research in the United States found that black and white Americans residing in the South had a higher prevalence of hypertension than those living in other parts of the country (Kershaw *et al.* 2009).

A study conducted in China using the China Health and Retirement Longitudinal Study which consisted of 13 583 over the age 45 years found provincial and municipal disparities in the prevalence, awareness, treatment, and control of hypertension (Yin *et al.* 2016). Guizhou had a high prevalence rate at 56.3% and the lowest awareness and treatment rate at 37.3% and 21.1% respectively. This has been attributed to the low education rates and poor healthcare infrastructure as Guizhou is one of the country's underdeveloped rural provinces (Yin *et al.* 2016). More developed, urban regions such as Shanghai and Beijing although having the highest prevalence rates also had the highest awareness, treatment and control rates. According to Yin *et al.* (2016) this is most likely due to the higher education rates and better health care facilities as well as access to antihypertensive medication.

In Northern Ethiopia, a community-based study amongst 1183 adults found that the prevalence of hypertension was approximately 22.5% and 19% for males and females respectively in urban settings and 19.5% and 15.2% in males and females respectively in rural areas (Mengistu 2014). In South Africa rural areas are often haunted by unemployment, poverty as well as low life expectancy (Monyeki *et al.* 2008).

2.7 Socioeconomic profile of hypertension

Differences in health status are further associated with differences in socioeconomic status (Lahana *et al.* 2010). In the same vein, Lahana *et al.* (2010) further stress that low socioeconomic status is associated with poor health and greater levels of mortality. Social and economic determinants are defined as having much to do with where one is born, grows, works, lives and ages which in turn therefore has an impact on access to adequate healthcare and nutrition thus influences their overall life expectancy (Magnan 2017).

2.7.1 Educational Attainment

Education is a significant part of health (Adler & Glymour 2017; Burger *et al.* 2016; Dégano *et al.* 2017; Hahn & Truman 2015). Education as an indicator of socioeconomic status is the most reliable as it is easy to recollect and does not present the issue of reverse causation found in other determinants such as income (Cuschieri *et al.* 2017).Whilst it is recognized as an important driver of success, its role as a reproducer of social inequality is also realized

(Zajacova & Lawrence 2018). Education is also an important tool to bridge health inequality between population groups (Hahn & Truman 2015). Knowing the educational level of patients as well as those potentially at risk is important and studies have shown noteworthy associations between educational attainment and risk of cardiovascular diseases (Adler & Glymour 2017; Burger *et al.* 2016; Dégano *et al.* 2017).

Differences in education and hypertension vary by gender (Choi 2017). A closer association is often noted for females than for males (Kautzky-Willer *et al.* 2012). A cross-sectional study conducted amongst 502 mild to moderate essential hypertensive patients found gender differences in the correlation between hypertension and education of which a stronger correlation was found amongst females (Chen & Tan 2013). Low education is an important determinant of employment status (van Zon et al. 2017). The impact of low education and poor health on unemployment varies by work life stage. Adults with higher educational attainment have greater health outcomes as they live healthier and subsequently longer lives than their less-educated counterparts (Zajacova & Lawrence 2018). A study that investigated this association using an ecological model, argued that education has an impact on placing individuals in different ecological contexts as it influences many choices thus impacting life experiences including health outcomes (Zimmerman *et al.* 2015).

Education amongst other positive links is associated with better lifestyle decision making, better understanding and use of preventative services, as well as building and maintaining support networks (Shankar *et al.* 2013). It is important to note that education does not on its own produce better health outcomes as it is linked to other factors such as better employment opportunities which most often are linked to better income and their individual effects are hard to measure (Shankar *et al.* 2013). Hahn & Truman (2015) note that whilst the most common method of measuring education is by years of schooling and educational attainment, it is unreliable as it does not indicate the time spent in school and what was learnt. Rather it is more effective to measure using school-level completion as it betters represents the quality and quantity of what was learned (Hahn & Truman 2015).

2.7.2 Employment Status

The impact of employment on workers as well as changes in employment on health is often understudied and often of poor quality (Benach *et al.* 2010). Employment is an important determinant of income level and living standards which have consequences on health outcomes hence the need to understand the relationship (Hahn & Truman 2015). Goodman (2015)

maintains that employment has social, psychosocial as well as financial benefits which in various ways improve health outcomes.

Unemployment is associated with negative health outcomes (Dupre *et al.* 2012). Rosenthal & Alter 2012 argue that literature on the relationship between job strain and blood pressure disagrees on the nature of the relationship. For instance, a study amongst 9 985 people over the age of 50 found in over 13 European countries, concluded that there is no correlation between hypertension and unemployment (Rumball-Smith *et al.* 2014). Contrary to these findings, a Polish study amongst 3 052 unemployed and 2 059 employed individuals observed differences in cardiovascular risk factors when comparing data on blood pressure, body mass index, smoking habits and mental health (Zagożdżon *et al.* 2014). Furthermore, another study that analysed the data of 13 451 individuals over the age of 50 from the Health and Retirement Study found that job instability is also an important risk factor in cardiovascular-related health outcomes (Dupre *et al.* 2012). Thus Rosenthal & Alter (2012) reiterate that hypertension is linked to occupational stress and job strain that is attributed to a lack of balance between job demand and job control. Furthermore, youth unemployment is said to add to the risk of hypertension in older ages (Nygren *et al.* 2015).

South Africa's' unemployment rate is currently at its highest in comparison to the last decade as it is currently estimated to be approximately 29% (Stats SA 2019). Recent findings estimate that the youth (mainly those aged 15-24 years) is the most vulnerable as it is estimated that the unemployment rate in this age group is 52.2% with 31% being unemployed graduates (Stats SA 2019). Moreover, a cohort study conducted in Northern Sweden that aimed to study the relationship between early youth unemployment of those aged 16-21 and adult hypertension, found that there was a correlation between early youth unemployment and hypertension in later stages of life for women and not so much for men (Nygren *et al.* 2015). The causal relationship between health and employment also goes both ways as ill-health decreases one's chances of getting employment hence disabled persons are less likely to get employed than their nondisabled counterparts (Goodman 2015).

2.7.3 Wealth Quintile

Wealth and wealth distribution have a strong influence on a society's health (Ward & Viner 2017). Income and wealth status reflect the ability to access resources including healthcare (Palafox *et al.* 2016). Widening inequality gaps are a cause for concern due to the relationship that exists between health disparities and income inequality (Chokshi 2018). Although income

alone does not influence health outcomes, it is considered a causal pathway for health outcomes as it provides access to health services and care, nutritious food and a safe living environment (Hahn &Truman 2015). There are various causal pathways and they are not straightforward and easy to measure (Benzeval *et al*. 2014).

Benzeval and Judge (2001) maintain that reverse causation such as that poor health leads to low income is often ignored. Furthermore, Chokshi (2018), stresses that interactions between educational attainment, race and sex further complicates the relationship between health and income. Understanding socioeconomic inequalities in health is important as health is a significant contributor to peoples' overall wellbeing and health inequalities can either perpetuate or alleviate differences in income disparities influencing overall wellbeing (Bor *et al.* 2017). Hence the notion that improving the the poor's level of income is a way of improving their health (Benzeval *et al*. 2014).

Income inequality has negative impacts on health as it relates to higher levels of obesity, heavy drinking, diabetes, less physical exercise, physical and mental strain, heart-related diseases and depression (Matthew & Brodersen 2018). Low, middle and upper-middle-income countries have hypertension prevalence rates above 40% whereas high-income countries had lower prevalence of hypertension of around 35% (WHO 2019a). An analysis of the WHOs' Study on Global Ageing and Adult Health that examines prevalence, awareness, treatment and control amongst those aged 50 years and over in China, Ghana, India, Mexico, Russia and South Africa, reported that hypertension was associated with being overweight or obese especially amongst women of the lowest wealth quintile who were heavy alcohol consumers (LloydSherlock *et al.* 2014). An analysis of the same measures amongst 151 619 participants aged 35-70 from 661 urban and rural communities reported that awareness, treatment and control is higher in poorer countries but amongst the wealthier households (Palafox *et al.* 2016). In the same breath, a study examining the socioeconomic inequalities in the prevalence, awareness, treatment and control amongst 14 823 adults aged 15 years and older with blood pressure measured in the 2016 Nepal Demographic Health Survey, found that those from the richest wealth quintile were 1.7 times more likely to be hypertensive in comparison to those from the poorest category (Mishra *et al*. 2019).

Following the end of the apartheid regime in South Africa, there seem to be no significant differences in socioeconomic inequalities in health and healthcare (Omotoso & Koch 2018) the country is still regarded as one of the most unequal societies in the world (Stats SA 2019).

Moreover, according to the World Bank (2019), an estimated 18.8% of South Africans were poor in 2019 which is a 2% increase from 16.8% in 2011, this is attributed to its history of racially motivated exclusion. Recent statistics suggest that white South Africans on average earn approximately three times more than black South Africans (Stats SA 2019).

Income inequalities have an impact on social class differences which influences health inequalities. Significant quality gaps have been observed between public and private healthcare services as the public sector is under-resourced while the private sector overuses resources (Schellack 2011). Additionally, it is those with higher incomes that can afford private healthcare whilst the poor are forced to make use of the resource strained public sector (Girdwood *et al.* 2019).

As stated in the previous chapter, income as a direct factor of health is difficult to use as it involves multiple components (Solar & Irwin 2010). Income, therefore, is indirectly linked to health outcomes as it gives people the power to create environments and circumstances and are conducive for and that promote good health.

2.8 Summary

This chapter outlined the role played by various socioeconomic and demographic factors in influencing overall health outcomes. The literature argues that illness and health outcomes are not just a matter of biological and genetic characteristics as overall health outcomes are influenced by an array of social issues that are consequences of the unequal distribution of power and resources. Additionally, it was noted that those with minimum or no access to primary education, healthcare services and job opportunities show poorer health outcomes compared to their better educated, employed and better earning counterparts that can afford well-resourced healthcare services and health promoting environments. Health outcomes are also greatly influenced by age, geographical location and race. The idea therefore of categorizing lifestyle diseases such as hypertension as such is a point of contention as it acknowledges only the behavioural aspects as the cause of adverse health outcomes and not the demographic and socioeconomic aspects. The literature further highlights that the beliefs that hypertension only affects those living in high-income countries and the elderly need to be debunked as Africa has the highest prevalence rates of hypertension which is triggered in younger ages as a result of obesity and being overweight in children. Furthermore, an emphasis was placed on the importance of recognizing gender differences in health especially that of women. The promotion of women's rights is argued to not only be fundamental in fighting

illness, but they form part of basic human rights. These differences are not just biological, but they are intertwined with other factors. Additionally, the reviewed literature argued that strategies to fight the fast-growing rate of hypertension globally requires holistic interventions that considers factors beyond the clinical walls. Attending to illness alone without addressing pressing issues such as inequality will result in minimal, slow or no progress.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter of the dissertation will provide an outline of the methodology adopted in this study. It begins by contextualizing the study with a brief description of South Africa and the South African population. This is followed by an overview of the National Income Dynamics Survey (NIDS), which is the source of data. Thirdly, descriptions of each variable and variable codes will be provided as well as the statistical methods used for data analysis. Lastly, the strengths and weaknesses of the methods and data will be highlighted briefly, as well as ethical considerations.

3.2 Study context

South Africa's population, according to mid-year population estimates, is approximated to be around 58.78 million (Stats SA 2019b). The country's population profile is comprised of a young population with an estimated 28.8% of the population being younger than the age of 15 years and only an estimated 9% being 60 years or older (Stats SA 2019b). The overall life expectancy is 64.2 years which is 8 years behind the global life expectancy, which is estimated to be 72.6 years (Stats SA 2019b). Females have a higher life expectancy at 67.7 years compared to their male counterparts who have a life expectancy of 61.5 years (Stats SA 2019b). In the country's nine provinces, Gauteng, KwaZulu-Natal and the Western Cape are home to most of the population with 15.2 million, 11.3 million and 6.8million people found respectively in these provinces (Stats SA 2019b). Northern Cape has the lowest population with only approximately 1.3 million people living there. South Africa classifies the country's population into Black African, Coloured Indian/Asian, White and Other with over 80% of the population being Black Africans (Stats SA 2019b). Approximately 66.3% of the total population is found in urban areas, and 33.7% reside in rural areas (Business Tech 2014).

The South African economy is one of the largest on the African continent (World Bank 2019). The South African economy grew by 1.3% and 0.8% in 2017 and 2018 respectively and was projected to grow by 1.3% in 2019 and up to 1.7% in the year 2020 (World Bank 2019).

However, in the third quarter of 2019 South Africa's GDP had contracted by 0.6% (Stats SA 2019c). The June 2019 Quarterly Employment Survey reported that South Africa's

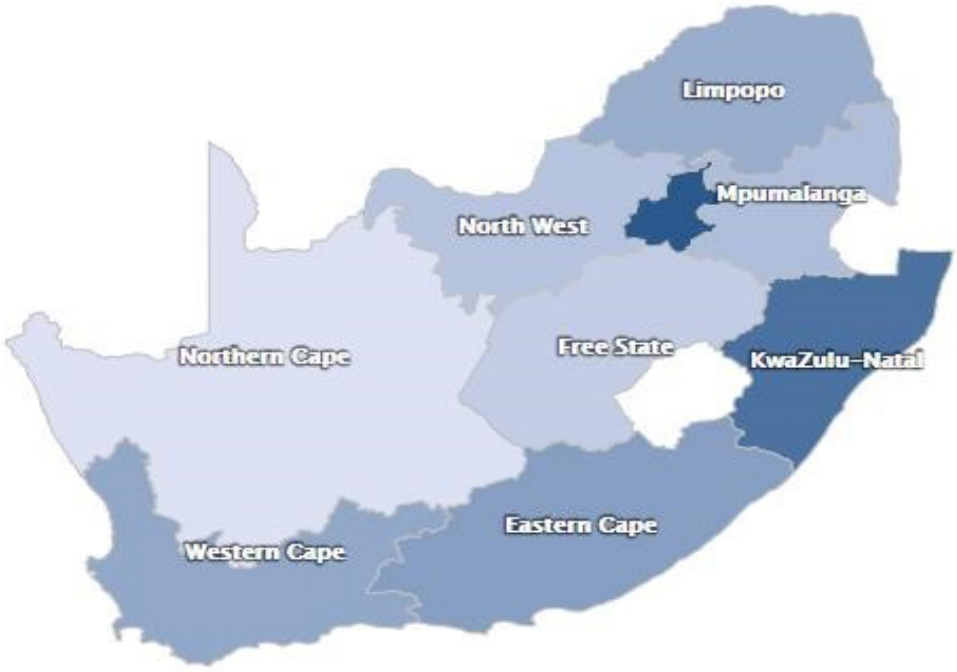
unemployment had reached its highest level at 29.01%, as jobs in the formal sector have declined (Stats SA 2019e). Out of an estimated total of 38.6 million South Africans within the working age (15-64), 16.4 million are employed, 6.7 million are unemployed, 2.8 million are unemployed work seekers and 12.7 million are economically inactive (Stats SA 2019e). Furthermore, the highest unemployment rates are amongst the youth as observed rates illustrate that unemployment is higher for those aged 25- 34 years, followed by those aged 15-24 (Stats SA 2019e).

Stats SA (2019e) reported that in the 2017/2018 financial year, education and health received the bulk of the total spending of R557 billion. Approximately R230 billion was spent on education with tertiary education, receiving only 0.1% of the share. Health received the secondlargest contribution with 177 billion being spent on healthcare, of which the preponderance of the share (61%) went to hospital services. South Africa has a total of 580 public hospitals as well as 3500 public healthcare clinics and centres (Stats SA 2019e). Moreover, South Africa is one of the most unequal societies with a Gini coefficient of 0.63 in 2015 (World Bank 2019).

Consequently, this has resulted in more than half the country's population having to access public healthcare which is only sponsored by approximately 40% of the total spending. Despite the billions that are pumped into this sector every year, South Africa's healthcare sector faces many challenges, with the most pertinent being that it is strained and poorly resourced (Mayosi & Benatar 2014). Those that belong to the middle and upper classes and are fortunate enough to have medical aid and can therefore access the private healthcare sector which has most of the countries highly specialized doctors (Maphumulo & Bhengu 2019).

Passchier (2017) argues that because of the rapid and fast-changing burden of diseases, South Africa's healthcare sector has trouble keeping up with the demands that it is faced with, which the government plans to counter with the implementation of the National Health Insurance (NHI). Access inequality is further exasperated by geographical locations, as the most impoverished are not only the most affected by diseases but are victims of the consequences of spatial inequality and are expected to make use of mediocre healthcare services (McLaren Ardington & Leibbrandt 2014). Therefore, in line with the Sustainable Development Goals (SDGs) and the National Development Plan 2030 (NDP), demographic and socioeconomic inequality patterns in South Africa have become significant in addressing the changing burden of diseases (National Planning Commission 2012)

Figure 3.1: Map of South Africa



Source: Statistics South Africa

3.3 National Income Dynamics Survey

This is a quantitative study that makes use of secondary data obtained from NIDS, in particular Waves 1 and 5. Wave 1, which is the base wave, was released in July 2009, and Wave 5 was released in August 2018 (Brophy *et al*. 2018; Leibbrandt *et al*. 2009). The primary investigator for this research is SALDRU which is affiliated to UCT with aid from the Department of Planning, Monitoring and Evaluation. It is conducted in all nine South African provinces with households and individuals being the units of analysis (Leibbrandt *et al*. 2009). It is a longitudinal study that is interested in the living standards of South Africans across a wide range of indicators. It covers aspects from health, education, race, employment, mortality, the standard of living, agriculture, intergenerational developments, access to social services, anthropometric data and family support amongst children and adults (Brophy *et al*. 2018).

3.4 Sampling size and sampling design

The initial study comprises of 28 255 individuals targeted from 7305 private households (Leibbrandt *et al*. 2009). Every two years, the study is repeated with the same household members who are referred to as Continuing Sample Members (CSMs). For Wave 5, 2 775 CSMs were added as a result of the attrition of White, Indian/ Asian and high-income

participants in order to maintain that the study sample remained representative of the population (Brophy *et al*. 2018). This survey, unlike the other household surveys does not use the head of the household as a proxy for all the individuals of the household, rather it studies the individuals of the household as well as the household dynamics. Thus, producing data that is more representative of the household than the other household surveys. The study employed a stratified, two-stage cluster sample design (Leibbrandt *et al*. 2009). Stats SA's 2003 Master Sample was used to sample 400 Primary Sampling Units (PSUs) across all nine provinces with 300 fieldworkers (Leibbrandt *et al*. 2009). The study excluded those that reside in nursing homes, hostels, hospitals, military barracks, as well as student hostels (Leibbrandt *et al*. 2009). Data was collected using household, adult, child and proxy questionnaires (Leibbrandt *et al*. 2009).

3.5 Weights

Weights are used to adjust for unequal probabilities of selection and non-response (Branson & Wittenburg 2019). This is done by assigning a value to each case in the data to make it more representative of the population (Johnson 2008). For instance, most population surveys are comprised of more female than male respondents (60/40), thus resulting in an overrepresentation of females and an underrepresentation of males (Johnson 2008). Poststratification/ non-response weights are used to make-up for the shortcomings that result in the non-participation of those with the desirable characteristics (Johnson 2008). In the data analysis of this study, the Stata IC version 12 software survey commands were used, and data was weighted using w1_wgt, w1_hhdc2011 and pweight =w5_pweight for Wave 1 and Wave 5 respectively. In order to reduce the influence of a few households with high weights and this was, done to the 95^{th} percentile (Branson & Wittenberg 2019).

3.6 Study Hypothesis

The study hypothesizes that a relationship exists between hypertension and socioeconomic and demographic factors. The null hypothesis states that there is no significant relationship exists between hypertension and socioeconomic and demographic factors.

3.7 Outcome variable:

The outcome variable for this study is hypertension. The variables associated with hypertension in the NIDS dataset in the year 2008 were *w1_a_bpdia_1,* and *w1_a_bpdia_2* measured diastolic while *w1_a_bpsys_1* and *w1_a_bpsys_2* measured systolic. In the year 2017 they were

represented as *w5_a_bpdia_1* and *w5_a_bpdia_2* measured diastolic while *w5_a_bpsys_1* and *w5_a_bpsys_2* measured systolic. An average of both the systolic and diastolic variables was considered for both years, and new variables called w1_highbp & w5_highbp were generated and labelled "high blood pressure" for both Wave 1 and Wave 5 respectively. A weighted average of both datasets was considered.

Given that those on medication for hypertension would not have a high measured blood pressure reading, this was also considered during the analysis. In 2008 NIDS (Wave1), 15 461 respondents were asked questions related to high blood pressure and 2 472 respondents were reported to have high blood pressure while 12 989 were not. Furthermore, in 2017 (Wave5), 22 217 respondents were asked questions related to high blood pressure and 3 107 were reported as having high blood pressure, whereas 19 110 were not. In both waves, responses that were not needed for the study were excluded. These included missing data and nonresponse as the number of observations were too small and therefore there was no need to redistribute them when creating the new hypertension variables. Whilst researchers often differ on the threshold of hypertension; this study has chosen to define it as 140mg/90mg (Monakali *et al*. 2018). The variables were defined using the following questions from NIDS:

Have you ever been told by a doctor, nurse or health care professional that you have high blood pressure?

Are you currently taking medication for High blood pressure?

Do you still have High blood pressure?

0= No

1= Yes

3.8 Independent Variables

3.8.1 Demographic variables: *Age*

w1_best_age_yrs/ w5_best_age_yrs

Age is often misreported whether rounded off, skipped or exaggerated. To account for inconsistences, NIDS generated best variables. For age, a variable called best-age was generated and makes use of the date of birth and the date of the interview of that wave to calculate the respondents age (Brophy *et al*. 2018). For this study age was derived using the question:

B1: What is your birth date?

Age is then left as a continuous variable in order to categorize it into age groups. It is then coded as follows:

0= 15-24

1= 25-34

2= 35-44

3=45-54

4= 55-64

5= 40-44

6= 45-49

7= 50-54

8=55-64

9=65+

Marital status

Marital status is an integral part of health research as it influences health outcomes and significantly affects human longevity (Kim *et al*. 2018). According to Robards *et al.* (2012), healthy individuals are more likely to get married in comparison to their unhealthy counterparts who are more likely to remain single, separate or divorce. Kim *et al*. (2018), further argues that changes in marital status such as termination are stressful events that have adverse health implications, which makes individuals more susceptible to poor health. It is important to note that marriage, like age, is often misreported. Chae (2016), argues that respondents often misreport marriage if they do not carry out each step of the process. Furthermore, marriage is often defined or understood differently by different people. For instance, in Sub-Saharan Africa, various forms of marriage exist, such as free unions, consensual unions, customary marriages, religious and civil marriages which are often categorized by surveys as all being marriage unions thus resulting in misreporting Chae (2016). In South Africa, 'never married' is distinguished between single and living with partner or cohabiting. It is important to note that cohabitation, living with partner, domestic relationship or any common law marriage is not

recognized as a legal relationship status (Stats SA 2016). Cohabitation is also preferred mainly by young people under the age of 30, males and more likely in urban areas (Stats SA 2016). South Africa also has customary marriages that are indigenous to the African culture, which must be registered within three months of being celebrated or concluded at a nearby Home Affairs or designated traditional authority (Department of Home Affairs 2020). For this study, marital status is derived from the following questions: Wave 5 and Wave 1 respectively -Are you currently married, widowed, divorced or separated? / What is your current marital status?

w1_a_marstt/ w5_a_marstt

The variable is then coded as follows:

0= Married

1= Living with partner

2= Widow/ Widower

3= Divorced or Separated

4= Never married

Gender

The stereotypical expectations about how men and women is key in how they perceive themselves and treat others. Gender, which is a social construct, attaches ideas of masculinity and femininity to people based on biological features that are used to categorize males and females. Men are expected to be assertive and strong, whereas women are expected to be warm and nurturing (Edström 2015; Rohleder 2012). These have an impact on the life choices of both men and women and such as overconfidence in men that result in risky choices such as irresponsible sexual behaviour and career choices of being a nurse for women (Ellemers 2018). Ideas perpetuated by patriarchy have resulted in the political, economic, social and cultural oppression of women (Ademiluka 2018). Rawat (2014), argues that imposing ideas of masculinity and femininity stereotypes in societies strengthens the iniquitous power dynamics that exist amongst men and women. Moreover, women's access to health and more especially sexual reproductive and maternal health is often dictated by their male partners who have been decision makers in the relationship as allowed by patriarchy (Ganle & Dery 2015). For this study, *w1_best_gen/ w5_best_gen* was used to determine gender and a binary dummy variable was created and coded as:

0= Male

1= Female

Population Group

Race and ethnicity in health research are important in understanding how diseases affect populations and identifying groups that are most at risk (Katzmarzyk & Statiano 2012). Race and ethnicity are social categories that determine how people not only perceive themselves but perceive others. According to the National Academies of Sciences, Engineering and Medicine (2017), although they are socially constructed, the categorisations have tangible effects on the lives of individuals. In South Africa, historical events still shape and influence health, services as well as resource inequities which have an impact on overall health outcomes (Harris *et al.* 2011). For this study, a new variable was created using *w1_a_popgrp/w5_a_popgrp* and it was derived from the following questions:

Wave 5-What population group do you belong to? / What population group would you describe yourself as belonging to? – Wave 1 and variable is created as follows:

0= Africa

1= Asian/ Indian

3= Colored

4= White

Geographic location

Geographic location has an impact on overall outcomes as it determines the overall environment one lives in, the distance to social and health resources as well as the availability of resources (Spasojevic *et al.* 2015). The geographic location variable for this study is divided into traditional, urban and farms. Traditional refers to communally owned land that is ruled by traditional leaders and is made up of villages. Urban refers to cities, townships, towns, small towns and hamlets. Farms are land that is allocated and used for commercial farming which includes the structures and infrastructure found on it (Branson & Wittenberg 2019). For this study, these are coded as follows:

0= Traditional/Rural

1= Urban

2= Farms

3.8.2 Socioeconomic variables:

Educational attainment

Educational attainment is linked to better future employment and income prospects. This is associated with better health outcomes and subsequently delayed mortality (Byhof *et al.* 2017). Raghupathi & Raghupathi (2020), similarly maintain that adults with higher educational attainment are more likely to live longer than their less-educated peers. This is attributed to better health behaviours, being able to recognize symptoms of illness and report it, having access to resources and strategies to deal with things such as stress (Raghupathi & Raghupathi 2020). NIDS has 25 educational attainment categories from no education to tertiary education. New variables were derived from "What is the highest grade in school that you have successfully completed?" and Coded as:

0= Primary education (Grade 0 to Grade 6)

1= Secondary education (Grade 7 to Grade 12, National Vocational Certificates, Nated Certificates, Certificates and Diplomas with grade 12 and less)

2= Tertiary education (Bachelors degree, Bachelors degree and Diploma, Higher degree (Masters, Doctorate)).

3=No education

Employment status

The CSDH makes use of occupation, however this study has opted to use employment status being cognisant of the limitations of occupation such as excluding certain groups (Solar & Irwin 2010). If a respondent was economically active or reported that they had any form of employment at the time that the interview was conducted they were regarded as being employed (Brophy *et al*. 2018). This included a primary or secondary job, self-employment, paid casual work, personal agricultural work or if they aided someone involved in any business activities (Brophy *et al*. 2018). NIDS defines employment in accordance with the International Labour Organization (ILO), which categorizes employment status into employed, unemployed (strict), unemployed (broad) and not economically active (Brophy *et al*. 2018; Leaker 2009). The definition of unemployment distinguishes between those that are unemployed but are actively looking for employment and those that are not searching or have no desire to work into the

narrow or strict definition and the broad definition respectively (Alenda-Demoutiez & Mugge 2020). The economically inactive are defined as those who are neither employed nor unemployed and are not available to work due to various reasons such as being a student, retired, unable to work due to illness (Leaker 2009). This study has chosen to adopt the broad definition of unemployment as defined by Alenda-Demoutiez & Mugge (2020) and has coded the variable as follows:

0= Employed

1= Unemployed

2= Economically inactive

Wealth quintile

Income, as indicated by the CSDH is an unreliable indicator. It is for this reason that this study has opted to use a wealth quintile (Solar & Irwin 2010). Wealth quintiles are created by dividing the household income by the household size to generate per capita household income *w1_hhqincome/w1_hhsizer* (wave 1) and *w5_hhqincome/ w5_hhsizer* (wave 5). Five wealth quintiles were generated ranging from quintile one to five. Quintile one being the lowest quintile and quintile five being the wealthiest. The codes were as follows:

Quintile 1 = R0 – R1500 per capita

Quintile 2 = R1501 –R2500 per capita

Quintile 3 = R2501 – R3000 per capita

Quintile 4 = R3001- R4500 per capita

Quintile 5 = R4501+ per capita

3.9. Data analysis

In order to determine the relationship between demographic and socioeconomic factors and hypertension, secondary data analysis was done using the NIDS Wave 1 and Wave 5 datasets.

This data was analysed using Stata IC version 12 software and a combination of descriptive and inferential statistical methods were employed.

Firstly, descriptive summaries of the outcome variables and the independent variables were presented. This gives a description of the prevalence of hypertension as well as the

demographic and socioeconomic characteristics of the population. Descriptive statistics are essential as they summarize data in a simplified manner using simple quantitative measures such as the frequency distribution tables and percentages used in this study which allows for more straightforward interpretation. Descriptive statistics can be used to describe a single variable (univariate analysis) or more (bivariate/ multivariate analysis) (Kaliyadan & Kulkarni 2019).

Multivariate logistic regression was conducted in order to determine whether there was a significant relationship between the selected demographic and socioeconomic independent variables and hypertension. Variables that showed a $P < 0.05$ at a 95% CI level were regarded as being statistically significant for hypertension. Chi-square test was conducted to test for significant associations between 2008 and 2017 associations. The equation for the multivariate logistic regression is given below:

$$y = \beta 0 + \beta 1 \cdot x1 + \beta 2 \cdot x2 + \ldots + \beta p \cdot xp + \epsilon \text{ y}$$

– dependent variable (hypertension) β1 –

coefficient of the independent variable x1

– independent variable (age, gender etc.) €

- error

3.10. Validity, Reliability and Rigor

The study makes use of data from the National Income Dynamics Study (NIDS), which makes use of a larger sample than the researcher could ever reach alone. Making use of the NIDS data increases the level of reliability and validity as the sample size is representative and generalizable of the whole population. No study is without limitations, and this one is no exception. One of the main challenges is that because the researcher was not involved in the data collection processes, the specific questions that the researcher might have wanted to ask or how they were phrased will not necessarily be reflected by the NIDS study. Overall, however, the data is comprised of all the aspects that the researcher wishes to explore.

3.11 Ethical considerations

Ethics make up a critical part of research and therefore it is imperative to consider for every research project no matter how minimal the risk is projected to be. For this study, secondary data is being analysed, and permission was granted by the Human and Social Sciences Research Ethics Committee (HSSREC) of the University of KwaZulu Natal. The study protocol number is HSSREC/00000269/2019.

3.12 Summary

This chapter outlined the research methodology of the study in detail. NIDS is the source of data for the study and the variables were recoded to suit the study objectives. A new hypertension variable was created by using a weighted average of three of the NIDS variables pertaining to hypertension. The study opted to use wealth quintiles rather than income as income is an unreliable indicator. Furthermore, employment status was used rather than occupation as occupation excluded certain groups. The broad definition of employment was utilised, and the variable was coded accordingly. Data was analysed using various descriptive and inferential statistical methods. These methods were employed in the presentation of data as well as to test whether a significant relationship exists between demographic and socioeconomic factors and hypertension.

CHAPTER FOUR

RESULTS

4.1 Introduction

The following chapter is a depiction of the findings of the study using secondary data from NIDS 2008 (Wave 1) and 2017 (Wave 5). The outcome variable for this study is high blood pressure, and the independent variables are demographic and socioeconomic indicators. The demographic variables comprise of marital status, population group, gender, age and geographical location. Furthermore, the socioeconomic variables are education, wealth quintile and employment status.

To test the association between individual demographic and socioeconomic characteristics and high blood pressure, a Chi-square analysis was performed. These variables were then entered into a multivariate binomial logistic regression to obtain the odds ratios of the demographic and socioeconomic variables significantly associated with high blood pressure.

4.2: Prevalence of high blood pressure in 2008 and 2017

Table 4.1: Percentage of respondents with high blood pressure in 2008 and 2017

	2008 N=15 461		**2017 N=22 217**	
Variables	Percent (%)	95% CI	Percent (%)	95% CI
High Blood Pressure				
Yes	13.5	(12.4 – 14.7)	11.3	(10.6 - 12.1)
No	86.5	(85.3 – 87.6)	88.7	(87.9 - 89.4)

NIDS 2008 & 2017(weighted)

Table 4.1 presents the overview of high blood pressure prevalence and CIs of the 2008 and 2017 NIDS sample. The 2008 sample was comprised of 15 461 respondents and the 2017 sample included 22 217 respondents. Of the 15 461 participants in 2008, 13.5% (CI: 12.4 – 14.7) had high blood pressure. In 2017, of the 22 217 participants, 11.34% (CI: 10.6 – 12.1) had high blood pressure. There are no significant differences in the prevalence of high blood pressure between the two samples.

4.3: Demographic and socioeconomic characteristics of respondents in 2008 and 2017

Table 4.2: Demographic characteristics of adult respondents in 2008 and 2017

	2008		2017	
Variables	**Percent**	**95% CI**	**Percent**	**95% CI**
Gender				
Male	44.1	(42.8 – 45.4)	46.1	(44.9 – 47.3)
Female	55.9	(54.6 – 57.2)	54.0	(52.7 – 55.1)
Marital Status				
Married	31.5	(29.1 – 33.9)	27.2	(26.1 – 28.3)
Living with a partner	9.1	(8.1 – 10.3)	5.3	(4.8 – 5.9)
Widow/Widower	6.9	(6.3 – 7.6)	7.6	(7.0 – 8.2)
Divorced/Separated	3.3	(2.7 – 4.1)	3.5	(3.0 – 4.0)
Never Married	49.2	(46.8 - 51.5)	56.4	(55.2 - 57.6)
Population Group				
African	79.2	(74.6 – 83.1)	83.0	(81.0 – 83.2)
Coloured	8.0	(6.0 – 10.8)	8.9	(8.3 – 9.6)
Asian/Indian	2.4	(1.1 – 5.3)	2.1	(1.7 – 2.6)
White	10.5	(7.5 – 14.1)	7.0	(6.1 – 7.9)
Age				
15-24	20.7	(19.5 – 21.9)	26.3	(25.3 – 27.3)
25-34	23.6	(22.6 – 24.6)	20.6	(19.6 – 21.6)
35-44	20.9	(20.0 – 21.7)	15.6	(14.7 – 16.6)
45-54	17.8	(17.0 – 18.5)	11.4	(10.6 – 12.2)
55-64	14.5	(13.8 – 15.2)	21.3	(20.4 – 22.2)
65+	2.7	(2.4 – 3.0)	4.7	(4.3 – 5.3)
Geographical Location				
Traditional/ Rural	33.5	(28.9 – 38.5)	33.0	(32.0 – 34.0)
Urban	58.8	(53.8 – 63.6)	62.4	(61.3 – 63.5)

Farms	7.7	(5.1 – 11.4)	4.5	(4.1 – 5.0)

NIDS 2008 & 2017(weighted)

Table 4.2 presents the demographic characteristics of adult respondents aged 15+ years included in the study in 2008 and 2017. The sample comprised of more males than females in both waves as they account for 44.1% and 55.9% in 2008 and 2017, respectively. There were no significant changes in the gender composition of the sample between 2008 and 2017. There are noteworthy differences in the marital status category. Firstly, there is a decrease in the number of married individuals and those living with partners. In 2008, 31.5% were married compared to 27.2% in 2017. Those living with partners contributed 9.1% in 2008 and 5.3% in 2017. Lastly, there was an increase in those that were never married as they accounted for 49.2% in 2008 and 56.6% in 2017.

There were also changes in the age composition between the samples. There was an increase in the 15-24 years age group from 20.7% in 2008 to 26.3% in 2017. This reflects the youthfulness of the country's population. According Stats SA (2019b), approximately 28.8% of the South African population is comprised of young people. There is a decrease in those aged 25-54 years in the sample. This may be attributed to the fact that this group is the economically active group and they are often unavailable for the interview. In Wave 5 (2017), there is a larger sample of the elderly, which are those aged 55+. Those within this category are often retired and at home meaning they are available for the interview. This increase in the elderly population could also be as a result of the increased life expectancy (Stats SA 2019b).

Africans made up the bulk of the study population, reflecting South Africa's population. In 2008, 79.2% were African and similarly in 2017, 83.0% were African. There was a slight decrease in the White population as they contributed 10.5% in 2008 and 7.0% in 2017. In terms of the geographical location of the sample, the majority lived in urban areas. In 2008, 58.8% was residing in urban areas and 62.4% in 2017 were resident in urban areas. One third of the population lived in traditional/rural settings and only less than one tenth was found in farms. This closely reflects the findings of Business Tech (2014) who reported that approximately 66.3% of the total South African population is found in urban areas, and 33.7% reside in rural areas. Yarahmadi *et al*. (2013) state that fast economic growth and rapid industrialization is the reason behind the increase in urbanization as more and more people relocate to the cities in pursuit of greener pastures.

Table 4.3: Socioeconomic characteristics of adult respondents in 2008 and 2017

	2008		2017	
Educational Attainment	**Percent**	**95% CI**	**Percent**	**95% CI**
Primary Education	35.6	(34.3 – 36.9)	13.4	(12.7 – 14.2)
Secondary Education	47.7	(46.3 – 49.2)	77.3	(76.4 – 78.3)
Tertiary Education	2.2	(1.5 – 3.2)	3.7	(3.2 – 4.3)
No Education	14.4	(13.6 – 15.3)	5.5	(5.0 – 6.0)
Wealth Quintile				
Quintile 1	74.6	(70.6 – 78.2)	48.1	(47.0 – 49.3)
Quintile 2	8.1	(7.0 – 9.3)	18.1	(17.2 – 19.0)
Quintile 3	2.5	(1.9 – 3.4)	5.3	(4.8 – 5.9)
Quintile 4	5.3	(4.2 – 6.6)	9.8	(9.1 – 10.6)
Quintile 5	9.5	(7.1 – 12.7)	18.7	(17.5 – 19.6)
Employment Status				
Employed	44.3	(42.3 – 46.4)	44.8	(43.6 – 46.0)
Unemployed	19.4	(18.1 – 20.8)	11.8	(11.1 – 12.6)
Not economically active	36.3	(34.7 – 37.9)	43.4	(42.2 – 44.6)

NIDS 2008 & 2017(weighted)

Table 4.3 depicts the socio-economic characteristics of adult respondents included in the study in 2008 and 2017 aged 15+. The data shows that the 2017 sample is better educated in comparison to the 2008 sample. The 2008 sample was more likely to have a primary education and less likely to have a tertiary education. Less than half (47.7%) of the population only had a secondary education and only 2.2% had a tertiary education in 2008. In 2017, 77.3% had a secondary education, 3.7%. The 2008 sample also had a bulk of the population comprising of those from the poorest households (74.6%) whereas less than half (48.1%) from the 2017 sample were resident in households in the lowest quintile. Those from the wealthiest households only consisted of less than one tenth (9.5%) in 2008 compared to almost one fifth (18.7%) in 2017.

The data also indicates a shift in terms of employment status. In 2008, 19.4% was unemployed and 36.3% were not economically active. However, in 2017, 11.8% were unemployed and

43.4% were not economically active. This is most likely a reflection of the increase in the 1524 age group as they are mostly likely to be students. It also mirrors Stats SAs recent findings that estimated that out of an approximate total of 38.6 million South Africans within the working age (15-64), 16.4 million are employed, 6.7 million are unemployed, 2.8 million are unemployed work seekers and 12.7 million economically inactive (Stats SA 2019e).

4.4: Demographic characteristics and high blood pressure

Table 4.4: Chi-square test of association between demographic variables and high blood pressure in 2008

Variable	**High Blood Pressure**				
Gender	**Yes**	**95% CI**	**No**	**95% CI**	**P-value** = *0.00**
Male	8.2	(7.0 – 9.5)	91.8	(90.4 – 93.0)	
Female	17.7	(16.3 – 19.2)	82.3	(80.8 – 83.7)	
Marital Status					**P-value** = *0.00**
Married	19.6	(17.7 - 21.6)	80.4	(78.4 – 82.3)	
Living with partner	15.2	(10.3 – 21.8)	84.8	(78.2 – 89.7)	
Widow/Widower	37.3	(33.1 – 41.8)	62.7	(58.2 – 67.0)	
Divorced/Separated	25.0	(16.5 – 35.8)	75.1	(64.2 – 83.5)	
Never Married	5.2	(4.7 – 5.8)	94.8	(94.1 – 95.3)	
Population Group					**P-value** = *0.00**
African	11.9	(10.8 – 13.1)	88.1	(86.9 – 89.2)	
Coloured	19.3	(16.4 – 22.7)	80.6	(77.3 – 83. 6)	
Asian/Indian	16.5	(12.6 – 21.2)	83.5	(78.8 – 87.4)	
White	20.7	(15.6 – 26.9)	79.3	(73.1 – 84.4)	
Age					**P-value** = *0.00**
15-24	2.8	(2.2 – 3.7)	97.1	(96.3 – 97.8)	
25-34	8.3	(6.3 – 11.0)	91.7	(89.0 – 93.7)	
35-44	19.0	(16.5 – 21.9)	80.9	(78.1 – 83.5)	
45-54	30.7	(27.0 – 34.6)	69.3	(65.4 – 73.0)	
55-64	14.2	(12.3 – 16.3)	85.8	(83.7 – 87.7)	

65+	38.3	(33.8 – 43.0)	61.7	(57.0 – 66.2)	
Geographical Location					**P-value** = *0.00**
Traditional/Rural	11.0	(10.0 – 12.3)	89.0	(87.7 – 90.1)	
Urban	15.0	(13.2 – 16.8)	85.1	(83.2 – 86.8)	
Farms	13.0	(10.6 – 15.8)	87.0	(84.1 – 89.4)	

NIDS 2008 weighted

Table 4.4 presents the association and confidence interval between demographic variables and high blood pressure in 2008, and that this difference was statistically significant. Where the $p < 0.05$, there is a significant association between the variable and high blood pressure therefore, rejecting the null hypothesis states that no significant relationship exists between high blood pressure and the variable under consideration.

The results indicated that more females (17.7%) than males (8.2%) in 2008 had high blood pressure. Those that were widowed were most likely to have high blood pressure (37.3%) and those that were never married were least likely (5.2%). Overall, there was a significant association between marital status and high blood pressure. There was also an association between population group and high blood pressure, with 20.7% Whites having raised blood pressure and only 11.9% of Africans. Only 2.8% of those aged 15-24 years had high blood pressure compared to 38.3% of those aged 65+ years high blood pressure. There were significant differences in age specific high blood pressure rates. An association was found between age and high blood pressure. Respondents who lived in urban areas had the highest levels of raised blood pressure at 15% and only 11% of those living in traditional settings had high blood pressure.

Table 4.5: Chi-square test of association between demographic variables and high blood pressure in 2017

Variable	**High Blood Pressure**				
Gender	**Yes**	**95% CI**	**No**	**95% CI**	**P-value =** *0.00**
Male	7.6	(6.7 – 8.7)	92.3	(91.2 – 93.3)	
Female	14.6	(13.6 – 15.7)	85.4	(84.2 – 86.4)	
Marital Status					**P-value** = *0.00**
Married	20.1	(18.2 - 22.2)	79.9	(77.8 – 81.8)	
Living with partner	13.4	(9.9 – 17.9)	86.6	(82.1 – 90.1)	
Widow/Widower	37.9	(33.8 – 42.1)	62.1	(57.9 – 66.2)	
Divorced/Separated	14.9	(11.2 – 19.7)	85.1	(80.3 – 88.8)	
Never Married	4.2	(3.6 – 4.8)	95.8	(95.2 – 96.4)	
Population Group					**P-value =** *0.00**
African	10.1	(9.4 – 10.9)	89.8	(89.1 – 90.5)	
Coloured	15.8	(13.3 – 18.6)	84.2	(81.4 – 86.7)	
Asian/Indian	10.9	(5.8 – 19.5)	89.1	(80.5 – 89.1)	
White	20.1	(15.4 – 26.8)	79.4	(73.1 – 84.6)	
Age					**P-value =** *0.00**
15-24	2.0	(1.4 – 2.8)	98.0	(97.2 – 98.6)	
25-34	5.9	(4.7– 7.5)	94.0	(92.5 – 95.3)	
35-44	12.9	(11.0 – 15.2)	87.1	(84.8 – 89.1)	
45-54	26.2	(23.2 – 29.5)	73.8	(70.5 – 76.8)	
55-64	13.0	(11.5 – 14.8)	87.0	(85.2 – 88.5)	
65+	51.3	(45.5 – 57.0)	48.7	(43.0 – 54.5)	
Geographical Location					**P-value =** *0.21*
Traditional/ Rural	11.2	(10.2 – 12.3)	88.8	(87.7 – 89.8)	
Urban	11.2	(10.2 – 11.2)	88.8	(87.7 – 89.8)	
Farms	14.2	(11.1 – 17.9)	85.6	(82.1 – 88.9)	

NIDS 2017 weighted

Table 4.5 presents the association and confidence interval between demographic variables and high blood pressure in 2017. Where the $p<0.05$, there is a significant association between the variable and high blood pressure therefore, rejecting the null hypothesis states no significant relationship exists between high blood pressure and the variable under consideration.

The data shows that gender is significantly associated with high blood pressure. Females were more likely to have high blood pressure, 14.6%, compared to their male counterparts at 7.6%. There were significant differences in high blood pressure in terms of gender. There was also

an association between marital status and high blood pressure. Just over one fifth (20.1%) of those who were married had high blood pressure compared to 4.2% of the never married respondents. In terms of population group, 10.1% Africans of the African respondents had high blood pressure compared to 20.1% of White respondents in 2017.

Over half (51.3%) of the respondents who were 65+ years had high blood pressure. Only 2.0% of those aged 15-24 years had high blood pressure and no significant differences were found between those aged 35-44 years and those aged 55-64 years. Geographical location was not significantly associated with high blood pressure in 2017. In urban and traditional/rural areas, only 11.2% of the respondents from each geographical location had high blood pressure whilst 14.2% of those in residing in farm settings had high blood pressure.

4.5: Socioeconomic characteristics and high blood pressure.

Table 4.6: Chi-square test of association between socioeconomic variables and high blood pressure in 2008

Variable	**High Blood Pressure**				
Education	**Yes**	**95% CI**	**No**	**95% CI**	**P-value** = *0.00**
Primary Education	21.4	(19.3 – 23.7)	78.6	(76.2 – 80.7)	
Secondary Education	9.2	(8.3 – 10.3)	90.7	(89.6 – 91.7)	
Tertiary Education	14.9	(6.8 – 29.6)	85.1	(70.4 – 93.2)	
No Education	27.4	(23.6 – 31.7)	72.6	(68.3 – 76.4)	
Wealth Quintile					**P-value** = *0.20*
Quintile 1	13.7	(12.6 – 14.7)	86.3	(85.2 – 87.4)	
Quintile 2	13.7	(10.0 – 18.5)	86.3	(81.5 – 90.0)	
Quintile 3	7.9	(4.9 – 12.6)	92.1	(87.4 -95.1)	
Quintile 4	10.1	(7.3 – 14.0)	89.9	(86.0 – 92.7)	
Quintile 5	15.9	(11.7 – 21.2)	84.1	(78.8 – 88.3)	
Employment Status					**P-value** = *0.00**
Employed	12.7	(11.3 – 14.2)	87.3	(85.7 – 88.7)	
Unemployed	9.8	(8.0 – 12.0)	90.2	(88.0 – 92.0)	
Not Economically Active	16.5	(15.0 -18.2)	83.5	(81.8 – 85.0)	

NIDS 2008 weighted

Table 4.6 presents the association and confidence interval between socioeconomic variables and high blood pressure in 2008. Where the $p < 0.05$, there is a significant association between the variable and high blood pressure therefore, rejecting the null hypothesis states that no significant relationship exists between high blood pressure and the variable under consideration.

There was an association between raised blood pressure and education in 2008. Over one quarter (27.4%) of those with no education had high blood pressure and only 9.2% of those with a secondary education had high blood pressure. The wealthiest quintile had the largest percentage of people with high blood pressure (15.9%) whilst quintile three had the lowest (7.9%), although overall there was no significant differences between wealth quintiles. Employment status was significantly associated with high blood pressure. Of those that were not economically active, 16.5 % had high blood pressure and those that were unemployed were least likely to have raised blood pressure at 9.8%.

Table 4.7: Chi-square test of association between socioeconomic variables & high blood pressure in 2017

Variable	**High Blood Pressure**				
Education	**Yes**	**95% CI**	**No**	**95% CI**	**P-value** = *0.00**
Primary Education	23.8	(21.4 – 26.3)	76.2	(73.7 – 78.6)	
Secondary Education	7.8	(7.04 – 8.6)	92.2	(91.4 – 93.0)	
Tertiary Education	14.9	(9.8 – 22.0)	85.1	(9.8 – 90.2)	
No Education	31.6	(27.6 – 36.0)	68.4	(27.6 – 36.0)	
Wealth Income					**P-value** = *0.39*
Quintile 1	10.4	(9.5 – 11.3)	89.6	(88.7 – 90.4)	
Quintile 2	12.8	(11.0 – 14.8)	87.2	(85.2 – 89.0)	
Quintile 3	11.8	(8.8 – 15.6)	88.2	(84.4 – 91.2)	
Quintile 4	11.1	(8.8 – 14.0)	88.9	(86.0 – 91.2)	
Quintile 5	12.5	(10.3 – 15.0)	87.5	(85 – 89.7)	
Employment Status					**P-value** = *0.00**
Employed	9.0	(8.0 – 10.1)	91.0	(89.9 – 89.4)	
Unemployed	7.4	(5.6 – 9.6)	92.6	(90.4 – 94.4)	
Not Economically Active	14.9	(13.7 – 16.2)	85.1	(83.8 – 86.3)	

NIDS 2017 weighted

Table 4.7 presents the association and confidence interval between socioeconomic variables and high blood pressure in 2017. Where the $p < 0.05$, there is a significant association between the variable and high blood pressure therefore, rejecting the null hypothesis states that no significant relationship exists between high blood pressure and socioeconomic factors.

Education and raised blood pressure were found to be significantly associated. Almost one third (31.6%) of those with no education (14.9%) had high blood pressure and while only 7.8% of those with a secondary education had the same. There were significant differences between wealth quintiles and high blood pressure. Those who were not economically active were the

most likely to have high blood pressure (14.7%) while those who were unemployed were the least (7.4%).

4.6: Multivariate analysis of demographic variables and high blood pressure

Table 4. 8: Multivariate binomial logistic regression of demographic variables and high blood pressure in 2008 and 2017.

Year	**2008**			**2017**		
Variable	**Odd ratio**	**95% CI**	**p>|t|**	**Odd ratio**	**95% CI**	**p>|t|**
Gender	**RC=Male**			**RC=Male**		
Female	2.33	(1.9392 – 2.7960)	0.00*	2.00	(1.6507 – 2.4173)	0.00*
Marital Status	**RC=Married**			**RC=Married**		
Living with partner	1.10	(0.7131 - 1.6868)	0.67	1.02	(0.7135 -1.4583)	0.91
Widow/Widower	1.32	(1.0625 – 1.6540)	0.01*	1.08	(0.8326 – 1.3955)	0.57
Divorced/Separated	0.98	(0.5813 – 1.6481)	0.94	0.60	(0.4124 – 0.8803)	0.00*
Never Married	0.31	(0.2466 – 0.3878)	0.00*	0.25	(0.1939 – 0.3344)	0.00*
Population Group	**RC=African**			**RC=African**		
Coloured	1.26	(0.9929 – 1.6039)	0.06	1.24	(0.9646 – 1.5976)	0.09
Asian/Indian	0.92	(0.6134 – 1.3732)	0.68	0.65	(0.2956 – 1.4316)	0.28
White	0.88	(0.6083 – 1.2853)	0.52	0.99	(0.6504 – 1.4970)	0.95
Age	**RC=15-24 years**			**RC=15-24 years**		
25-34	2.06	(1.3724 – 3.1031)	0.00*	1.97	(1.2469 – 3.1197)	0.00*
35-44	4.66	(3.3959 – 6.3922)	0.00*	3.48	(2.2073 – 5.4826)	0.00*
45-54	8.70	(6.3517 – 11.9075)	0.00*	7.63	(4.9135 – 11.8643)	0.00*
55-64	5.92	(4.3471 – 8.0642)	0.00*	6.24	(4.2023 – 9.2540)	0.00*
65+	10.32	(7.3374 – 14.5048)	0.00*	19.34	(11.7278 – 31.8993)	0.00*
Geographical Location	**RC= Traditional**			**RC= Traditional**		
Urban	1.57	(1.2227 – 2.0058)	0.00*	0.11	(0.4716 – 0.9074)	0.01*
Farms	1.27	(0.9227 – 1.7611)	0.14	0.78	(0.5789 – 1.0701)	0.13

NIDS 2008 and 2017 weighted
RC=Reference Category

Table 4.8 presents the logistic regression analysis to show the significant relationship between individual demographic characteristics and respondents with high blood pressure in 2008 and 2017. The data found a statistically significant relationship between gender and high blood pressure. The odds of having high blood pressure were higher for females than for males. In 2008, females were 133% likely to have high blood pressure than male respondents and in 2017, females were 100% more likely to have high blood pressure. This highlights the gender inequality that exists in society which not only deprives women of certain opportunities but increases their chances of ill health (Solar & Irwin 2010). In 2008 widowed/widower adults were 32% more likely to have high blood pressure while those who never married were 69% less likely to have high blood pressure than those who were married. In 2017, those that were widowed were 8% more likely to have high blood pressure while those who were never married were 75% less likely to have high blood pressure in comparison to those who were married.

In both 2008 and 2017, a statistically significant relation was found between urban settings and high blood pressure. In 2008, those residing in urban areas were 57% more likely and those resident on farms were 27% more likely than those in traditional/rural areas to have elevated blood pressure. In 2017, the odds of having high blood pressure were 89% less for those in urban areas and 22% less in farm settings compared to those living in traditional/rural areas.

4.7: Multivariate analysis of socioeconomic variables and high blood pressure

Table 4.9: Multivariate binomial logistic regression of socioeconomic variables and high blood pressure in 2008 and 2017.

Year	**2008**			**2017**		
Variable	**Odd ratio**	**95% CI**	**p>|t|**	**Odd ratio**	**95% CI**	**p>|t|**
Educational Attainment	**RC=Primary Education**			**RC=Primary Education**		
Secondary Education	0.34	(0.2886 – 0.4063)	0.00*	0.25	(0.2085 – 0.2968)	0.00*
Tertiary Education	0.41	(0.1789 – 0.9424)	0.04*	0.44	(0.2589 – 0.7413)	0.00*
No Education	1.35	(1.0676 – 1.7144)	0.01*	1.33	(1.0494 – 1.6834)	0.02*
Wealth Quintile	**RC= Quintile 1**			**RC= Quintile 1**		

Quintile 2	1.44	(0.9895 – 2.0839)	0.06	1.55	(1.2611 – 1.9099)	0.00*
Quintile 3	0.85	(0.5023 – 1.4542)	0.56	1.72	(1.1936 – 2.4893)	0.00*
Quintile 4	1.12	(0.7481 – 1.6860)	0.57	1.71	(1.2495 – 2.3271)	0.00*
Quintile 5	2.02	(1.4301 – 2.8513)	0.00*	2.06	(1.5591 – 2.7178)	0.00*
Employment Status	**RC=Employed**			**RC=Employed**		
Unemployed	0.77	(0.6310 – 0.9304)	0.00*	0.55	(0.4513 – 0.6687)	0.00*
Not Economically Active	0.70	(0.5518 – 0.8843)	0.00*	0.60	(0.4443 – 0.8196)	0.00*

NIDS 2008 and 2017 weighted
RC= Reference Category

Table 4.9 presents the logistic regression analysis to show the significant relationship between individual socio-economic characteristics and respondents with high blood pressure in 2008 and 2017.

The results indicate that in 2008, were 35% more likely to have high blood pressure than those with primary education. Those who had secondary school education were 66% less likely to have high blood pressure, and those with tertiary education were 59% less likely to have high blood pressure compared to those with primary education. In 2017, respondents who had no education were 33% more likely to have high blood pressure while those who had secondary school education were 75% less likely to have high blood pressure compared to those with a primary education. A significant relationship was found between all individual educational attainments and high blood pressure for both 2008 and 2017. Those from the wealthiest quintile were (102%) than those in the poorest quintile in 2008. In 2017, those in the wealthiest quintile were 106% more likely to have high blood pressure compared to those in the poorest quintile Those in quintiles two, three and four were respectively 55%, 72% and 71% were more likely to have high blood pressure than those from the poorest wealth quintiles.

A significant relationship was found between employment status and high blood pressure in both 2008 and 2017 for all categories. In 2008 those that were not economically active were 30% less likely to have high blood pressure compared to those that were employed while the unemployed were 23% less likely than those who were employed to have high blood pressure. In 2017, those that were unemployed were 45% less likely to have elevated blood pressure

compared to those that were employed. Similarly, those that were not economically active were 40% less likely to have high blood pressure compared to those that were employed

4.8: Summary

This chapter presented the findings of the study. A secondary data analysis was conducted on NIDS data from wave 1 (2009) and wave 5 (2017). The study found that socio-economic and demographic determinants have a significant impact on the risk of raised blood pressure among adults in South Africa. Noteworthy findings indicated that the highest odds for high blood pressure amongst South African adults in 2008 included, females, those that were widowed and Coloured. The results also indicated that the odds increased with age and were highest amongst those aged 65+. The odds were also higher for those living in urban areas, those with no education and those in quintile five. Those who were not economically and those who were unemployed were less likely have raised by pressure than those who were in employed in 2008. In 2017, the odds were again higher for females, those who were widowed, Coloured and those aged 65+. Those living in urban areas and farms were less likely have raised blood pressure than those in traditional/rural areas. The odds were higher for those with no education and those in wealth quintile five. Those that were not economically active and the unemployed had lower odds of having raised blood pressure than those who were employed in 2017.

Chapter 5
Discussion

5.1 Introduction

The world has observed an increase in the morbidity and mortality associated with noncommunicable diseases (Murray & Lopez 2013). In low and middle-income countries, this shift means that they are now faced with a double burden of disease due to communicable and noncommunicable diseases. South Africa however is said to be facing a quadruple burden of disease, as injuries, and maternal and child mortality also contribute significantly to the country's burden of disease (Bradshaw *et al*. 2011). In Africa, this shift also manifested amidst various political, social and economic difficulties on the continent. For South Africa, the risk and prevalence of diseases disproportionality affects the population as a result of demographic and socioeconomic inequality (Ataguba *et al*. 2011), which is a legacy of the country's segregation history (Omotoso & Koch 2018).

The study is placed within the context of South Africa which has observed an increase in the upsurge of non-communicable diseases of which hypertension is a dominant part. South Africa's history is one that is dominated by racial segregation which has infiltrated into all aspects of its society, of which healthcare is no exception. With the changing burden of disease, the shortage of resources and growing population, it is important to understand factors beyond the healthcare system that impact health with an eye towards drafting improved and befitting policies. Understanding the demographic and socioeconomic determinants that impact health outcomes is a step in the direction of acknowledging that health outcomes are a result of the intertwining of various factors outside the healthcare system. Merely understanding the aetiology of hypertension will only go so far in addressing the growing burden of this disease. Against this backdrop, this study aimed to determine the prevalence of hypertension amongst South African adults between 2008 and 2017, as well as to determine the demographic and socioeconomic factors that increase the risk of hypertension. This final chapter will discuss the findings of this study in relation to the research questions that seeked to determine whether there was a change in the burdern of disease between 2008 and 2017; whether there was a significant association between demographic factors and hypertension in 2008 and 2017; and whether whether there was a significant association between socioeconomic factors and hypertension in 2008 and 2017. Thereafter the limitations of the study will be outlined followed by future study recommendations and the conclusion.

5.2 Discussion

The study overall, found a significant relationship between demographic factors and the prevalence of hypertension amongst South African adults. The 2008 sample population had a high blood pressure prevalence rate of 13.5 % out of 15 461 respondents whilst 11.3% of the 22 217 respondents from the 2017 sample population had raised blood pressure. There were no significant differences in the prevalence of raised blood pressure noted between the two samples. This means that the burden of high blood pressure did not change much between this period. In both Wave 1 and Wave 5, females had the highest prevalence of high blood pressure. In 2008 females were also 133% more likely to have raised blood pressure than males. Females in 2017 were 100% more likely to have high blood pressure than males. These findings are in line with those of the WHO (2019b) who reported that hypertensive patients are comprised of 1 in 4 men and 1 in 5 women. Ramirez & Sullivan (2018) argue that men generally have higher rates of hypertension prior to the age at which women typically begin menopause. Age-specific hypertension rates are reported as being much higher for women after the age of 50 years due to menopause (Reckelhoff 2018). These differences could also be as a result of cultural and societal ideas of masculinity and femininity that encourage irresponsible behaviours such as alcoholism amongst boys and promotes voluptuous women as being more attractive (Rohlder 2012; Edstrom 2015). This is dangerous as alcohol and obesity are both main risk factors of hypertension. According to the CSDH framework, women are the most affected by gender divisions as being a woman inevitably means that they have limited access to power and resources, which translates to unequal access to health facilities and health knowledge (Solar & Irwin 2010). This is important as hypertension is not easily detectable and therefore unequal access to health resources and knowledge may lead to health differences. Bradshaw *et al*. (2011) argue that more than 70% of women aged 35 years and above in South Africa are either overweight or obese (both of which are important risk factors of hypertension) and a 45% increase was observed over the last decade.

The literature revealed that hypertension is most associated with old age (Lloyd-Sherlock *et al.* 2014; Ntuli *et al.* 2015). However, there is research that suggests that there is a notable increase in the prevalence of high blood pressure amongst younger people, especially in the SubSaharan region (Van Der Spuy *et al*. 2018). Research further suggests that the burden of hypertension in old age is a result of unchecked hypertension in younger ages of which childhood obesity is the strongest risk factor (Bhimma *et al.* 2018; Ejike *et al*. 2018; Ewald *et al*. 2017). This study found that 38.3% of those aged 65+ years had high blood pressure in 2008 whilst 51.3% of the

respondents who were 65+ years had high blood pressure in 2017. The odds of raised blood pressure also increased with age, but they were highest for those aged 65+. These findings resemble those of (Ntuli *et al.* 2015) who reported that amongst 1 407 participants, hypertension was found to increase with age. The increase in life expectancy and consequently of the elderly population, will likely result in an increase in the future prevalence of high blood pressure due to its association with age (Buford 2016; Kotchen 2017).

The study further found that elevated blood pressure was highest amongst those that were widowed in both 2008 (37.3%) and 2017 (37.9%) and lowest amongst those that were never married. In 2008, raised blood pressure was second highest amongst those that were divorced/separated (25.0%) whilst it was second highest amongst those that were married (20.1%) in 2017. Manfredini *et al.* (2017) suggests that marital status and changes that occur such as divorce, separation and losing a spouse are associated with negative health outcomes. This may be the reason for the high rates amongst those that were widowed, divorced/separated in the NIDS data. According to Robards *et al.* (2012), this is because marriage is considered to provide a certain degree of protection against illness due to the support system provided by the union. Those that were widowed were also 32% more likely than those that were married to have high blood pressure in 2008 and 8% more likely in 2017. Those that were never married had the lowest prevalence of high blood pressure as well as the lowest odds. They were 69% and 75% less likely to have raised blood pressure in 2008 and 2017 respectively. This reflects the findings of a study that analysed self-reported data on 103 154 men and 125 728 women from 57 countries in the World Health Survey 2002–2004 which concluded that those that were divorced, widowed or separated reported poorer health in comparison to those that were never married (Hosseinpoor *et al.* 2012).

The data indicated that White South Africans had the highest prevalence of high blood pressure in both 2008 (20.7%) and 2017 (20.1%). Surprisingly, Africans had the lowest prevalence of elevated of high blood pressure as they contributed 11.9% and 10.1% in 2008 and 2017 respectively. This is surprising as Sliwa *et al*. (2014), argued that Africans are not only more prone to hypertension, but it is often more severe. This study anticipated that Africans would have the highest levels of hypertension as it is a marginalized group. Marginalized groups record worse health status and outcomes in comparison to privileged groups (Solar & Irwin 2010). White South Africans are mostly affluent which places them in the upper wealth quintile and this study found that wealth quintile five has the highest prevalence of high blood pressure. These finds could possibly provide an explanation as to why White South Africans were most

likely to have high blood pressure. Another reason for the difference in findings could be the differences as a result of selection bias in studies that looked at the association between hypertension and population group which is dependent on the sampling frame (Nissen *et al.* 2018)

Those residing in urban areas had the highest levels of raised blood pressure at 15% and only 11% of those living in traditional settings in 2008. In 2017 that lived in urban and traditional/rural areas, only 11.2% of the respondents from each geographical location had high blood pressure whilst 14.2% of those residing in farm settings had high blood pressure. In 2008, those residing in urban areas were 57% more likely and those resident on farms were 27% more likely than those in traditional/rural areas to have elevated blood pressure. In 2017, the odds of having high blood pressure were 89% less for those in urban areas and 22% less in farm settings compared to those living in traditional/rural areas. There was also no significant association between geographical location and hypertension. High blood pressure was expected to be higher in urban areas due to the high levels of urbanization that lead to the adoption of unhealthy lifestyle habits (Gurven *et al*. 2012). However according to the NIDS data, hypertension is proving to be prevalent throughout South African despite the geographical location.

In terms of educational attainment, over one quarter (27.4%) of those with no education had high blood pressure and only 9.2% of those with a secondary education had high blood pressure in 2008. In 2017 over one third (31.6%) of those with tertiary education (14.9%) had high blood pressure and while only 7.8% of those with a secondary education had the same. Although on its own it does not produce better health outcomes, a better education is linked to better employment and income prospects which gives individuals access to healthcare services and resources (Shankar *et al.* 2013). Raghuphathi & Raghuphathi (2020), argue that those with higher educational attainment are more likely to outlive their less educated peers. This is attributed to better health related behaviour, being able to recognize illness and symptoms and report it as well as access to healthcare services and resources to deal with things such as stress (Raghuphathi & Raghuphathi 2020). The findings of this study are akin to the findings of Yin *et al.* (2016) who reported that the rural province of Guizhou in China, had the lowest awareness rates which was attributed to low education rates and poor healthcare infrastructure.

The wealthiest quintile had the largest percentage of people with high blood pressure (15.9%) whilst quintile three had the lowest (7.9%), although overall there was no significant differences between wealth quintiles in 2008. Those from quintile five which are the wealthiest,

were 102% more likely than those in the poorest quintile to have elevated blood pressure in 2008. In 2017, those in the wealthiest quintile were 106% more likely to have high blood pressure compared to those in the poorest quintile. Individuals in quintiles two, three and four were respectively 55%, 72% and 71% more likely to have high blood pressure than persons from the poorest wealth quintile. The high prevalence of raised blood pressure amongst those in wealth quintile five may be as a result of an increase in the elderly in this population which results in a higher burden of hypertension as the wealthy are likely to outlive their less fortunate peers (Raghuphathi & Raghuphathi 2020). This reflects the findings of a study examining the socioeconomic inequalities in the prevalence, awareness, treatment and control amongst 14 823 adults aged 15 years and older with blood pressure measured in the 2016 Nepal Demographic Health Survey, which found amongst other things that those in wealthier wealth quintiles were 1.7 times more likely to be hypertensive (Mishra *et al*. 2019). Wealth quintiles are determined by household income and adjusting for household size. This could possibly mean that these quintiles are not entirely representative of the population as they are based on self-reported on household assets and expenses (Nissen *et al.* 2018). This may be another reason why wealth quintile five, had the highest prevalence of high blood pressure.

Adults that were not economically active had the highest levels of raised blood pressure as they contributed 16.5% and 14.9% in 2008 and 2017 respectively. In 2008 those that were not economically active were 30% less likely to have high blood pressure compared to those that were employed while the unemployed were 23% less likely than those who were employed to have high blood pressure. In 2017, those that were unemployed were 45% less likely to have elevated blood pressure compared to those that were employed. Similarly, those that were not economically active were 40% less likely to have high blood pressure compared to those that were employed. Whilst unemployment is often associated with negative health outcomes (Dupre *et al*. 2012), the relationship is understudied. Although studies had different findings on the impact of employment status on hypertension (Rosenthal & Alter 2012; Rumball-Smith, Nandi & Kaufman 2014; Zagożdżon *et al.* 2014), employment is an important determinant of income level and living standards which have consequences on health outcomes (Hahn & Truman 2015). Employment has social, psychosocial as well as financial benefits which in various ways improve health outcomes Goodman (2015).

5.3 Limitations

There is no study that is without limitations irrespective of the methodology or approach that was used. One of the major downfalls of quantitative research is that it lacks the depth which qualitative research possesses (Rahman 2020). A mixed method study would do well in filling in the void left by a purely quantitative one by providing insight on the impact that the analysed variables have on South African adults. Since the researcher did not collect the data, it is difficult to ascertain things that occurred during the process of data collection, however NIDS data is highly reliable and as it has a large enough sample size.

5.4 Recommendations

The literature review, guiding framework and study findings revealed that gender inequality is a huge factor in overall health outcomes. Gender limitations on economic opportunities and societal expectations more especially on women, have resulted in complex relationships with other variables which further exacerbates the impact of ill health on women in South Africa. Future studies should examine the impact of gender and other demographic and social determinants on the risk and prevalence of hypertension amongst adults in South Africa. The inclusion of gender in health research is important as the biological composition alone is not enough in understanding the inequality in health outcomes and behaviour that exists between men and women. Focusing on gender differences is therefore imperative for future policy consideration.

The health system needs to adapt to the new burden of diseases and allocate resources accordingly. The private and public health sectors need to come together to ensure that no one in need of healthcare is denied on the grounds of affordability or accessibility. This is important in improving the awareness, treatment and control of hypertension in South Africa. It is also important not to look at poor health outcomes in isolation to demographic and socioeconomic characteristics. Therefore, one of the most effective ways of dealing with the unequal prevalence and risk of hypertension is to deal first and foremost with health inequities which include the socioeconomic and demographic indicators that were discussed in this research. Future research needs to look further into the impact that various factors contribute to the distribution of the disease and the risk of disease within the South African population. It is also suggested that future policies consider these inequalities when developing health policies. Ignoring the factors outside of clinical walls that impact health, will have dire consequences in the future. Population based policies such as that limit the amount of salt in food, promote

responsible drinking, exercising, healthy eating and frequent check-ups are also an urgent addition above and beyond what was outlined.

5.5 Conclusion

Socioeconomic and demographic indicators are important for not only understanding the prevalence of diseases, but it is also imperative for assessing which group is mostly at risk of ill health. Although there is a substantial amount of work that looks at hypertension, not much of that data looks at it in relation to the demographic and socioeconomic status in South Africa. The study found that demographic and socioeconomic determinants were significantly associated with hypertension overall amongst South African adults. South Africa's apartheid history has a significant impact on the way in which demographic and socioeconomic determinants impacts different groups within the population. This contributes significantly to the inequality in the country which has severe consequences for health outcomes. As the burden of disease changes and non-communicable diseases become increasingly popular, it is important to recognize that improving the socioeconomic status and decreasing demographic inequality of individuals can decrease negative health outcomes.

The CSDH framework presents important factors to include in policies that seek to address the issues of health, healthcare and healthcare systems. The framework not only highlights how the equal sharing of resources is important in mitigating health inequalities, but it also points out that some of the factors that impact the way diseases such as hypertension impact certain groups differently are mainly manmade. This framework which guided this study, is an important blueprint for further research and policies.

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04 September 2019

Miss Simangele Azande Shezi (214532048)
School of Built Env & Dev Stud
Howard College

Dear Miss Shezi,

Protocol reference number: HSSREC/00000269/2019
Project title: Hypertension in South Africa between 2008 and 2017: an analysis of National Income Dynamics Survey Data

Full Approval – Expedited Application

This letter serves to notify you that your application received on 12 August 2019 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid for one year from 04 September 2019.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

Yours sincer

[redacted]

Dr Rosemary Sibanda (Chair)

/spm